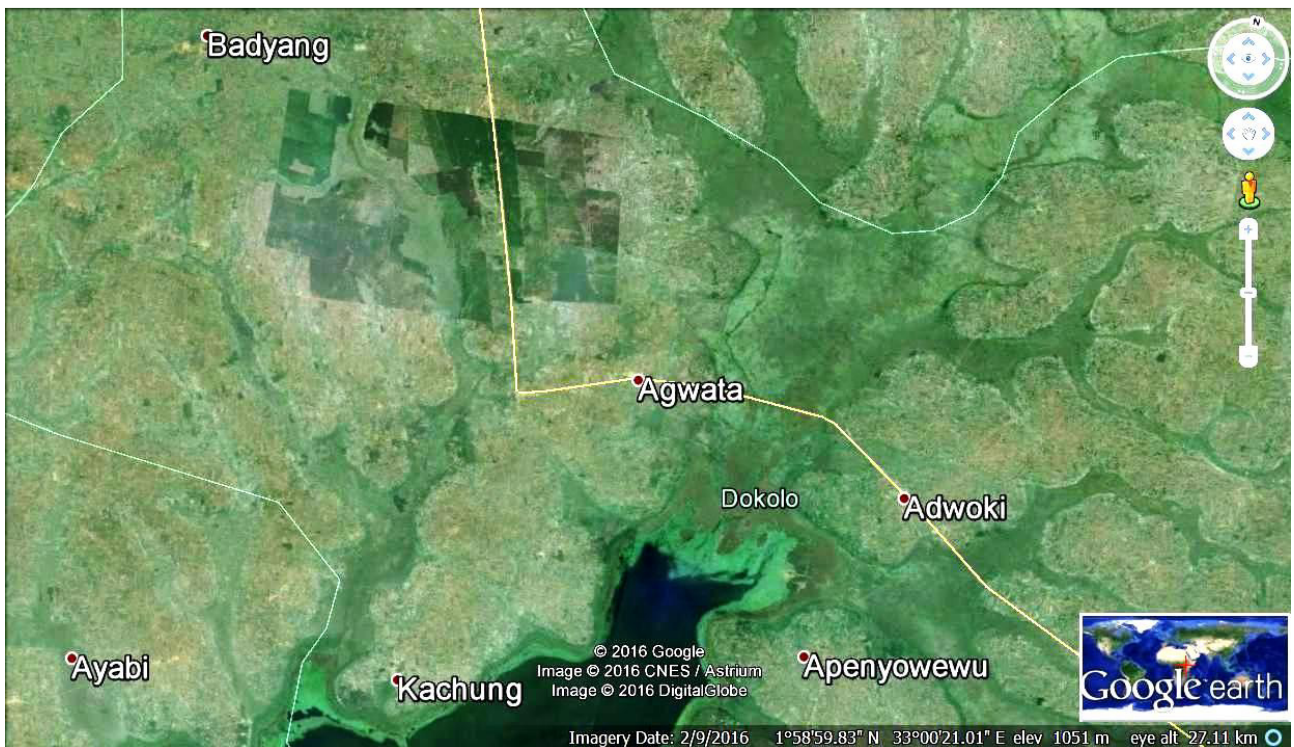


Impacts of Green Resources' tree plantations at Kachung, Uganda



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Local community – The villagers of Kachung are traditionally dependent on shifting cultivation, small-scale subsistence farming and fishing for their livelihoods. Now they are being denied access to land they previously utilised, that is vital for growing food crops, grazing their livestock, as well as for obtaining water, medicinal plants and building materials from within the Green Resources tree plantation project area.¹

