Ecography

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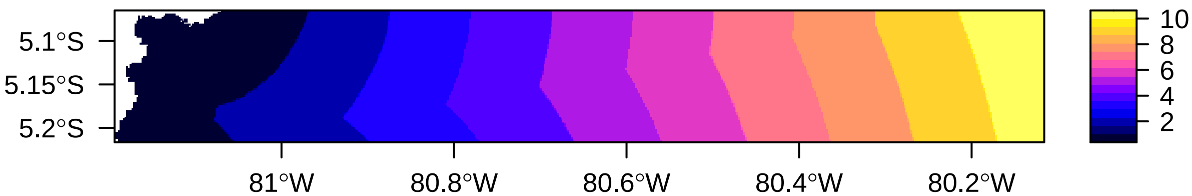
Muenchow, J., Dieker, P., Böttcher, T., Brock, J., Didenko, G., Fremout, T., Jakubka, D., Jentsch, A., Nüst, D., Richter, M., Rodriguez, E., Rodríguez, R., Rollenbeck, R., Salazar, P., Schratz, P. and Brenning, A. 2020. Monitoring and predictive mapping of floristic biodiversity along a climatic gradient in ENSO's terrestrial core region, NW Peru. – Ecography doi: 10.1111/ecog.05091

Supplementary material

Supplementary Information

Appendix 1. Study area stratified by distance to sea in 10 classes.



Appendix 1: Study area stratified by distance to sea in 10 classes.

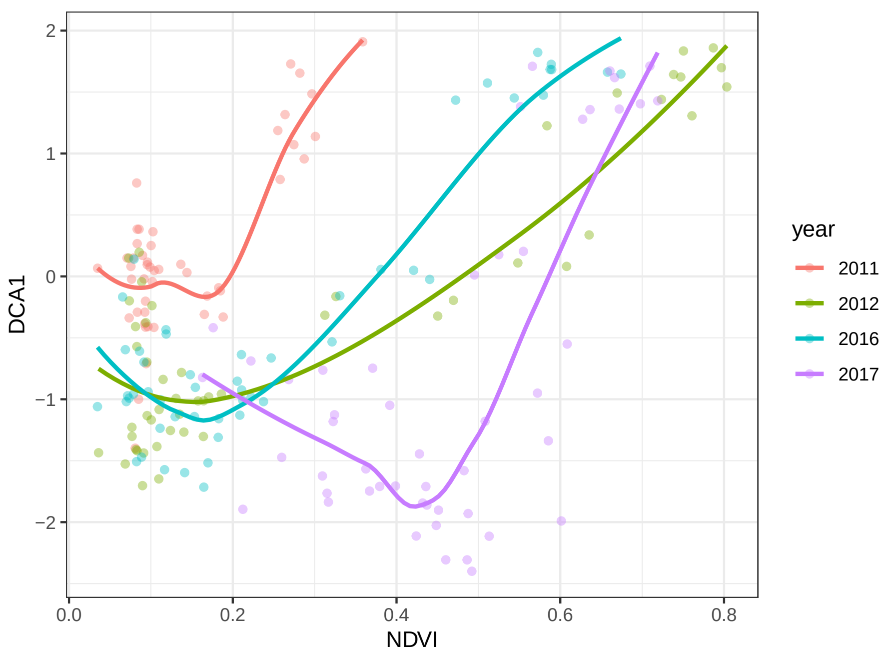
Appendix 2: Detailed description of the methodological approach used for the irrigation-nutrient experiment.

We established 12 experimental plots of 3 × 3 m^2 in a sandy area typical of the region. Plots were located on the campus of the Universidad de Piura (Sechura Desert; 5°10'S, 80°38'W) on a sandy plain devoid of woody vegetation. We built a barbed wire fence around the experimental area to avoid the intrusion of domestic animals such as deer wandering the campus. The soils of the region are nutrient-poor (e.g., mean nitrogen content: 0.005 mg g^{-1}) with high water infiltration rates (Muenchow et al. 2013a). The vegetation surrounding the experimental area mirrors the typical plant formation around Piura, hence a transition between tropical desert and open-shrubland vegetation (Muenchow et al. 2013b). Prior to the irrigation experiment, we clipped the scarce aboveground biomass. Between December 2012 and May 2013 four plots received the simulated rainfall amount of the Super El Niño event in 1997/98 (1780 mm), another four received the rainfall amount of the moderate El Niño event in 1991/92 (258 l mm) and the remaining four plots served as baseline plots without any additional water input. Natural rainfall amounted to 53.9 mm during the study period (data: meteorological station of the University of Piura). If natural rainfall occurred, it was subtracted from the artificial water input in the case of the Normal and Super Niño plots. The irrigation water stemmed from rain-collecting tanks. Irrigation was applied using hand sprinklers (Ronnenberg and Wesche 2011) before and after sunset and followed the intensity and frequency of the rainfall events of the El Niño episodes in 1991/92 and 1997/98 as recorded by the automatic climatic station of the University of Piura. On the one hand, this reproduced the temporal pattern of El Niño rainfalls, which commonly took place at night time. An on the other hand, this procedure impeded undesired evaporation and subsequent salinization effects. The plan sandy underground prevented any runoff from irrigated plots to adjacent plots.

