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How to find suitable habitats for the conservation of shea butter trees under current and future climate conditions in Burkina Faso?

Estimates of species distribution for effective adaption strategies

In sub-Saharan Africa, where the majority of the population depends on natural resources for their livelihoods, understanding the impact of climate change on these resources is imperative. Under climate change, species ranges can shift along with the appropriate conditions for the subsistence of their populations. Species could move to these new areas, if their dispersal capabilities can keep up with the speed of change. According to projections, 20%–30% of plant and animal species will face a great risk of extinction if global warming exceeds 1.5 °C to 2.5 °C in Africa. According to studies, 25%–42% of plant species in Africa could be threatened with extinction due to a loss of 81%–97% of suitable habitats by 2085. Considering the negative impacts of climate change on biodiversity, it is necessary to have future estimates of the distribution range of species in order to develop effective adaptation strategies to maintain the ecosystem services and functions.

The importance of shea butter trees for local populations

The shea butter tree, or karité (*Vitellaria paradoxa*) is an agro-managed crop, which grows in the wild and in the traditional parkland agroforestry systems of the Sahelo-Sudanian savannas. While the pulp of the fruits is directly consumed for its vitamins and energy contents, the seeds are sold raw as kernels or processed to make the shea butter, which can be used either for cooking, skincare, medicine or for many other purposes. Furthermore, almost all other parts of the plant are used, e.g. the leaves serve as fodder for livestock and constitute a good alkaline in the paint industry shea butter tree contributes to local household incomes and is an important cash crop for exportation. It has also become the economically and culturally most important tree species in the

Sudano-Sahelian regions where oil palms do not grow. It provides other regulation services such as wind breaks and erosion control in agroforestry systems, serves as habitat for other organisms, and contributes to local climate regulation through carbon sequestration.

Why does shea butter tree face a threat and why is it necessary to model its distribution under current and future climate conditions?

Beside the importance of this species for local population, the shea tree is threatened in Burkina Faso due to overexploitation and changing land-use. Furthermore, it remains unclear how climate change will influence its frequency and distribution. The investigations of climate change impacts on the projected spatial distribution of favorable habitats for the species demonstrated that precipitation of wettest month, precipitation of coldest quarter, isothermality, mean diurnal range, mean temperature of driest quarter and precipitation of warmest quarter mostly influenced the distribution range of the shea butter tree in Burkina Faso. Under current climatic conditions, ~51% of the national area was found to be suitable for cultivation and conservation of the species. Under future climate projections, our models predict that suitable habitats of this species will decline by 12% (Representative Concentration Pathway (RCP) 4.5; temperature increase (1.8°C, greenhouse gas concentration (GHG))) and 13% (RCP 8.5; temperature increase (3.7°C, GHG)) by 2070. This result suggests that climate change will negatively affect the species at the 2070 horizon by significantly reducing its current suitable habitats. Under the combined action of climate, wildfires, herbivory and human pressures, the shea butter tree may become threatened with an extinction risk in Burkina Faso.

Implications for sustainable use and adaptive conservation management

Adaptive management approaches of the shea tree and other economically valuable savanna species are needed (e.g. *Adansonia digitata*, *Parkia biglobosa*, *Gardenia erubescens*), not only in Burkina Faso but also in the other regions of the shea belt across Africa where variations in bioclimatic factors will be more severe. As strategies for sustainable use and conservation of the species, it is therefore recommended that immediate action should be initiated to conserve this valued species. Appropriate incentives should be given to encourage individuals and rural communities in establishing plantation of the species in its suitable habitats. Taking these results into account as part of official development policies should help to ensure the conservation and sustainable use of the species in Burkina Faso.

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