Non-native tree monocultures – Green Resources plants alien trees which do not naturally occur in Africa. Single species even-aged monocultures of mainly pine, *Pinus caribaea var. hondurensis*, from Central America, and different Eucalyptus species of Australian origin are being planted.² Green Resources declares, in its Project Design Document (p. 119-120), that these tree species are not invasive.³ According to CABI (Invasive Species Compendium) and Invasive Species South Africa both *Pinus caribaea* and *Eucalyptus grandis* are classified as invasive.^{4,5} These trees grow quickly, consuming a lot of water,⁶ which alters the natural hydrological regime.⁴ Eucalyptus plantations can consume more water than the rainfall, and this reduces the ground water level.⁷ They prevent water from reaching streams and rivers during dry seasons, which also affects the local community negatively. Both eucalyptus and pine trees contain volatile oils in their foliage,⁸ which can increase the incidence of wildfires.⁴ Tree plantations kill the native vegetation within their direct footprint, damage ecosystems, and their rapid growth also depletes soil nutrients.⁷

Natural vegetation – Green Resource's plantation project lies within an area which is a mosaic of principally grassland, with shrubland and groups of trees including *Combretum collinum*, *Borassus aethiopum* and *Acacia hockii*, interspersed by seasonal pans and wetlands. In recent times the area has been increasingly used for crop cultivation and grazing, as well as fuel-wood collection and charcoal production, which has reduced the number of native trees.⁹

In order to justify its plantation project, Green Resources claims this land is "degraded".⁹ The world's natural grasslands, savannas, and open-canopy woodlands are often misperceived to be of low conservation priority relative to forests, and are therefore at greater risk of conversion into agricultural lands and tree plantations. This conundrum is reflected in environmental policies which endorse tree planting projects. The International Union for Conservation of Nature (IUCN) and World Resources Institute (WRI) also mistake grassy biomes, including savanna, to be "degraded", even though they are functional components of important natural ecosystems.¹⁰

¹ Oakland Institute (2014). *The Darker Side of Green - Plantation Forestry and Carbon Violence in Uganda*; http://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/Report_DarkerSideofGreen_hirez.pdf

² Green Resources (2013). *Kachung plantation, Uganda*; <http://www.greenresources.no/Plantations/Uganda/Kachung.aspx>

³ UNFCCC/CCNUCC (2012). *Climate, Community and Biodiversity Standards Project Design Document Form for Afforestation and Reforestation Project Activities (CCB-AR-PDD)*, Version 05; https://cdm.unfccc.int/filestorage/p/i/RLSMTJXD08957BKV6FNYEAWI0U1Q2H.pdf/08_KachungAR_PDD_08_TRACK_Approved.pdf?t=OGR8bzFxaYQfDB3LDL8SKU21Mzt1yig970A

⁴ CABI (2014). *Pinus caribaea*. Invasive Species Compendium. Wallingford, UK: CAB International. <http://www.cabi.org/isc/datasheet/41573>

⁵ Invasive Species South Africa (2016). *Saligna gum*; <http://www.invasives.org.za/video/item/252-saligna-gum-eucalyptus-grandis>

⁶ New World Encyclopedia (2008). *Eucalyptus*; <http://www.newworldencyclopedia.org/entry/Eucalyptus>

⁷ Karumbidza, B. & Menne, W. (2011). *CDM carbon sink tree plantations in Africa: A case study in Tanzania*. The Timberwatch Coalition; <http://unfccc.int/resource/docs/2011/smsn/ngo/293.pdf>

⁸ New World Encyclopedia (2008). *Eucalyptus*; <http://www.newworldencyclopedia.org/entry/Eucalyptus>

⁹ UNFCCC/CCNUCC (2012). *Climate, Community and Biodiversity Standards Project Design Document Form for Afforestation and Reforestation Project Activities (CCB-AR-PDD)*, Version 05; https://cdm.unfccc.int/filestorage/p/i/RLSMTJXD08957BKV6FNYEAWI0U1Q2H.pdf/08_KachungAR_PDD_08_TRACK_Approved.pdf?t=OGR8bzFxaYQfDB3LDL8SKU21Mzt1yig970A