In addition to the water treatment, two randomly chosen plots of each irrigation treatment received a fertilization treatment of 200kg/ha granular nitrogen fertilizer (NH_4NO_3) using a hand-held spreader (Whitford and Steinberger 2011). To prevent a quick washing out of the fertilizer, we spread the granular nitrogen fertilizer four times during the study period (each time: 50 kg/h).

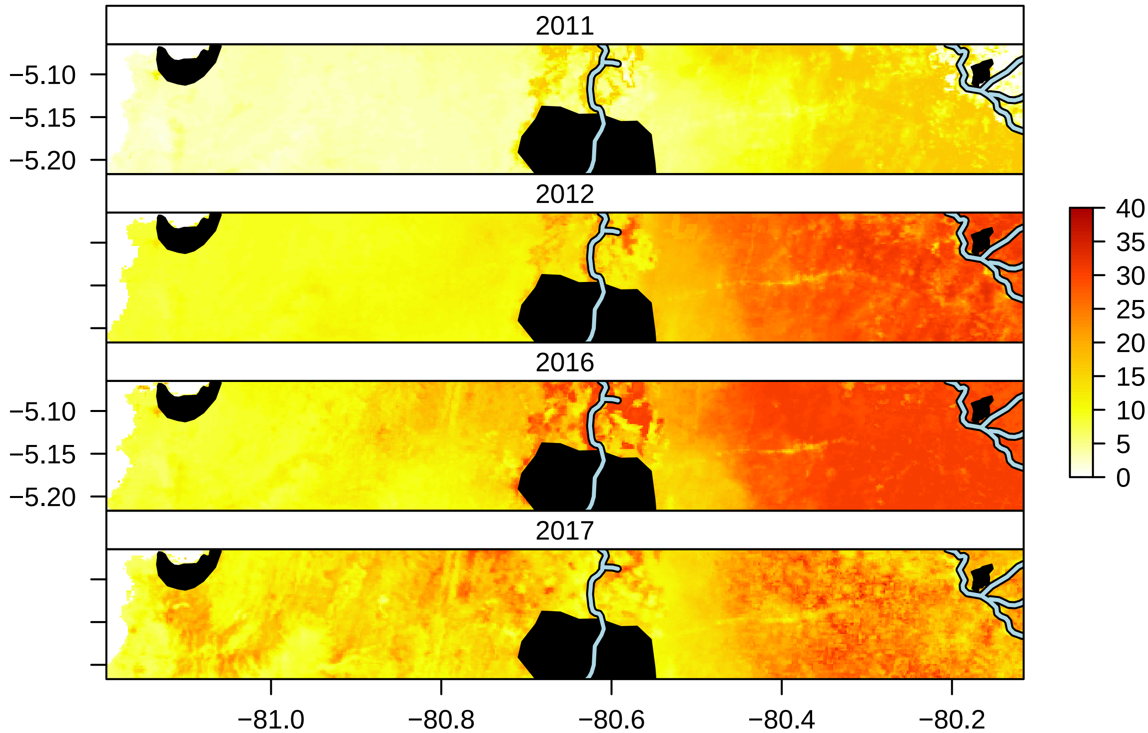
Plant development was monitored on a two-week basis and included the determination of plant species and corresponding coverage (%). Biomass was harvested between mid-April and the beginning of May. We randomly threw circles á 0.25 m^2 four times into each plot and collected all plants within the circular area including the subterranean biomass. Soil particles were thoroughly removed from the plants. Afterwards the biomass was subjected to 72 h of air drying. Before weighing, biomass was finally oven-dried at a temperature of 105 °C for 24 hours. From the total biomass we subtracted the subterranean biomass of the geophyte *Proboscidea altheifolia*, as it was already established prior to the irrigation experiment in most cases.

Appendix 3. Relationship between the response and NDVI by year.



Appendix 3: Relationship between the response (DCA1) and NDVI by year. To aid the visual interpretation, line smoothers were added.

Appendix 4. Predictive mapping of species richness.



Appendix 4: Spatial prediction of species richness along the cross-section for different ENSO episodes using the NDVI and year interaction as predictors (used model: GAM with a spline smoother with 3 degrees of freedom and a Poisson distribution). The urban boundaries of the cities Paita, Piura and Chulucanas are displayed in black. The Piura River and its tributaries are represented by light blue lines with a black contour.

References

Muenchow, J. et al. 2013a. Woody vegetation of a Peruvian tropical dry forest along a climatic gradient depends more on soil than annual precipitation. - Erdkunde: 241–248.

Muenchow, J. et al. 2013b. Coupling ordination techniques and GAM to spatially predict vegetation assemblages along a climatic gradient in an ENSO-affected region of extremely high climate variability (B Collins, Ed.). - Journal of Vegetation Science 24: 1154–1166.

Ronnenberg, K. and Wesche, K. 2011. Effects of fertilization and irrigation on productivity, plant nutrient contents and soil nutrients in southern Mongolia. - Plant and Soil 340: 239–251.

Whitford, W. G. and Steinberger, Y. 2011. Effects of simulated storm sizes and nitrogen on three Chihuahuan Desert perennial herbs and a grass. - Journal of Arid Environments 75: 861–864.