High intensity fires are not the silver bullet to address bush encroachment in Kruger National Park

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BUSH ENCROACHMENT IS A GLOBAL THREAT TO THE WORLD'S SAVANNAS. WHILE EARLY RESULTS SUGGESTED THAT HIGH INTENSITY FIRES COULD HELP CONTROL WOODY VEGETATION, RESULTS FROM A DECADE OF RESEARCH IN KRUGER NATIONAL PARK SHOW THAT ONE OR TWO HIGH INTENSITY FIRES ARE INEFFECTIVE

In an effort to reduce bush encroachment, a high-intensity fire experiment was initiated in southern Kruger in 2010. Monitoring over the next 10 years shown little success in using high intensity fires to reduce shrubs.

Worldwide, land managers are grappling with increased woody densification in previously open landscapes. This phenomenon goes by many names, including "woody thickening", "woody densification", "bush thickening" and "bush encroachment". The drivers behind bush encroachment have been identified both on a local scale, such as modifications in land-use practice, herbivory, rainfall, fire management, and global scale e.g. increased atmospheric CO_2 and climate change.

In the Kruger National Park bush encroachment has been on the radar for a long time as vegetation density has steadily been increasing in some areas. There were concerns around how this increase in woody vegetation would affect herbivore dynamics, fire patterns, changes in vegetation structure and the subsequent impact that these changes may have on Kruger's tourism experience. In response, ways were explored to combat bush encroachment and experiment with high intensity fires.

In 2010, scientists in Kruger began investigating whether high-intensity fires could be applied to knock back woody shrubs (< 5m in height) in the southern part of the park. The first landscape-scale high-intensity fire was applied in September 2010 and repeated at the same site again in September 2013. Two other sites received different fire treatments, including (1) a high-intensity fire in 2010 and medium intensity fire in 2013 and (2) low-intensity fires in 2010 and 2013. Although initial work found that the high intensity fires were effective in the short-term, we were interested in whether these differences could still be seen 10 years after the experiment started. To explore this, a combination of ground-based surveys and airborne LiDAR was used to assess woody vegetation over a 10 year period from 2010 to 2020.

Duduzile Mzimba and Noel Nzima inspect a shrub during a post-burn vegetation survey. Although the expectation was that shrub densities would decrease after one high intensity fire and a subsequent medium intensity fire, shrub densities ultimately increased while large tree densities decreased.

We found that between 2010 and 2020 the high-intensity fires did not significantly reduce the number of woody shrubs below 5 m. Interestingly, there was a substantial increase in shrubs smaller than 1 m which we believe is in response to the fire as shrubs started resprouting. Ten years after the fire, the high-intensity fires did not substantially reduce woody cover, and irrespective of the fire treatment, cover seemingly further increased over the decade.

A lot of time, money and effort were invested into this experiment with high hopes of meaningfully reducing bush encroachment using a high-intensity fire. Unfortunately, this did not happen, but we learned a lot about the (un)feasibility of such an approach for park-wide implementation, how trees can withstand such intense fires during the season and how important interactions with elephants and droughts are. Going forward, we aim to explore the impact of cooler fires at the start or end of the growing season when the shrubs are still active and may be more vulnerable to burning.

Strydom T, **Smit IPJ**, **Govender N**, **Coetsee C**, Singh J, Davies AB & van Wilgen B. W. 2023. High-intensity fires may have limited medium-term effectiveness for reversing woody plant encroachment in an African savanna. Journal of Applied Ecology 60(4): 661-672.