¹⁰ Veldman, J. W., Overbeck, G. E., Negreiros, D., Mahy, G., Le Stradic, S., Fernandes, G. W., Durigan, G., Buisson, E., Putz, F. E., Bond, W. J. (2015). *Where Tree Planting and Forest Expansion are Bad for Biodiversity and Ecosystem Services*. *BioScience*, vol 65 (10), pp 1011-1018; <http://bioscience.oxfordjournals.org/content/65/10/1011.full>

Biodiversity – Clearing an area of land of natural vegetation and then establishing a plantation of alien invasive trees destroys and fragments a greater area of natural habitat.¹¹ Grasslands, including savannas, are complex ecosystems, supporting large numbers of insects, birds and plant species.¹² A dense tree plantation canopy destroys the rich and productive natural biodiversity of grassy biomes by taking the light and moisture they require to survive. At the same time it reduces habitat for animals adapted to open environments.¹³

Recent research shows that grasslands are often ancient and highly biodiverse. Over millions of years, many plant species have evolved strategies to survive naturally induced fires. This includes the development of underground branches, roots, stems, tubers and bulbs of grassland plants including among certain trees.¹⁴

Although some parts of ecosystems within grassy biomes may be degraded and in need of rest or restoration, dense tree planting and the exclusion of grazing are in direct conflict with grassland biodiversity and ecosystem functions. The distinct ecologies and conservation needs of the grassy biomes must be properly understood and better integrated into both science and policy.¹³

Wetlands – Green Resources' project area includes parts of a vast wetland system which is of great importance for biodiversity. The wetlands are classed as regionally significant large landscape-level areas where viable populations of most naturally occurring species exist in natural patterns of distribution and abundance. The wetlands within Green Resources project area serve as resting sites and corridors for migratory species and provide a critical ecosystem service, water, to the local communities and their livestock.¹⁵

Green Resources recognizes that the wetlands within and surrounding the plantation project area are of ecological importance and claims that they will be conserved to protect biodiversity.¹⁶ However, considering that the company's activities will encroach onto fragile ecosystems by planting alien invasive trees and using toxic chemicals within the wetland buffer zones in the catchment of Lake Kwania, and in other riparian zones, Green Resources will clearly be violating the "Forest Management Plan" and the "Project Design Document", which state that the company has a requirement to maintain the forests, thickets and bushes in close proximity to water bodies, including avoiding planting in buffer zones.¹⁷

¹¹ Omoro L.M.A., Starr M., Pellikka P.K.E. (2013). *Tree biomass and soil carbon stocks in indigenous forests in comparison to plantations of exotic species in the Taita Hills of Kenya*. Silva Fennica vol. 47 no. 2 article id 935. 18 p;
https://helda.helsinki.fi/bitstream/handle/10138/44810/Omoro_SF_2013.pdf?sequence=2

¹² Karumbidza, B. & Menne, W. (2011). *CDM carbon sink tree plantations in Africa: A case study in Tanzania*. The Timberwatch Coalition;
<http://unfccc.int/resource/docs/2011/smsn/ngo/293.pdf>

¹³ Veldman, J. W., Overbeck, G. E., Negreiros, D., Mahy, G., Le Stradic, S., Fernandes, G. W., Durigan, G., Buisson, E., Putz, F. E., Bond, W. J. (2015). *Where Tree Planting and Forest Expansion are Bad for Biodiversity and Ecosystem Services*. BioScience, vol 65 (10), pp 1011-1018;
<http://bioscience.oxfordjournals.org/content/65/10/1011.full>

¹⁴ Bond, W. J. (2016). *Ancient grasslands at risk*. Science Vol. 351: 6269, 120-122.

