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Invasive plant species drive land use changes in East Africa

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Abstract

Invasive alien plant species affect biodiversity, agriculture, and rural livelihoods. For instance, in Baringo County, Kenya, the leguminous tree *Prosopis juliflora* was introduced in the 1980s to combat desertification, but has since invaded the fringes of Lake Baringo and rangelands with shallow water tables, threatening traditional resource management and inducing land system changes. Recently, with the annual Asteraceae *Parthenium hysterophorus*, another invasive species is rapidly spreading in Baringo. With combined household interviews, surveys on biomass and vegetation dynamics, and soil analyses we assessed interactions between invasive species and land-use changes. In the face of two consecutive waves of plant invasion, we (1) present a conceptual model of related land system shifts, (2) analyse biophysical factors determining spatial and temporal variations in invasive species spread dynamics, and (3) provide examples for changing agronomic practices. The rapid spread of *Prosopis* in the 2000s led to degradation and scarcity of grazing land, and restricted physical access to water for livestock, eventually affecting pastoral livelihoods. This had driven a shift to agro-pastoralism and commercial crop faming on land cleared from *Prosopis*. While land use intensification has partly eased problems associated with *Prosopis*, it appears to facilitate the spread of *Parthenium*. Hence, farmers in rainfed systems with seasonal fallows and pastoralists in rangelands report *Prosopis* as a key constraint, while crop farmers using irrigation and continuous cultivation report *Parthenium* to have recently developed into the main problem weed reducing crop performances in Baringo. Elevated soil moisture in irrigated land, an increased use of agricultural machinery, and seed dispersal in irrigation channels appear to accelerate the spread of *Parthenium*. The spread of both invasive species may drive further agricultural intensification with increasing pesticide use, the spatial separation of crop farming and livestock rearing and the replacement of farmyard manure by mineral fertilisers. The severe precipitation events in the El Nino year of 2023/24 have accelerated the spread of Parthenium, but may also favour a re-invasion by *Prosopis* of formerly cleared crop and rangelands. Our results show the need and indicate solutions for adapted sustainable land use systems and agronomic practices to halt and counteract invasive species.

Keywords: Kenya, *Parthenium hysterophorus*, *Prosopis juliflora*, system shifts, vegetation dynamics

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