The impact of seasonal anthropogenic bush burning on plant diversity and soils. A case of Northern region, Ghana

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Order of Presentation

- Background and Problem statement
- Objectives
- Research questions
- Study area & Methodology
- Results
- Highlights from the study

Background

- The use of fire for conversion of forests and savannas into agricultural and pastoral land is a major land use change, which is accompanied by large-scale burning of biomass

- There is extensive evidence that ecosystems are being degraded at an alarming rate for which bush burning is undeniably one of the major causes resulting in lost of flora and fauna (Hamid *et al.* 2010, Asser *et al.* 2005)

- In the tropical savannah, natural fires rarely occur however anthropogenic fires are a major driver of change in vegetation and ecosystem function (Dayamba, *et al*. 2010)


Photo: The advocate News, 2010


Photo: Alexandria Joyce , EWB Jan, 2012

Background cont'd

Time, frequency and intensity of fire has both direct and indirect influence: Soil organic compounds and texture, alteration of plants, reducing viability of some seeds and destroying food sources and habitats of animals

Bush burning, controlled or indiscriminate continue to be among the most important dynamics influencing diversity of plant communities in the savanna (Kugbe et al. 2013; Trollope and Trollope, 1996)

A survey conducted in parts of Ghana, including the Greater Accra, Ashanti and most communities in the Northern and Upper Regions, revealed that the Northern Region has recorded higher occurrences of fires (40-80%) than the other 9 regions of Ghana (Kugbe et al. 2013).

Reason for burning

Hunting

Tapping honey

Local belief that fire improves fruiting and yield of

- *Vitellaria paradoxa* Gaertner.f. *(Shea tree)*
- *Parkia biglobosa (Jacq.) (African locust bean tree)*

For easy picking of shea fruits

Reasons for burning

To save on labour cost for land preparation for cropping

Wood for fuel

To stimulate growth of fresh grass for grazing animals

Problem Statement

- This can lead to the alteration of ecosystem processes, loss of genetic and species diversity
- Research has shown that ecosystem degradation reduces carbon sequestration and may turn carbon sinks to sources, hence exacerbating the impacts of climate change
- Fire, however, has been purported to trigger germination of some savanna species
- Seasonal practice of bush burning is progressively becoming more detrimental than the supposedly beneficial purposes for which it was intended
- However, there is relatively little information on the impacts of fire on plant species diversity, soil seedbank
- This includes its impact on plant species diversity and abundance

Objectives

- To estimate tree species density and diversity under different burning regimes

- To estimate seedbank density under different burning regimes

Study area

- Lying mostly between 8–10° N and 0–2° W, occupies an area of about 70,383 km^2
- The region has a population of nearly 2.5 million
- Population density is relatively low, less than 38 persons per square kilometre
- The land is mostly flat, with an altitude of about 150 m above sea level
- The region is drained by the Black and White Volta rivers
- **Climate**:
- subhumid and semi-arid
- Mean monthly temperature of 24 - 35 °C

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Study area cont'd

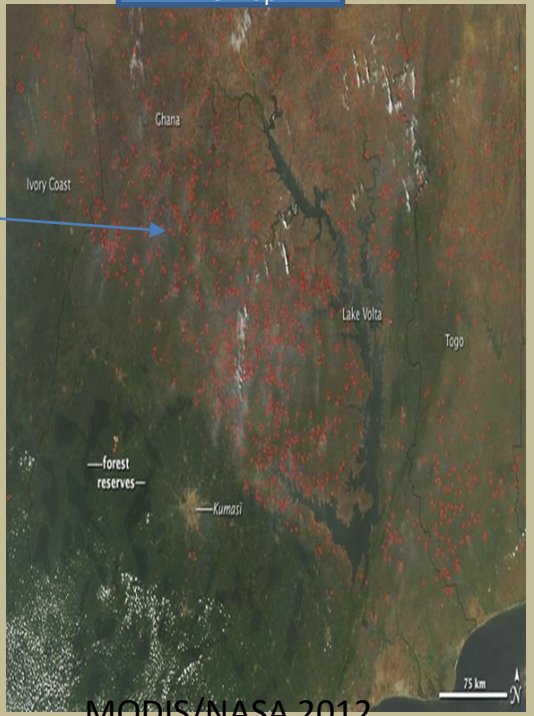
- Rainfall: about 1100 mm per annum
- Usually dry from Nov. to May which facilitates vegetation burning

