# Carbon, biodiversity & ecosystem services: exploring co-benefits

Initiatives aiming to Reduce Emissions from Deforestation and forest Degradation, and conserve, sustainably manage or enhance forest carbon stocks (REDD+) can help to deliver important benefits in addition to their primary goal of carbon management. Such co-benefits include conservation of forest biodiversity and maintenance of ecosystem services.

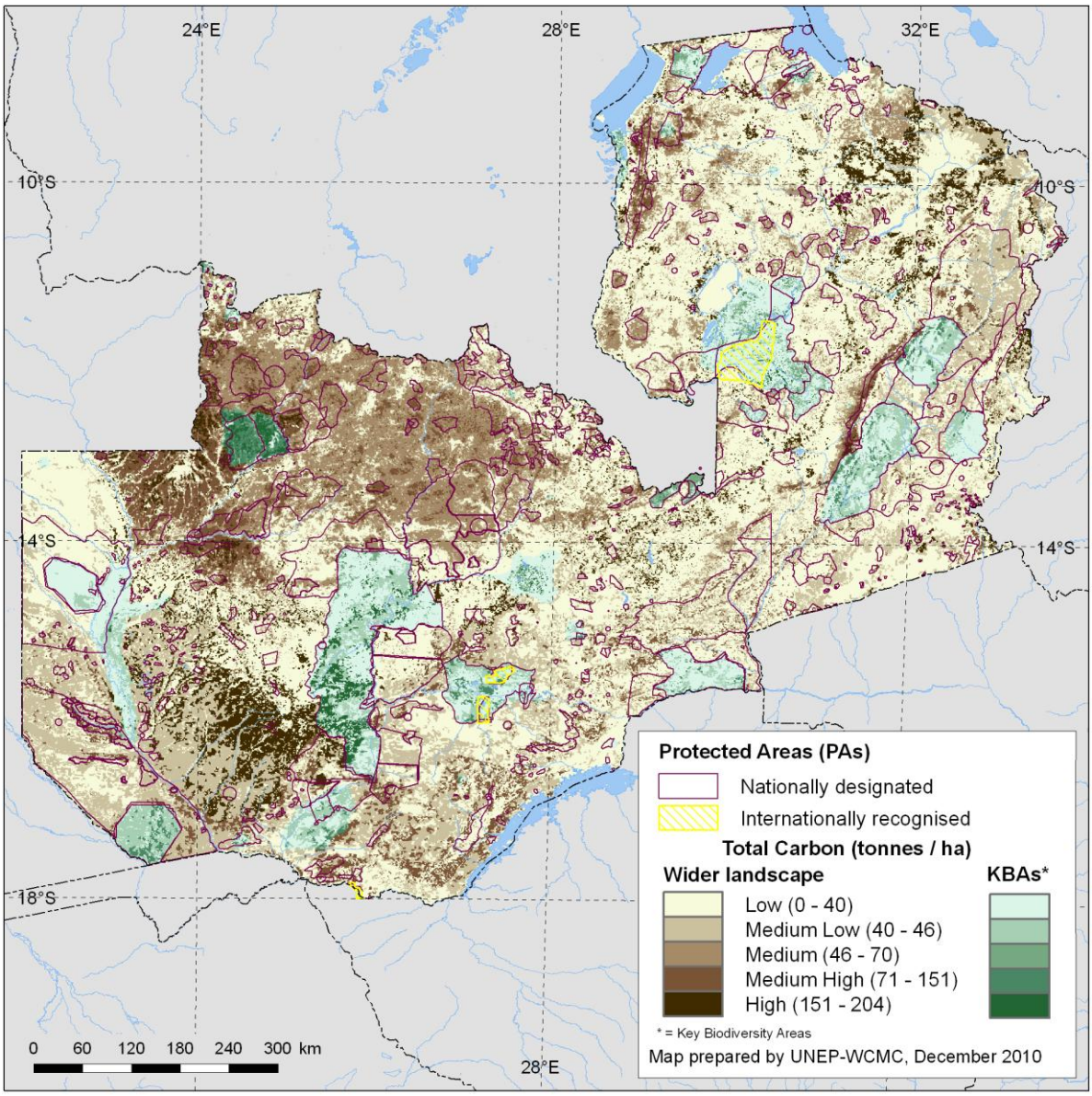
## Zambia

**Land area:** 743 390 km$^2$ (1)
**Population:** 11 441 000 (2005 estimate, 2)
**Bordering countries**: Angola, Congo (DRC), Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia
**Forest extent**: 494 680 km$^2$ (1)

REDD+ and its potential co-benefits are important in Zambia, where forest area is decreasing by 0.3% each year (1). Zambia contains 14 terrestrial ecosystem types, with forests and woodlands covering over 60% of the country's land (3). However, natural resources are increasingly under pressure from over-exploitation, destruction from fires, pollution and other anthropogenic activities.

## Carbon in Zambia's biomass and soil

Zambia's terrestrial carbon stocks total about 9.7 Gt, comprised of 3.2 Gt of carbon in above- and below-ground biomass (Map 1) and about 6.5 Gt in soils (to 1 m depth, Map 2).