¹⁵ UNFCCC/CCNUCC (2011). *Climate, Community and Biodiversity Standards Project Design Document Form for Afforestation and Reforestation Project Activities* (CCB-AR-PDD), Version 2;
https://s3.amazonaws.com/CCBA/Projects/Kachung_Forest_Project_Afforestation_on_Degraded_Lands/KFP_CCBA_PDD_Version_4.pdf

¹⁶ UNFCCC/CCNUCC (2012). *Climate, Community and Biodiversity Standards Project Design Document Form for Afforestation and Reforestation Project Activities* (CCB-AR-PDD), Version 05;
https://cdm.unfccc.int/filestorage/p/j/RLSMTJXDO8957BKV6FNYEAWI0U1Q2H.pdf/08_KachungAR_PDD_08_TRACK_Approved.pdf?t=OGR8bzFxaYOfDB3LDL8SKU21Mzt1vig970A

¹⁷ Oakland Institute (2014). *The Darker Side of Green - Plantation Forestry and Carbon Violence in Uganda*;
http://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/Report_DarkerSideofGreen_hirez.pdf

Forest certification – The Forest Stewardship Council (FSC) is considered by some to be a world leading certification system for sustainable forest management. Green Resources received FSC certification in Kachung in 2011. However, there is ample evidence that FSC certification has failed to achieve its original forest conservation objectives. Globally, FSC certifies companies that destroy high conservation value forests and natural grasslands, including natural areas important for indigenous peoples, and allow these areas to be converted into industrial tree plantations. The accredited certification bodies (CBs) approved by FSC International, are contracted directly by the forest companies they certify. Therefore, the CBs are not fully independent. Also, over time, the FSC has come to be heavily dominated by its so-called 'economic chamber' which is controlled by timber industry members and certification bodies, while a few remaining Civil Society Organizations and NGOs make up the membership of the "social" and "environmental" chambers.^{18,19,20,21}

Culturally significant trees and sites – Green Resources has not only cut down valuable indigenous trees, but has also destroyed culturally significant trees and religious sites. Local environment officers and villagers have questioned the suitability of the selected tree species (Pinus and Eucalyptus) to the site conditions (which is a requirement of the management plan), and have raised concerns about the very small area allocated to indigenous species (1% at Kachung according to Green Resources Company Report 2012).²²

Diseases – Even-aged plantations of single tree species composition are vulnerable to high levels of damage through disease, insect attack, wind and drought. They are also more prone to fire.²³

Nutrient leakage – Replacing grassland with plantations leads to a loss of soil fertility and undermines its long-term productivity. The soil is exposed to severe compaction, structural alteration, moisture and nutrient depletion, increased acidity and erosion.²³ A Chinese study has indicated that tree plantation management practices have negative impacts on a number of soil properties when compared to forests. Plantations do not maintain or improve soil fertility as naturally established forests do.²⁴ Decomposing pine needles and eucalyptus leaf litter in plantations are known to reduce soil pH, which increases leaching of nutrients. The altered soil pH also affects soil organisms negatively, natural vegetation is destroyed, and invasive plants thrive. Decomposing or oxidising plantation waste and detritus release carbon dioxide and methane.²³

Chemicals – Green Resources uses chemical pesticides and fertilisers in its plantations. It claims that it uses Roundup (Glyphosate) to a minor extent. This chemical is highly active as it kills all indigenous shrubs, herbs and grasses, as well as weeds, leaving the site free for a whole season of what is considered to be plant growth that might compete with plantation trees for water and nutrients.²⁵ Many villagers have described how the pollution of land and waterways by agrochemicals used in the tree plantations, has resulted in crop losses and livestock deaths.²²

¹⁸ Timberwatch, *Some information on the Forest Stewardship Council (FSC)*, http://www.timberwatch.org.za/old_site/certification.htm

¹⁹ Greenpeace (2013). *FSC at risk*; <http://www.greenpeace.org/international/Global/international/briefings/forests/2013/FSC-at-risk.pdf>

²⁰ Sahlin, M. (2013). *Credibility at Stake – How FSC Sweden Fails to Safeguard Forest Biodiversity*. Swedish Society for Nature Conservation; http://www.naturskyddsforeningen.se/sites/default/files/dokument-media/rapporter/2013_engelsk_rapport_skog_credibility_at_stake.pdf

