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Effectiveness of climate change adaptation measures in a drought-prone area

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In the state of Brandenburg in eastern Germany, land use is increasingly affected by long-lasting soil moisture deficits in the vegetation period. Therefore, it is important to take measures to improve water retention at the landscape level to delay and mitigate the effects of droughts.

As a first step, we developed a catalog of possible measures that can be implemented on agricultural land, in forests, settlements, and nature reserves in our study area, a 1900 km² county in Brandenburg. Our objective was then to quantify their bio-physical efficacy. The distribution of land surface temperature (LST), which we derived from Landsat thermal images from the vegetation seasons of 2013 to 2020, served as a proxy for environmental conditions that favor water retention. We modeled LST as a function of several parameters of the physical environment such as land cover, forest and crop type. In addition, we incorporated an antecedent moisture index and potential evapotranspiration at time of satellite overpass into the model. With the help of meteorological time series from climate projections, we can thus check to what extent the model results could change in the future.

In this contribution, we will present the modeling framework and results. The model predictions provide a ranking of measures in terms of their effectiveness both within and between land use classes. In agricultural landscapes, for example, the conversion of cropland to forest and, albeit to a lesser extent, to permanent grassland is much more efficient than organic fertilization, agroforestry, or the cultivation of permanent crops. Finally, we discuss possible approaches to using the results for practical recommendations despite the various uncertainties (data and model uncertainty, uncertainty of climate projection data).