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Nutrient hotspots from patch burning in a Namibian rangeland

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Key words: BIOTA, bioassay, firebreak, nutrient hotspots, patch burning

Introduction Although fires have shaped savanna rangelands for millennia, most farmers have controlled lightning induced fires on their farms for past decades, with resultant change in rangeland condition. A few farmers have tried to apply prescribed burning to portions of their farms, mainly to try controlling bushes that have thickened on the land, but very few apply patch burning for biodiversity, such as promoted by Fuhlendorf & Engle (2001). The significance of nutrient hotspots to savanna dynamics has been pointed out by Scholes & Walker (1993). This study, falling under the Biodiversity Transect Analysis in Africa (BIOTA) program, learns from a farmer who applies patch burning.

Materials and methods Patch burning for biodiversity is applied at Farm Otjekongo (21.13°S, 17.93°E) with a mean annual rainfall of about 400mm in Namibia's Thornbush Savanna. A firebreak of 30-40m width is heavily grazed by cattle within moveable electric fencing around the patch of roughly 10ha that then gets burnt with a head fire towards the end of the dry season. Transects of 50m were permanently marked for various measurements, including the lengths of intercepted dung as an index of herbivore pressure. Soil was collected at three burnt patches. At the patch burnt two years previously, soil was only collected from the burnt zone and nearby unburnt control, since the firebreak was no longer visible. At the patch burnt a year earlier soil was also collected from the firebreak zone, while at the patch burnt in the year of sampling, soil was furthermore collected before and immediately after the fire. Soil samples, augured to 15cm at 10 points spaced 10m apart on both sides of a transect, were mixed into the same bag for later distribution amongst 10 pots for radish bioassay to determine overall fertility. Five transects per zone were sampled this way. One radish was grown per pot and harvested after five weeks to measure diameter of the radish, length of the longest leaf, fresh mass (including leaves) and brix of sap squeezed from the radish onto a refractometer. Fuel load, by clipping in 34 randomly placed quadrats of $1m^2$ at the last of the three patches to be burnt, was 1.74 ± 0.29 t/ha of dry grass.

Results Previously burnt patches still attract more large herbivores at least two years after burning. Dung covered $1.29\% \pm 0.46\%$ of the firebreak after grazing compared with $0.08\% \pm 0.04\%$ in the control. Figure 1 shows differences in soil fertility from the fresh mass bioassay. Similar, but less significant, trends appeared from radish diameter, followed by leaf length, while brix showed a slightly opposite trend, with sap of thinner radishes generally more concentrated.

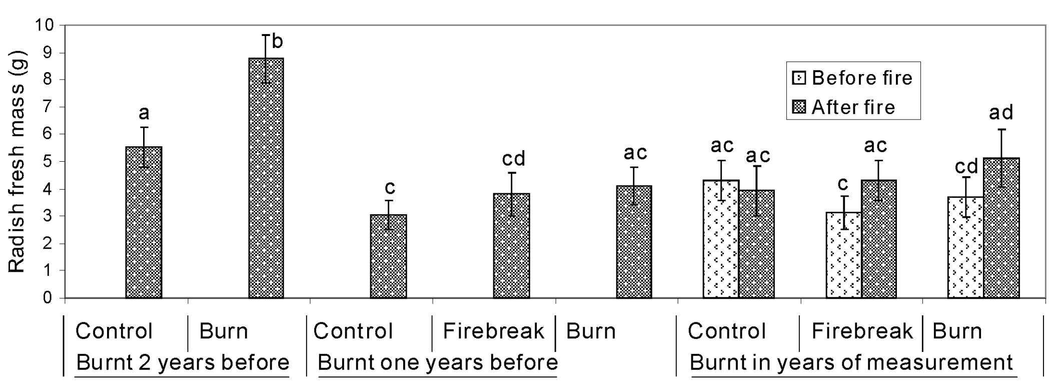

Figure 1 *Fresh mass per radish grown on soils from three patches (each burnt in a different year), grazed firebreaks around two of those patches and unburnt controls nearby (Error bars show 95% confidence limits; Bars do not differ significantly at $p < 0.05$ if they share any letter above them, by Tukey post-hoc test).*

Conclusions The soil was more fertile where a patch was burnt two years earlier, as expected from the shallow calcrete layer evident there. Burning increased its fertility two years later compared with the unburnt control, presumably from dung and urine of cattle and game attracted to the burnt patch. The higher fertilities of firebreaks and more recently burnt patches on deeper sandy loam are not significant at $p < 0.05$, but may become more pronounced over time.

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