# Future Carbon Storage in Vegetation

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## Introduction

### Carbon storage in trees ...

- ... has long been a neglected **ecosystem service** in global drylands though it may be substantial
- ... could play an **economic role** in the future, if carbon certificates were sold and people benefitted from conserving trees
- ... but rates of **carbon gains & losses need to be quantified** accurately.

**Methodological challenges** in doing so are biggest for highly disturbed dryland ecosystems. This is to the disadvantage of those regions in particular which are likely to be impacted by global climate change most severely while their inhabitants depend on natural resources most urgently.

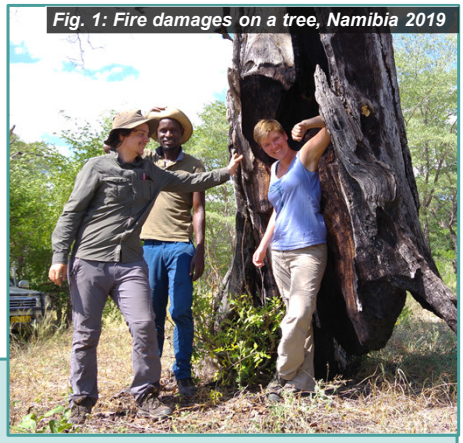


*Fig. 1: Fire damages on a tree, Namibia 2019*

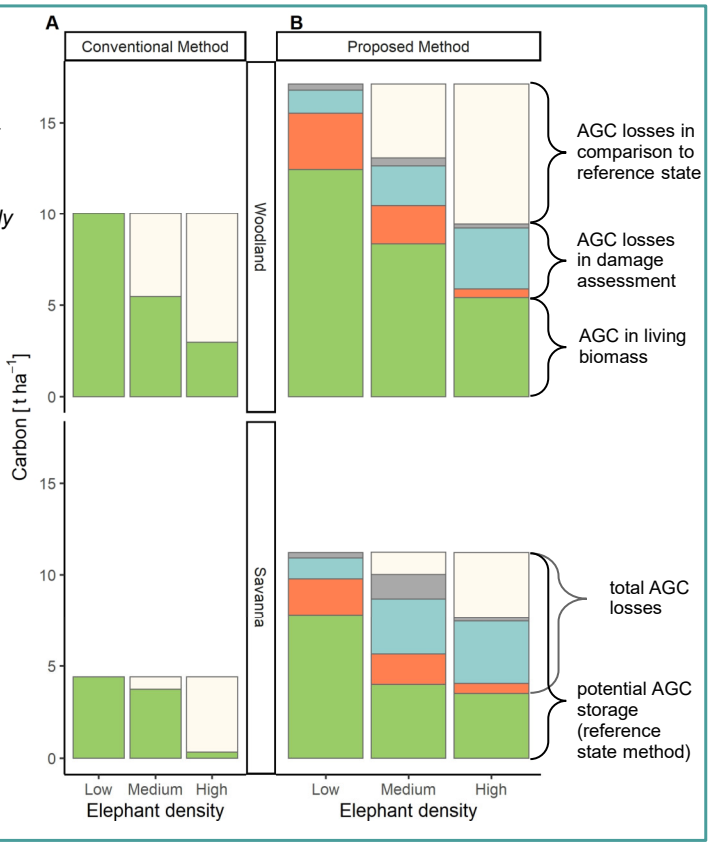
## Key Questions

- How much carbon is stored in savannas and dry woodlands?
- How can measuring protocols be attuned to better meet methodological challenges in disturbed ecosystems?
- How much carbon is going to be lost to disturbances (fires, elephant damage, or human impact) under future pathways of nature conservation and agricultural intensification, respectively?

## Problem Statement

- Conventional methods of carbon assessment ignore all small or highly damaged trees
- Most trees in savannas fall into this category and hold considerable aboveground carbon (AGC) storage
- Conventional methods do not allow for detailed AGC loss analysis, which is essential to understand impacts of future making on carbon storage

***Fig. 2:** Comparative carbon storage assessment with conventional and proposed methodology for two exemplaric dryland vegetation types. A) Conventional method's results; B) Proposed method's results with additional damage assessment; AGC = aboveground carbon in woody vegetation.*




## Results (see Fig. 2)

- Our proposed method shows higher AGC stocks and higher potential storage than would be conventionally estimated for both vegetation types
- Along the conservation pathway, AGC is increasingly lost to natural disturbances, mainly due to higher elephant densities
- Elephant damages and fire damages are interdependent

## Future-Making & Hypotheses

Two conflicting pathways of land-use change (Conservation vs Agricultural Intensification) will influence carbon storage.

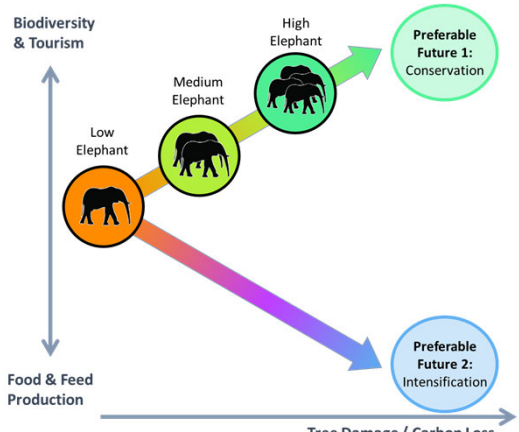



*Fig. 3: Space-for-time substitution design*

## General Fieldwork

- Stratified sampling design that includes trees of all sizes and damage levels
- Basic tree measurements (height, canopy diameters, stem diameter) to feed into allometric models **-> Tree biomass, carbon storage**
- Damage assessment on trees **-> Carbon losses to specific disturbance factors**
- Up-scaling from individual trees to area **-> Carbon storage on landscape level**
- Complemented by other plant functional traits **-> Inner functioning principles of dryland ecosystems**

## Most Recent Analysis

- Method comparison: conventional measuring protocol was compared to the procedure proposed by us **-> Development of methodological guidelines for future studies to assess carbon storage in highly disturbed dryland ecosystems more accurately**

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