- **Vegetation**:
  - Guinea savannah gradually tranforming into sudan savanna woodland toward the south

  - Characterized by drought-resistant trees such as *Grewia mollis*, *Adansonia digitata* grasses; *Andropogon gayanus* and *Sporobolus pyramidalis*

- **Soil:**
  - Light soils;prone to erosion
  - Ochrosols /ultisols

Fire map



MODIS/NASA 2012

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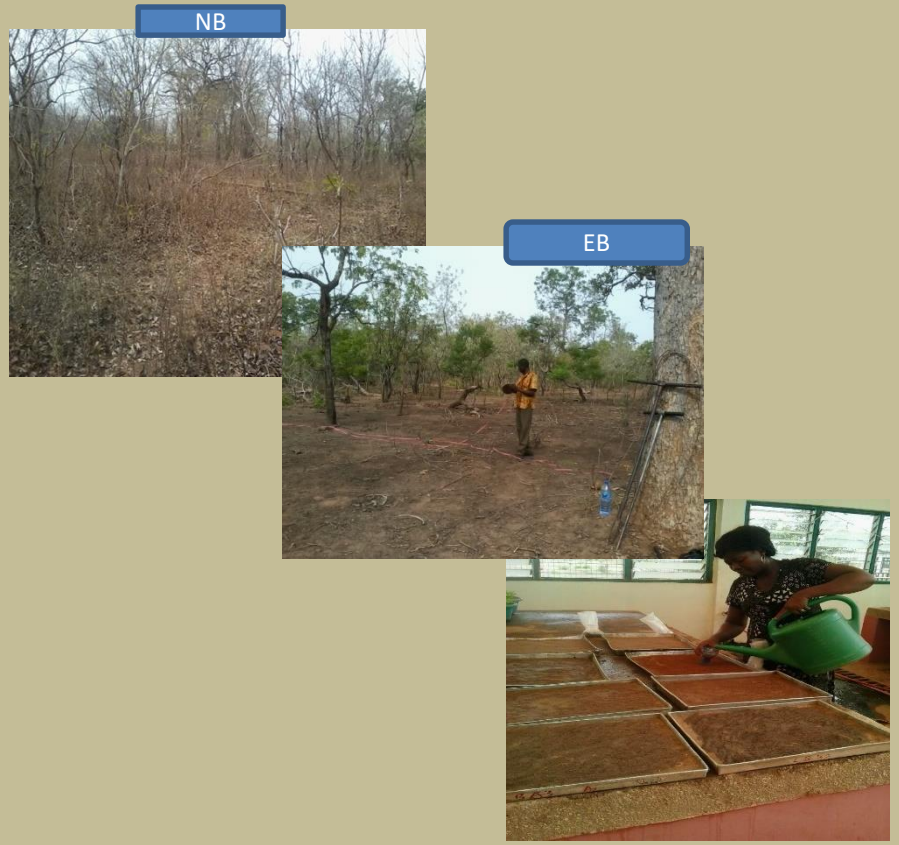
Sampling and Experimental design

- Samples were taken from three treatments :

Late burning, early burning and non burning (50*50m each) at the Mole National park

