Fire frequency influenced grazed grasslands' resistance and resilience to extreme drought

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Background

Drought and fire seem to increased and will continue increasing in both frequency and magnitude. **Drought, fire, and grazing, are factors influencing ecosystem functions, such as resistance and resilience**. However, the combinate in

Questions

In this study, we try to answer two questions:

Q1: How will grazed grassland's functions (resistance and resilience) response to extreme drought during and after extreme drought in recent decades?

Q2: Are the responses different between grasslands in North America and South Africa?

Data and Methods

Data:

- Landsat 5/7/8 NDVI (30m, 1984-2018)
- Global SPEI Database (0.5 deg)

Method:

(1) Homogenization (Roy et al, 2016)

(2) Resistance and resilience quantitation (Isbell et al., 2015)

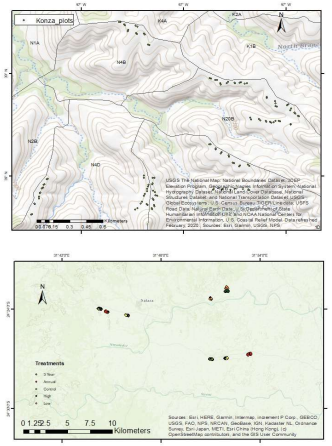

Figure 1. Study Areas and plots at
(a) Konza;
(b) Kruger

Results

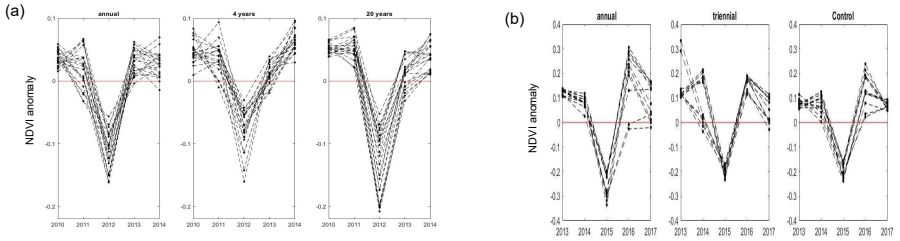

Figure 2. NDVI anomaly before, during, and after extreme drought.
(a) at Konza (2010 – 2014), extreme drought happened in 2012;
(b) at Kruger (2013-2017), extreme drought happened in 2015.

(1) Full recovery of productivities were observed the following year at the study sites (Fig. 2). These results suggest that grazed grasslands show high resilience, but low resistance to extreme drought.

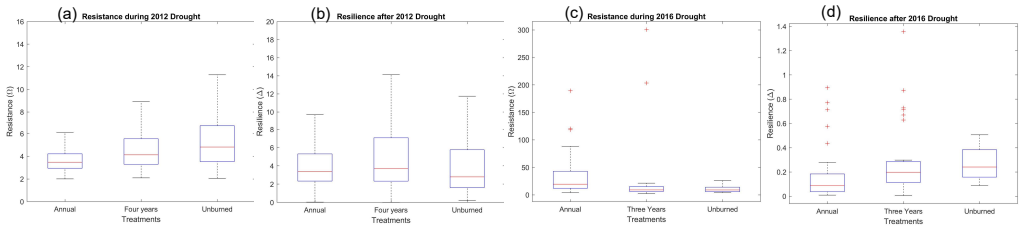

Figure 3. Resistance and resilience of different burning treatments

(a) Resistance of plots at Konza during 2012;
(b) Resilience of plots at Konza after 2012 drought;
(c) Resistance of plots at Kruger during 2015 drought;
(d) Resilience of plots at Kruger after 2015 drought.

(2) The degree of resistance and resilience were influenced by fire frequency. At Konza, during and after extreme drought in 2012, unburned grassland showed the highest resistance but lowest resilience, while grassland burned every four years and annually had lower resistance but relatively higher resilience. The resistance and resilience at Kruger exhibited an opposite pattern(Fig. 3).

Conclusion & future work

(1) Grazed grasslands at Konza and Kruger showed quick recovery from extreme drought events.

(2) Different burning frequency might influence grazed grasslands' resistance and resilience.

- Herbivore species and grazing intensity need to be considered;
- Burning history should be included. For example: both N20A and N20B watersheds at Konza were designed to be burned every twenty years, but only N20A was burned in 2012.
- Growing season also needs to be considered;

References

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