²¹ FSC-Watch (2014). *The 10 worst things about the Forest Stewardship Council*; <http://fsc-watch.com/2014/06/01/the-10-worst-things-about-the-forest-stewardship-council/>

²² Oakland Institute (2014). *The Darker Side of Green - Plantation Forestry and Carbon Violence in Uganda*; http://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/Report_DarkerSideofGreen_hirez.pdf

²³ Karumbidza, B. & Menne, W. (2011). *CDM carbon sink tree plantations in Africa: A case study in Tanzania*. The Timberwatch Coalition; <http://unfccc.int/resource/docs/2011/smsn/ngo/293.pdf>

²⁴ Liao, C., Luo, Y., Fang, C., Chen, J. and Li, B. (2012). *The effects of plantation practice on soil properties based on the comparison between natural and planted forests: a meta-analysis*. *Global Ecology and Biogeography*, 21: 318–327. doi: 10.1111/j.1466-8238.2011.00690.x; <http://onlinelibrary.wiley.com/doi/10.1111/j.1466-8238.2011.00690.x/pdf>

²⁵ UNFCCC/CCNUCC (2012). *Climate, Community and Biodiversity Standards Project Design Document Form for Afforestation and Reforestation Project Activities (CCB-AR-PDD)*, Version 05.

Climate mitigation – Many uncertainties remain regarding the potential of tree plantations to sequester carbon (C). Studies show a general pattern of decreasing carbon pools in plantations relative to forests, independently of biomes, geographic regions or other factors.²⁶ A study conducted in Kenya showed that forests sequester more carbon in biomass and soil than 30 to 50-year-old plantations of foreign tree species (Eucalyptus, Cupressus and Pinus) do.²⁷

A 2013 article in *Nature Climate Change*, written by a number of scientists, concluded that the concept of replacing primary forests with plantations to ‘create sinks’, and therefore be positive for climate mitigation, is false, as it fails to account for the carbon lost from the destroyed primary forest. Furthermore, the plantations store less carbon than the pre-existing natural primary forest or secondary (regenerating) forest under the same environmental conditions. The authors imply that the Kyoto Protocol is problematic as it does not discern between forest ecosystems and tree plantations. Technically, tree plantations are not seen as a change in land cover.²⁸

The Clean Development Mechanism (CDM) of the UNFCCC allocates carbon credits for both “reforestation” (i.e., planting trees on previously forested land) and “afforestation” (i.e., planting trees where they did not historically occur). However, establishing tree plantations in grasslands, savannas, and open-canopy woodlands devastates biodiversity and ecosystem services.²⁹ The underground branches, roots, stems and bulbs of fire-adapted grassland plants store considerable amounts of carbon, but after being deprived of light and water by tree plantations, the original vegetation soon dies and decomposes, releasing methane, a far more potent global warming gas than carbon dioxide, into the atmosphere.³⁰

The natural capacity of land to absorb atmospheric carbon and to store it in vegetation and soil is limited to the amount previously released by land use changes such as deforestation caused by logging or introduced fires. The mitigation value of forests and grasslands lies not in their current uptake of carbon dioxide, but in the durability of their accumulated carbon. Old-growth forests aged up to 800 years can still function as active sinks. By protecting high-carbon ecosystems from land-use change, greenhouse gas emissions can be avoided. Forest conservation measures can avoid or reduce some future carbon emissions, but cannot offset ongoing emissions from other sources. The most effective form of climate change mitigation is to reduce carbon emissions from all sources. This means that there would be no option but to cut fossil fuel emissions deeply. Industrial emissions added to the global carbon pool cannot be offset by the uptake of carbon dioxide in land systems. If carbon is to be usefully stored (on land, in the ocean or in geological repositories), it must remain stored not just for 100 years, but for more than 10,000 years.²⁸

