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Topic III Sustainable Production and Resource Efficiency
Presentation

Climate Change, Sustainable Land Use, and Ecohydrology in the Eastern Mediterranean

Dr. MARTIN KÖCHY*#, Dipl. Biol. MARTIN MATHAJ§, Prof. Dr. FLORIAN JELTSCH*
* University of Potsdam §Potsdam Institute for Climate Impact Research
# office@martinkoechy.de

LAND USE, ECOHYDROLOGY, ECOSYSTEM SERVICES

Within the GLOWA Jordan River project we examined the direct and indirect effects of global change on eastern Mediterranean natural vegetation, its ecosystem services, and potential socio-economic effects. We used spatially explicit, process-based models to simulate the impact of climate change (especially precipitation) and land use (especially grazing) on natural rangelands in the eastern Mediterranean. Our hierarchical scaling approach presents a continuous condensation of process effects from individual plants to vegetation at the landscape and even country scale (Fig. 1). Processes at the scale of individual plants include seed germination, competition, and soil water movement; processes at the scale of landscapes include topography, grazing, and competitive interactions between shrubs and herbs. Grazing by sheep and goats had a stronger impact on rangeland productivity and secondary effects like erosion than changes in precipitation (Fig. 2). The sensitivity of vegetation productivity (Δproductivity/Δstocking rate) increased with aridity and increasing grazing intensity, indicating that grazing close to the stocking capacity bears a great risk of long-term ecosystem damage (loss of productivity). Reduced vegetation productivity further entailed a greater portion of bare soil and higher erosion rates. Long-term intensive grazing combined with a reduction in precipitation reduced the threshold of sustainable feed production (stocking capacity) with consequences for the human demand for grazing areas. In order to maintain ecosystem productivity at a high level, reduce soil erosion, and ensure the livelihood of the rural population the access to rangeland and provision of supplemental feed must be reconsidered.

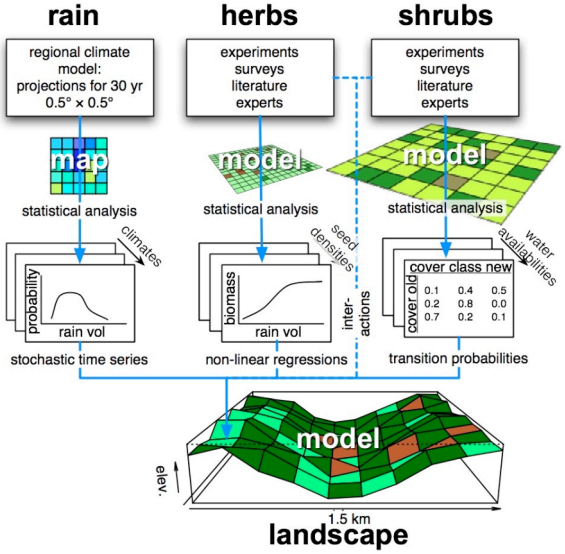

Fig. 1. Herbs and dwarf shrubs are studied in plots <1 m^2. The models reflect the processes at this scale. Small-scale dynamics are evaluated systematically and scaled up to regions, augmented by relevant factors like topography, fire, and land use.

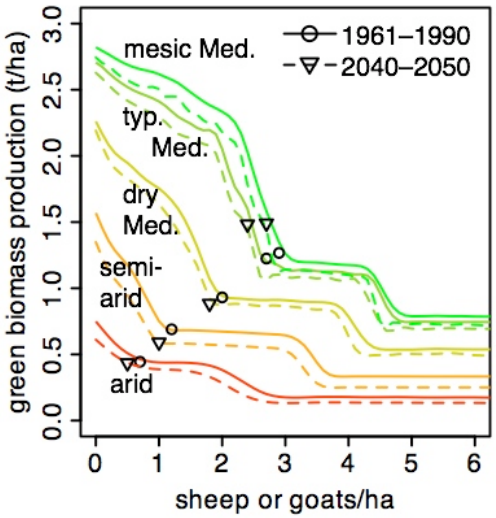

Fig. 2. Food production on natural rangelands in five climatic regions and for two time slices of the A1B global change scenario. Stocking capacity (enough food in 9/10 years for year-round grazing): ○ 1961–1990, ▽ 2040–2050. Level portions of productivity beyond stocking capacity are caused by averaging across habitats with contrasting productivity (wadis, slopes, plateaus).