Remote sensing techniques for calculating the above-ground biomass stored in agroforestry systems open the way for monitoring restoration policies

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Context: While many companies are seeking to offset their carbon emissions, following the resolutions of COP 26 in Glasgow, very few are financing carbon sequestration through enrichment of the above-ground biomass of traditional agroforestry systems in Africa. One reason is the difficulty of monitoring the effects of incentive policies on a large number of small-scale farmers in areas that are sometimes difficult to access.

In the Sahelian Far North region of Cameroon, several projects encouraged the restoration of *Faidherbia albida* agroforestry parklands by subsidising their ANR (Assisted Natural Regeneration) from 1997 to 2008. A subsidy of about 0.2 USD was given to each of the farmers who kept a Faidherbia seedling or shoot in their fields, i.e., 20 USD ha^{-1} for 100 trees per ha. An inventory of these parks in 2012 showed that about 1 million trees had been conserved.

However, the security crisis of 2015 and restrictions related to Covid-19 have made it difficult for scientists to access these areas.

Material and method: To verify the evolution of these agroforests after the end of the subsidy, a remote sensing study was carried out on the territories of two villages, Sirlawe and Gane, using Google-Earth images from 2009, 2013 and 2018.

Results: The projected crown area more than doubled between 2009 and 2018, increasing from 246 to 587 m^2*ha^{-1} (2.5% to 5.9%) and from 245 to 575 m^2*ha^{-1} (2.5% to 5.8%) for Sirlawe and Gane, respectively.

Discussion: The allometric equations for calculating the above-ground biomass of trees as a function of crown area remain too imprecise to make an acceptable calculation of the carbon stored during this period. However, it is very likely that the amount of above-ground biomass stored and pruned each year to feed livestock and produce wood energy cost much less than biomass obtained from plantations.

Conclusion: Further work needs to be carried out by a European project INNOVAC, from 2022 onwards, to refine the remote sensing methods and the reliability of the allometric equations, which would pave the way for monitoring the quantities of carbon stored and saved by this type of ANR subsidy.
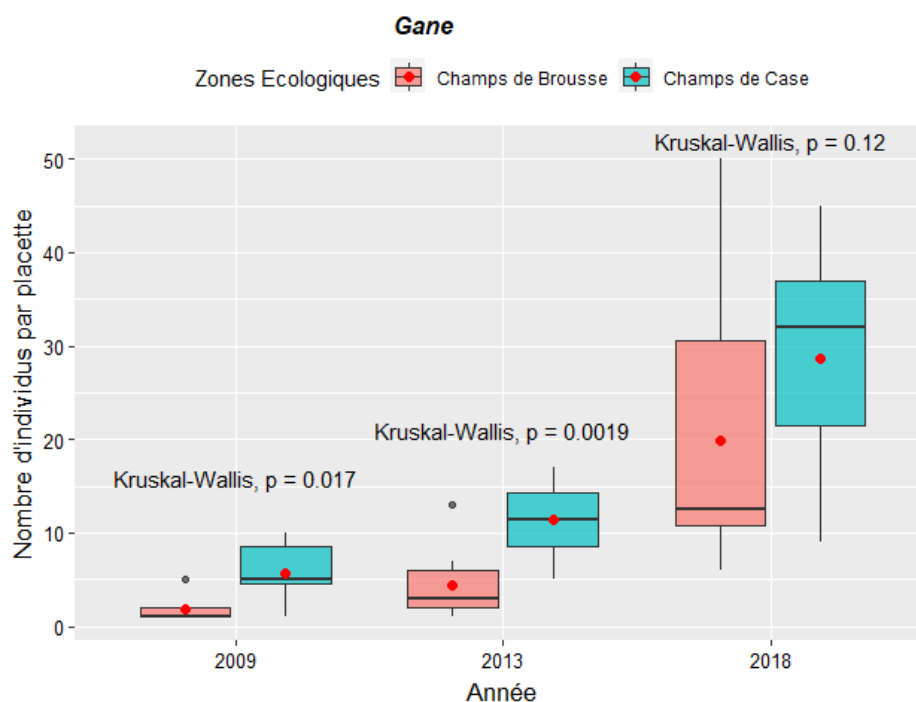

Figure: Number of trees estimated by agro-ecological zone, according to dates, on the Gane landscape