Green Resources anticipates 20-year rotations for Pinus and 10-year rotations for Eucalyptus in Kachung³¹, but this is too short a time to have any real mitigation effect. Instead of storing carbon, the trees are likely to be a net source of greenhouse gas emissions during the full cycle of habitat destruction, timber production, wood processing, transportation, consumption and disposal.³²

²⁶ Liao C, Luo Y, Fang C, Li B (2010). *Ecosystem Carbon Stock Influenced by Plantation Practice: Implications for Planting Forests as a Measure of Climate Change Mitigation*. PLoS ONE 5(5): e10867; www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0010867

²⁷ Omoro L.M.A., Starr M., Pellikka P.K.E. (2013). *Tree biomass and soil carbon stocks in indigenous forests in comparison to plantations of exotic species in the Taita Hills of Kenya*. *Silva Fennica* vol. 47 no. 2 article id 935. 18 p; https://helda.helsinki.fi/bitstream/handle/10138/44810/Omoro_SF_2013.pdf?sequence=2

²⁸ Mackey, B., Prentice, I. C., Steffen, W., House, J. I., Lindenmayer, D., Keith, H. and Berry, S. (2013). *Untangling the confusion around land carbon science and climate change mitigation policy*. *Nature Climate Change*, 3, 552–557; <http://www.fern.org/sites/fern.org/files/fern-comment/Untangling%20the%20confusion%20around%20land%20carbon%20science%20and%20climate%20change%20mitigation%20policy.pdf>

²⁹ Veldman, J. W., Overbeck, G. E., Negreiros, D., Mahy, G., Le Stradic, S., Fernandes, G. W., Durigan, G., Buisson, E., Putz, F. E., Bond, W. J. (2015). *Where Tree Planting and Forest Expansion are Bad for Biodiversity and Ecosystem Services*. *BioScience*, vol 65 (10), pp 1011-1018; <http://bioscience.oxfordjournals.org/content/65/10/1011.full>

³⁰ Bond, W. J. (2016). *Ancient grasslands at risk*. *Science* Vol. 351: 6269, 120-122.

³¹ Green Resources (2013). *Kachung plantation, Uganda*; <http://www.greenresources.no/Plantations/Uganda/Kachung.aspx>

Professors and researchers indicated in a 2005 article in Science that carbon sequestration strategies highlight tree plantations without considering their full environmental consequences.³³

Albedo – Albedo is the fraction of solar energy reflected from the Earth back into space. Managed dense evergreen coniferous forests (as well as plantations) reflect less sunlight back into space than unmanaged lighter-coloured broad-leaved deciduous forests. In combination with altered canopy roughness and evapotranspiration, this contributes to global warming rather than mitigating climate change. The authors of a 2016 Science article question whether it is at all possible to design a forest management strategy that can cool the climate and, at the same time, sustain wood production and other ecosystem services.³⁴

Environmental impact of sawmill – At the end of 2015, Busoga Forestry Company (BFC), Green Resources' Ugandan subsidiary, started up a new sawmill in Bukaleba.³⁵ Sawmill operations emit a number of different gases such as carbon monoxide (CO), nitrous oxides (NOX), sulphur oxides (SOx), and volatile organic compounds (VOCs). The polluted wastewater from the mill might leach into the soil, surface and ground water. The milled wood might be preserved with toxic chemicals and compounds such as chrome, copper and arsenic. Occupational health and safety issues associated with sawmilling and wood products manufacturing include physical hazards, noise, dust and chemicals.³⁶

Conclusion – If Green Resources continues with its plantation project over the 20 years that the Swedish Energy Agency has signed up for purchasing 'carbon credits', the top soil in the Kachung plantations would be substantially degraded due to soil acidification. Soil and water resources will be polluted, and the natural plant diversity of the surrounding area would be dramatically altered due to increased grazing pressure and invasion by plantation tree seedlings and other alien weeds. Will the Swedish Energy Agency take responsibility for the full costs of habitat restoration, and compensate the people of Kachung for their losses?