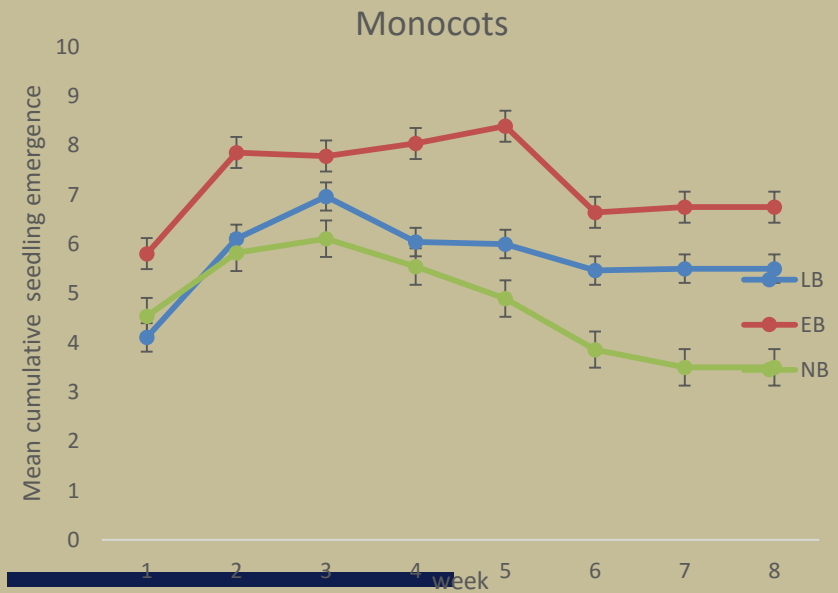
- Systematic grids of 10m*10m for soil
- 10m*10m quadrats used for tree sampling
- Tree enumeration and identification
- Germination experiments (seedlings identified as monocots and dicots)
- Laboratory analysis of basic soil parameters (pH, OC, N,P,K)

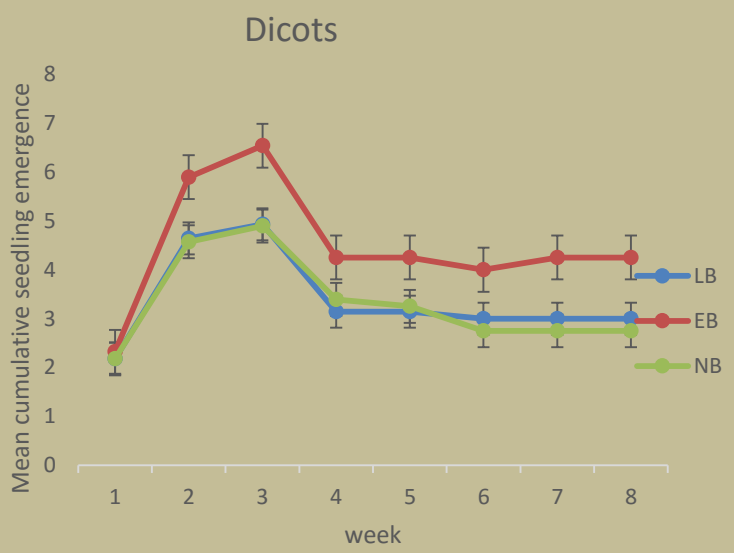


Statistical analysis

- ANOVA was used to compare means and standard deviation.
- Soil seed bank analysis showed a P = 0.0405 is significant.
- Soil nutrient analysis s P = 0.0001, is significant.
- Tree species identification showed a P = 0.5520, not significant.
- Results are presented in graphs

Effect of burning on seedling emergence





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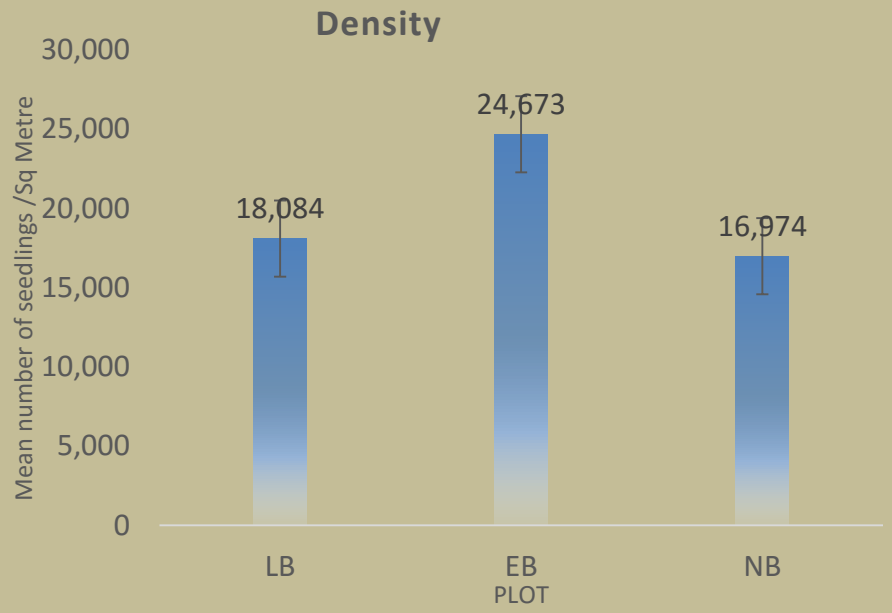
Seedling densities between treatments



