

THE LPJML MODEL OF BIOSPHERE AND AGROSPHERE

LPJML: HUMAN MANAGEMENT IN A DYNAMIC GLOBAL VEGETATION MODEL

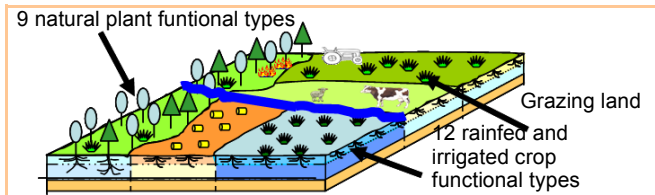


Fig. 1: Schematic representation of the LPJmL model.

VEGETATION DISEQUILIBRIUM

We have quantified time lags in the climate response of terrestrial biomes. We find that by the end of this century vast areas will be covered with suboptimally adapted vegetation, implying rather low ecosystem stability.

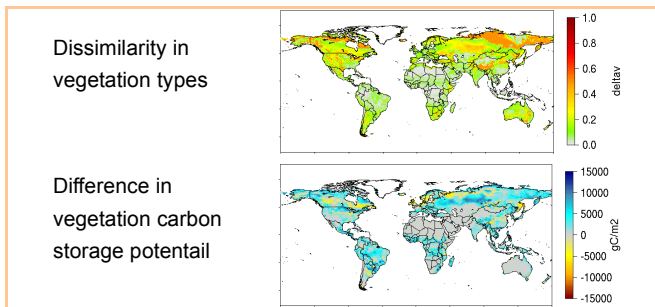


Fig.3: Difference between optimally adapted vegetation and transient vegetation under future climate (mean from 17 climate scenarios, A2).

WATER SCARCITY AND FOOD PRODUCTION

Global food production could be raised by 20% if water was used effectively in rainfed agriculture (water harvesting, vapour shift). But, such management will not suffice to produce the future food demand, suggesting the need for cropland expansion and tradeoffs.

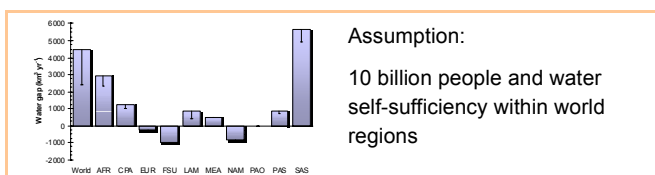


Fig.5: Additional water needs for crop production by 2050. Whiskers indicate water savings if soil evaporation was reduced and water harvested by 25% each.

AGROINDUSTRY AND ECOFARMING

Can the world feed itself in a sustainable way? We will quantify the potentials of sustainable alternatives to industrial land and water management strategies.

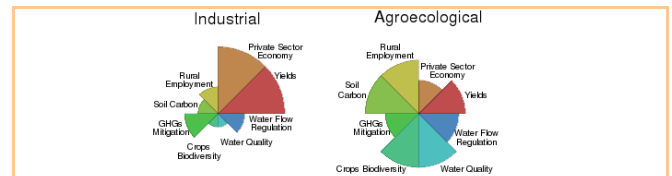


Fig. 2: Main environmental and socio-economic trade-offs from different agricultural systems. The LPJmL and MAGPIE models, and various globally/regionally available data sets will be used to quantify these trade-offs.

SUSTAINABLE BIOENERGY POTENTIAL

Applying a range of environmental sustainability criteria, global bioenergy potentials are found to range between 40 and 200 EJ/yr in 2050, but only if another 220-590 Mha of natural ecosystems are converted into dedicated biomass plantations.

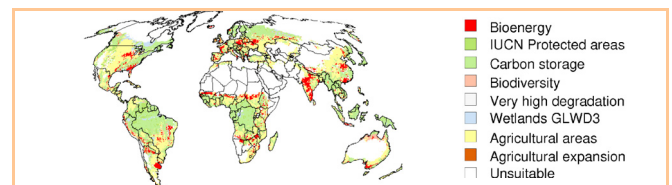


Fig.4: Global distribution of potential biomass plantations and of main factors precluding their cultivation.

We also quantify changes in water scarcity at and beyond 2K mean global warming and virtual water content of crops under climate change scenarios.

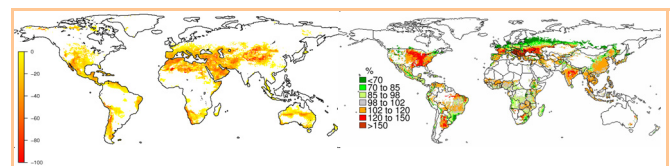


Fig.6: left: Averaged percent decreases in river runoff at 2K mean global warming (full range of IPCC climate and demographic scenarios). right: Percent change in virtual water content of maize by the 2050s (HadCM3 A2, no CO2 effects).