Vegetation-Climate Feedbacks

Universiteit Utrecht

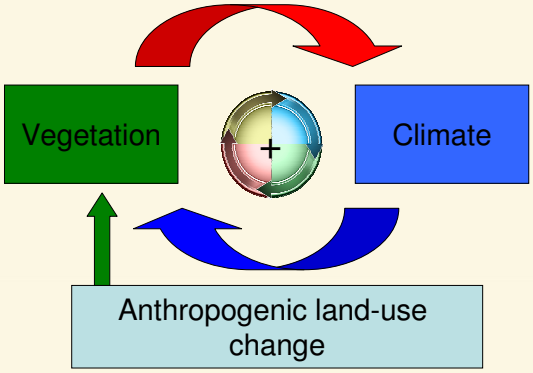
Stefan Dekker

Environmental Sciences, Faculty of Geosciences, Utrecht, Netherlands

Vegetation and climate markedly influence each other through modification of surface albedo and evapotranspiration by numerous relevant vegetation-climate feedbacks. Changes in land-use can switch the vegetation and climate states suddenly and unexpectedly.

Goals

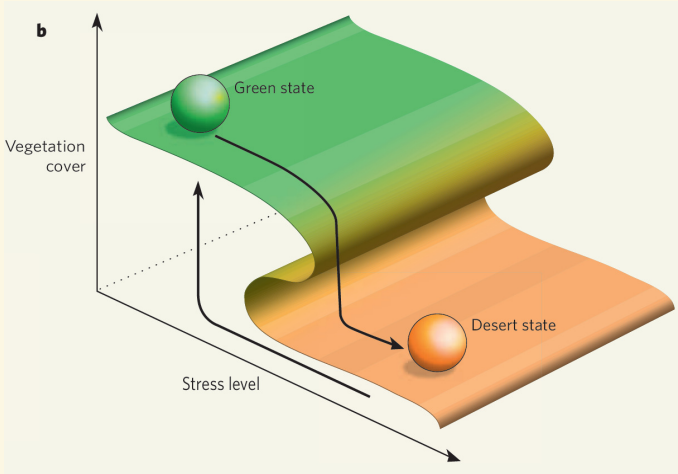
- **To understand the strength of vegetation-climate feedbacks from local to global scales**
- **Analyse whether net positive feedbacks are strong enough to lead to regime shifts.**



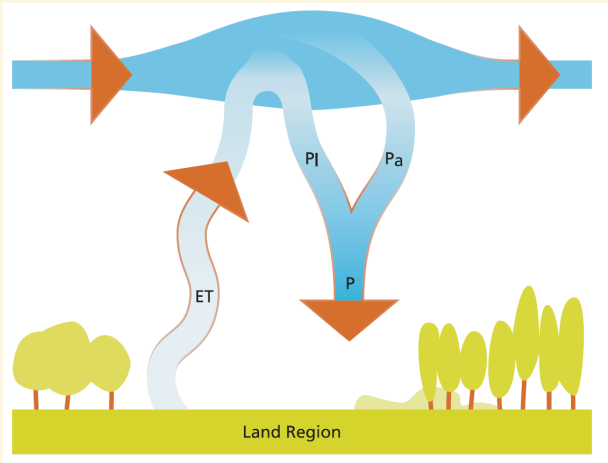
Importance

This study is important for:

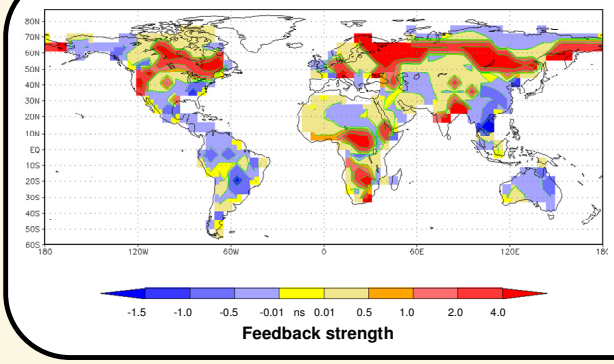
- **Large scale land use changes (e.g. Amazon, transitions to biofuel)**
- **Regions which are sensitive to vegetation-climate feedbacks (such as Monsoon areas);**
- **Understanding tipping points in the climate system;**
- **Understanding climate shifts during the Roman Warm Period, maybe triggered by large scale deforestation.**



Positive vegetation-climate feedback: Sudden collapse from vegetated state to desert state.



Positive vegetation-climate feedback: Increase in Evapo-transpiration (ET) leads to increase of local precipitation (P_l) and in turn increase in vegetation and ET. P_a is advective precipitation.



Global Vegetation-Climate feedbacks

For current climate, we have performed perturbations of biomass change to model the vegetation-climate feedbacks strenghts (FB; Dekker et al. 2009).

FB>1 means a positive feedback. Biomass perturbation is amplified.

0<1<FB means a negative feedback. The system moves back to the original climate and vegetation state.

FB<0 means an opposite effect. The positive feedbacks of one region(FB>1) negatively influence these regions.