**Map 1 Distribution of biomass carbon, Key Biodiversity Areas (KBAs) and protected areas (PAs) in Zambia** (underlying data from 4; 5; 6; 7)

Both biomass and soil carbon are distributed unevenly over the country; areas of highest biomass carbon density contain 24% of Zambia's biomass carbon but cover only 7% of the country's land area (i.e. around 50 600 km$^2$; Figure 1). More than half of Zambia's land is low in biomass carbon, but a few of these areas are characterized by high soil carbon.

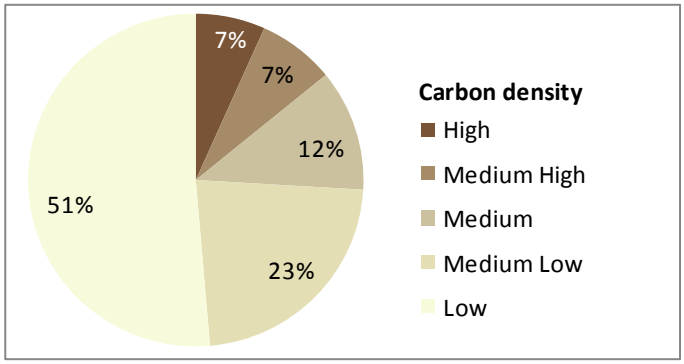
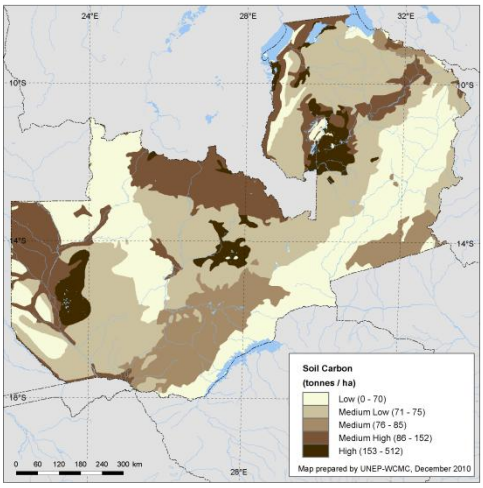



**Figure 1: Percentage of country area covered by different biomass carbon density classes**

It may be important for Zambia to consider the importance of soil carbon and its management in developing national strategies for climate change mitigation.




**Map 2: Soil organic carbon stocks of Zambia** (underlying data from 8)

## Carbon, biodiversity and protected areas

Key Biodiversity Areas (KBAs) are areas of high priority for biodiversity conservation that have been identified by stakeholders in country according to internationally agreed criteria (9). The 40 KBAs that have so far been identified in Zambia (Map 1) cover about 97 800 km$^2$ of land, and include roughly 0.4 Gt of biomass carbon and 1.2 Gt of soil carbon. About 7% of the land within KBAs (6 400 km$^2$) is of high biomass carbon, i.e. representing about 13% of the high carbon area in the country. However, most of the KBAs are of lower biomass carbon.

Zambia has 628 protected areas (nationally designated and internationally recognised) covering around 266 900 km$^2$, or 36% of its total land area (Map 1), which in total contain about 1.1 Gt of biomass carbon (and 2.2 Gt of soil carbon). They cover 88% of the land area that is both high in biomass carbon and of biodiversity importance (defined as being located within a KBA). Of the 780 Mt of biomass carbon stored in land that is high in carbon, 162 Mt (about 20%) are in protected areas (Figure 2). In total, 12% of the land area important for both carbon and biodiversity has no form of legal protection.

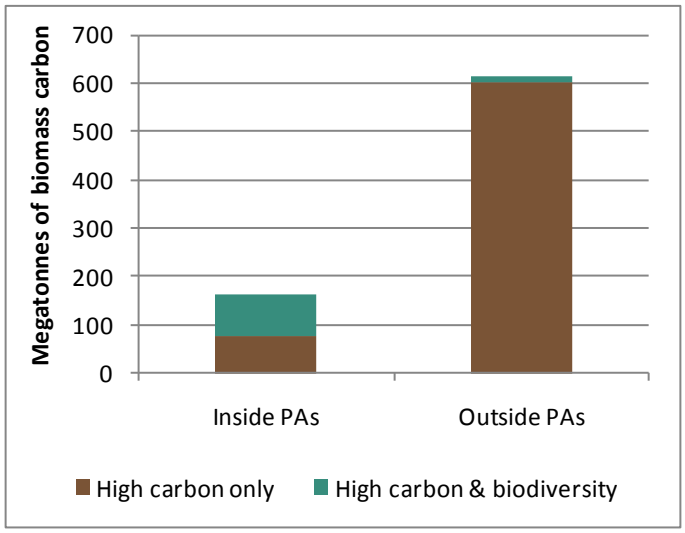



**Figure 2: Biomass carbon from areas that are high in carbon and of biodiversity importance inside and outside protected areas (PAs)**

Well-designed REDD+ interventions in these areas are likely to provide a considerable benefit to biodiversity. Similarly, projects that improve the effectiveness of protected areas in retaining both forest carbon and biodiversity value may make a significant contribution to REDD+.

## Further development

These preliminary analyses are based on regional and global data. They represent a first step in exploring the potential for co-benefits of carbon management for climate change mitigation under REDD+ in Zambia. Any future work should be conducted in close collaboration with national stakeholders and institutions to ensure that national priorities are considered and best available national data are used. Further analyses could build on these first results by: improving the carbon map; integrating additional datasets on biodiversity and ecosystem services; and exploring how pressures on carbon (e.g. infrastructure, mining) relate to carbon distribution.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