

Spatial aspects of tree-grass co-existence

Ruimtelijke aspecten van boom / gras coëxistentie

Thomas Groen

Begeleiding: Frank van Langevelde, Claudius van de Vijver & Prof. Herbert Prins
Wageningen UR, Resource Ecology Group
Bornsesteeg 96, 6708 PD Wageningen
E-mail: thomas.groen@wur.nl

Summary

Savanna landscapes are dominated by an, in first instance, illogical mix of both trees and grasses. Under some conditions a rapid shift toward a woody dominated system, so called bush encroachment, occurs. This process poses a major threat to grazing by livestock, which is the dominant land use in many savannas. This process also raises the question of which forces play a role in the co-occurrence of both trees and grasses on savannas.

Tree-grass co-existence has been explained in many ways in the past. These explanations can be roughly divided in spatial and non-spatial approaches. The latter were able to explain a great deal of tree-grass biomass ratios as a results of e.g. competition for water, fire interaction and herbivory. However, these approaches neglected the spatial heterogeneous aspect of the savanna landscape. Therefore also spatial models were developed. These models mostly rely on stochastic processes like erratic rainfall, or spatial heterogeneities like termite mounds as driving forces to model ecologically realistic tree-grass patterns. I expect that next to stochastic processes more deterministic processes play a role on tree-grass ratios. For example, the amount of grass biomass determines the intensity of fire, and the intensity of fire determines for a part the mortality of trees. In my research, I try to find out through spatial modeling exercises which processes direct the possible tree-grass co-existence on savannas. Secondly, focus will be placed on the stability of different tree-grass patterns of savannas.

Currently a fire distribution model is tested and evaluated for its savanna pattern forming properties. Although in first instance the modeling of ecosystems is pursued, also a more mathematical approach will be taken. In this approach mathematical conditions, needed for pattern formation in spatial diffusion reaction equations, will be evaluated and then interpreted on a possible ecological meaning.

Reference

Van Langevelde, F., C.A.D.M. van de Vijver, L. Kumar, J. van de Koppel, N. de Ridder-N, J. van Andel, A.K. Skidmore, J.W. Hearne, L. Stroosnijder, W.J. Bond, H.H.T. Prins & M. Rietkerk, 2003. Effects of fire and herbivory on the stability of savanna ecosystems. *Ecology* 84(2): 337-350.