Should Green Resources really want to mitigate climate change, improve the social and economic conditions of the people living in Kachung, and preserve biodiversity, the grassland and savanna should be appropriately restored to its natural state using locally indigenous trees. Researchers recommend a low planting density.³⁷ Moreover, a number of different fruit trees could be planted in the villages in order to provide the community with food. The villagers need to be allowed to continue to cultivate their land using small-scale subsistence farming methods, and be permitted to graze their animals and engage in cultural practices within the project area. Household food security improves overall household income, which benefits health and access to education. Green Resources needs to respect and to guarantee the human and economic rights of the local community.³²

³² Karumbidza, B. & Menne, W. (2011). *CDM carbon sink tree plantations in Africa: A case study in Tanzania*. The Timberwatch Coalition; <http://unfccc.int/resource/docs/2011/smsn/ngo/293.pdf>

³³ Jackson, R.B., Jobbagy, E.G., Avissar, R., Roy, S.B., Barrett, D.J., Cook, C.W., Farley, K.A., le Maitre, D.C., McCarl, B.A., Murray, B.C. (2005). *Trading water for carbon with biological sequestration*. *Science* 2005; 310:1944-1947; <http://science.sciencemag.org/content/310/5756/1944.full>

³⁴ Naudts, K., Chen, Y., McGrath, M. J., Ryder, J., Valade, A., Otto, J. & Luyssaert, S (2016). *Europe's forest management did not mitigate climate warming*. *Science* 351, Issue 6273, 597-600.

³⁵ RISI (2016-01-07). *Green Resources opens sawmill in Uganda*; <http://www.risiinfo.com/timber/news/green-resources-opens-sawmill-in-uganda142504.html>

³⁶ International Finance Corporation (2007). *Environmental, Health, and Safety Guidelines for Sawmilling & Manufactured Wood Products*; http://www.greenresources.no/Portals/0/IFC_Guidelines/Environmental_Health_Forest_Sawmilling_Man_Wood.pdf

³⁷ Veldman, J. W., Overbeck, G. E., Negreiros, D., Mahy, G., Le Stradic, S., Fernandes, G. W., Durigan, G., Buisson, E., Putz, F. E., Bond, W. J. (2015). *Where Tree Planting and Forest Expansion are Bad for Biodiversity and Ecosystem Services*. *BioScience*, vol 65 (10), pp 1011-1018; <http://bioscience.oxfordjournals.org/content/65/10/1011.full>

Satellite images

According to Timberwatch, satellite (Google Earth) images of the Kachung plantation area indicate that much of the area may be seasonal wetland and that some newly planted trees might have died due to water-logging.



It could be inferred that this is a temporary situation due to heavy rains. These pine trees were reportedly planted in 2009, and are now more than 6 years old. As the surviving trees grow they will cause the general area to dry out and this could make it possible to plant trees where it would have been too wet before.



It appears from the Kachung CDM documentation that *Maesopsis eminii* (a tall forest tree with invasive tendencies) has been planted around and between the two surviving patches of forest:



Although *Maesopsis eminii* is native to Uganda, it is considered an aggressive colonizer of grasslands and disturbed areas within forests. In Tanzania, the introduction of *Maesopsis eminii* resulted in an invasion of evergreen rainforest, indicating deleterious effects on the ecosystem.³⁸ The two surviving patches of forest above, which could serve as indispensable reference areas for scientific research and monitoring, may become invaded by *Maesopsis eminii*.

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For more general information on tree plantations in Uganda, please read the following article in Earth Island Journal by Hilary Heuler:

Heuler, H. (2013). *Missing the Forest for the Trees*. Earth Island Journal;
http://www.earthisland.org/journal/index.php/eij/article/missing_the_forest_for_the_trees/

³⁸ CABI (2016). *Maesopsis eminii* (umbrella tree); <http://www.cabi.org/isc/datasheet/32199>