Relating biomass and vegetation structure in water limited ecosystems using a celluar automata based model

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Within arid and semiarid regions banded vegetation patterns are wide spread. While the soil-vegetation feedback causing this self-organized has been well understood and implemented in various models, the relationship between the actual pattern, e.g. band width and spacing as well as plant density, has not been well understood. In this study we use a cellular automaton [1] to investigate the effect of infiltration properties and rainfall on patter formation as well as on biomass production and vegetation coverage. The first part of the investigation showed that the model is consistent with the existing knowledge on the dependence of wavelength on annual rainfall. We use the same parameter space to assess biomass and fractional coverage. We found that there is a nonlinear relationship between biomass and infiltration capacity normalized with rainfall input. This indicates that the degree of organisation is not directly related to the productivity as expressed with biomass. Similar results were found for fractional surface cover of the vegetation.

[1] McGrath, G. S., K. Paik, and C. Hinz. 2012. Microtopography alters self-organized vegetation patterns in water-limited ecosystems, Journal of Geophysical Research: Biogeosciences (2005–2012) 117, G03021, doi:10.1029/2011JG001870