CARBON OFFSETS: FORESTRY

This work is preliminary, and subject to change. Questions and comments are welcome at givinggreen@idinsight.org.

SUMMARY:
Forestry carbon offsets suffer from two classes of problems that make it difficult to know their true impact. First, the contribution of forests to global warming is surprisingly immature, and there is controversy in the scientific community as to how much (if at all) changing forest cover affects the temperature of the planet. Second, there are problems measuring the contribution of any forestry offset project – there is limited rigorous evaluation research on the effectiveness of forestry interventions. Of particular concern is “permanence”, which refers to the fact that in order to keep CO₂ out of the atmosphere, trees must stay alive for many years. This adds an additional layer of uncertainty to any forestry project that is nearly impossible to resolve. At this moment, we have not found any forestry offsets that we feel comfortable recommending.

OUR RESEARCH PROCESS:
OVERVIEW OF FORESTRY OFFSET PROJECTS
Forestry offset projects generally fund NGOs working to increase forest cover. There are two main types of projects. The first are forest conservation projects. These projects work with local communities to prevent deforestation, through establishing forest management plans, providing alternative livelihoods, or simply offering cash payments (known as “payment for ecosystems services”, or PES). The second type of project involves increasing forest cover by planting trees (also known as “afforestation”).

SCIENTIFIC QUESTIONS REGARDING TREES AND THEIR RELATION TO CLIMATE CHANGE
Planting trees seems to be an obvious way to reduce atmospheric carbon dioxide: photosynthesis pulls carbon dioxide and water from the environment and produces oxygen and glucose in return. Much of this carbon dioxide is stored in the wood of the tree, sequestering it from the atmosphere as long as the tree is alive. (Once a tree dies its biomass eventually decomposes, releasing carbon back into the atmosphere.) The reduction in CO₂ suggests that tree planting should be a clear winner for carbon offset markets.

Unfortunately, it is hard to know the net contribution of any tree or forest to global carbon dioxide or global warming. This recent article in the journal Nature discusses the difficulty of assessing the effect of trees on climate change. While direct carbon capture likely has a cooling effect, trees emit other gases into the atmosphere, some which may have warming effects. Additionally, trees can affect warming through changing the earth’s reflectivity of sunlight (known as an “albedo” effect). For example, conifers with dark leaves in far northern forests tend to absorb a lot of heat relative to highly reflective snow cover, reducing or even eliminating the positive effects of their carbon capture.
This research is highly controversial, and many climate scientists to believe that increasing forest cover is a key tool in fighting climate change. However, it is safe to say that our understanding of the relationship between trees and climate is still evolving.

**CHALLENGES WITH FORESTRY OFFSETS**

In addition to the scientific challenges of measuring trees’ impact, forestry projects must address the standard set of challenges common to all offset projects: overestimation, additionality, leakage, and permanence.

**Additionality (I): Would the project have been implemented without offsets?** In general, forestry conservation programs are run by NGOs dependent on outside funding. In these cases, it seems reasonable to assume that income from offsets are directly fueling project operations, allowing more activities than without them. However, sometimes forestry offsets are related to enterprises hoping to make a profit by selling lumber. In these cases, it is possible that the enterprise was profitable without offsets, and therefore it can be more difficult to quantify their additionality.

**Additionality (II): Did the project actually cause changes in forest cover?** Another difficulty with forestry offsets is determining whether the project actually resulted in increased forest cover. For example, some forestry offset projects aim to prevent deforestation by paying landowners to not cut down their trees - but how can you really know that they would have cut down the trees without the credit? Organizations like Gold Standard that sell offsets set detailed standards and require projects to document the history of the land and suggest what would have happened in the absence of credits. But here is limited rigorous evidence using valid counterfactuals on the effect of forestry interventions. Without a convincing counterfactual it is hard to trust claims of the amount of change in forest cover.

**Leakage:** Forestry projects can also suffer from “leakage” – the concept that preventing deforestation in one area may just cause it to increase in other areas. This is likely true if the underlying demand for forest destruction is not addressed. For example, a project in Brazil might seek to protect a certain forested area from being converted to pasture land, but if the ranchers’ demand goes unmitigated they will likely just shift their activities to another forest where the project is not operating.

**Permanence:** Trees capture and store carbon as biomass as the tree grows. This carbon is not eliminated, but converted into tree matter and fixed to the soil, and if the tree dies and decays (or burns) it will be released back into the air. The ability of trees to reduce atmospheric carbon depends on their survival over decades.

If trees that are planted or conserved end up getting destroyed in the future, all benefits of the project are lost (except a delay in GHG emissions). However, most forest projects seem to have significantly shorter timelines, often just a few years or decades. Risks to permanence can be unintentional (such as fires and pests), or intentional (such as logging). To address the risks of such “reversals”, voluntary certifying agencies such as Gold Standard assign a risk score to forestry projects and require a risk-related proportion of credits to be put into a risk buffer pool. However, it is unclear whether future monitoring of reversals will be adequate, and if the buffer pool will be enough to account for them.
Overestimation: Forestry carbon offset projects do not try to directly measure greenhouse gas emissions or quantify other contributions to warming, presumably because doing so would be prohibitively expensive. Instead, program staff model carbon capture based on the number and type of trees planted. But project implementers face the incentive to exaggerate claims about the number and type of trees, as well as various forest management practices that affect net carbon reduction. Agencies such as Gold Standard address this by requiring periodic audits, but these are generally contracted by the program implementer, which presents a conflict of interest.

EVIDENCE OF EFFECTIVENESS OF FORESTRY INTERVENTIONS

Given the difficulty of assessing the causality of forestry offsets in theory, we turn to the literature to understand what evidence exists on the effectiveness of forestry interventions.

There has been significant criticism of forestry offsets. For instance, a guide to assessing the validity of carbon offsets by Broekhoff et al (2019) categorizes forestry offsets as being “higher risk” of being low quality due to concerns about additionality and permanence.

Additionally, a recent article by the investigative journalism organization ProPublica looked into a myriad of forest conservation offset projects, and came to the following conclusion:

“In case after case, I found that carbon credits hadn’t offset the amount of pollution they were supposed to, or they had brought gains that were quickly reversed or that couldn’t be accurately measured to begin with. Ultimately, the polluters got a guilt-free pass to keep emitting CO₂, but the forest preservation that was supposed to balance the ledger either never came or didn’t last.”

We now turn to the public policy literature. Unfortunately, there are few rigorous impact evaluations of forestry interventions. One exception is a recent RCT by Seema Jayachandran published in the journal Science. This RCT studied a program in Uganda in which farmers were paid to not cut down their trees. They indeed found decreased deforestation compared to control areas, and established that leakage was unlikely to be occurring. However, this program only lasted two years, so permanence is an issue. The authors do not make a claim of permanence- instead they assume that deforestation will likely resume once the program ends, and therefore the benefits of project come from delaying the deforestation. While they do find that the program is cost-effective even when only considering a delay in deforestation, this conclusion comes from a complicated calculation relying on an assumed discount rate and evolution of the social cost of carbon over time. The parameters chosen in this calculation are controversial, and therefore we don’t have a high degree of confidence that this program is cost effective. To permanently offset carbon emissions the program would have to be run in perpetuity, making the cost of the offset prohibitively high.

RECOMMENDATIONS

Given the limited evidence on the effectiveness of forestry interventions and concerns over permanence, we have not yet been able to find any forestry interventions we can recommend with confidence.
REFERENCES