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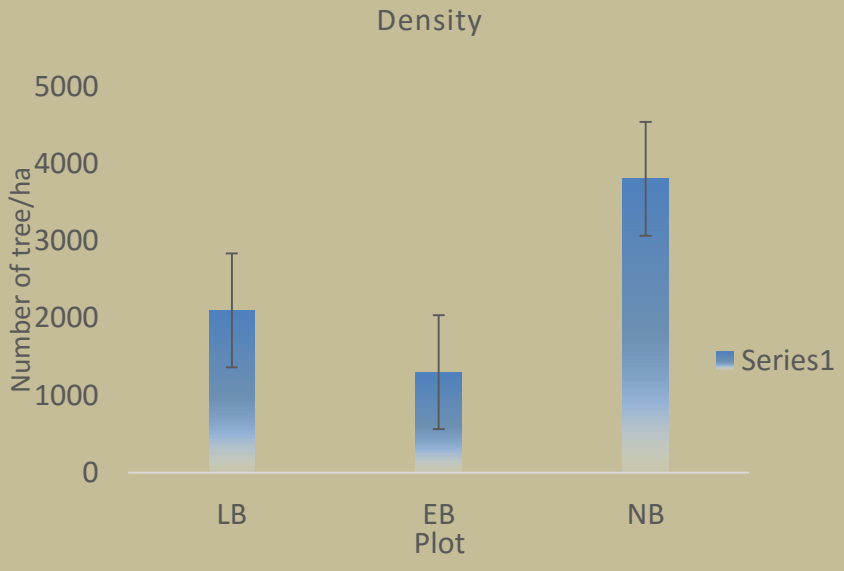
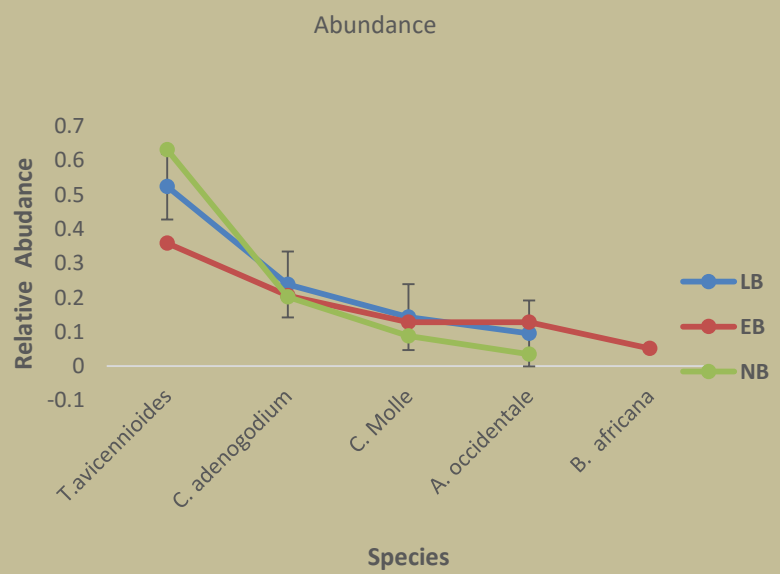
Tree species density and relative abundance





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Some highlights from the study

- The study revealed that burning has significant influence on density of soil seed bank. The extent of influence however depends on the time of burning
- Tree species density was higher in non-burnt treatments than burnt treatments
- Species diversity (relative abundance) was high in early burning treatment but the lowest tree density

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Thank you for listening

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