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Deforestation in Zambia

Driving factors and potential solutions

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Abstract:
Deforestation in Zambia is the result of myriad factors. Among those significant contributors are charcoal production, land tenure systems, agricultural practices, tobacco production, and structural adjustment policies. Though these factors are often interrelated or work in combination, they have each been identified in peer reviewed or development literature and thus are addressed below. Proposed solutions to these specific drivers are also included. Additional recommendations to reduce deforestation in the country include addressing inequalities of forest derived economic benefits, managing for multiple uses, and establishment of a transboundary peace park.

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Table of Contents

Contents

Drivers of deforestation 4
- **Charcoal and fuel wood production** 4
- **Land tenure** 5
- **Agriculture** 7
- **Tobacco** 7
- **Structural adjustment** 8
- **Additional solutions** 9

Bibliography 10

Drivers of deforestation

Charcoal and fuel wood production

Much of Zambia's charcoal is produced using vegetation from the *miombo* woodlands, an extensive ecosystem stretching across the continent from Tanzania and Mozambique to Angola, and covers over 50% of area in the country.[1] Charcoal is produced for household consumption by individuals as well as for commercial distribution, while firewood is used almost exclusively within the community where harvested. This is primarily a result of the relative ease of transport of the two wood fuels: though the energy content of firewood is much higher than charcoal its weight makes it prohibitively difficult to transport over long distances to urban centers.[2] About 88% of Zambian households rely on forest resources to meet energy needs, and woodfuels contribute 68% of Zambia's energy consumption. In the Central Province, where the capital city Lusaka is located, urban households consume about 86.2% of total charcoal and 2.4% of firewood consumed in the Province while rural household consumption figures are about 13.8% and 97.6% for charcoal and firewood respectively.[3] Zambia is the largest consumer of charcoal in the region and charcoal production provides livelihoods for a substantial number of people, employing an estimated 40,000 people in the sector.[4] Though estimates vary greatly on charcoal production's contribution to deforestation, a review of studies reports an average annual loss of over 300,000 ha of woodland.[5]

Deforestation patterns are uneven as a result of charcoal being a primary fuel for urban areas, with major areas of complete deforestation near Lusaka and Ndola and along transport corridors. These areas are not allowed to regrow, and are not able to be compensated for by wood production in other areas. Deforestation is local, severe, and largely irreversible. Although regeneration of biomass in miombo woodlands after clear-felling is about 30 years, this rate is sustainable as long as forests are allowed to regrow. However, woodlands cleared for charcoal are often subsequently converted to cassava cultivation. Recovery is possible, but slow and incomplete, hampered by reduced organic matter in soils and requiring planting of seedlings (instead of regeneration from rootstock).[6]

Migrant workers make up a large portion of those employed in charcoal production. For example, individuals who had migrated to the Copperbelt region to work in the mines turned to charcoal production after many of the mines closed in the 1990s.[7] Unemployed individuals from urban areas have also been identified as migrant charcoal

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[1] Kutsch et al. The charcoal trap: Miombo forests and the energy needs of people. *Carbon Balance and Management* 2011, 6:5.
[2] *Ibid.*
[3] Mulombwa, John. Woodfuel review and assessment in Zambia. Addis Ababa, Ethiopia: EC-FAO Partnership Programme. 1998.
[4] van de Veen, H. & BureauM&O. 2005. Managing the Miombo: Economic Crisis Threatens People and Nature in Zambia's Copperbelt. Gland, Switzerland: WWF DGIS-TMF Programme.
[5] Kutsch et al. 2011.
[6] *Ibid.*
[7] van de Veen, H. & BureauM&O. 2005.

producers.[8] Additionally, large-scale charcoal production results in a migratory pattern where workers will move to a woodland area, buy trees (~USD 0.28/tree), burn them into charcoal, sell the charcoal, and finally move to a new area when the trees are gone. Charcoal producers are not recipients of *miombo* ecosystem services, so there is little incentive to harvest in a sustainable manner.[9]

To describe the complex situation surrounding charcoal production, Kutsch et al. use the term 'charcoal trap': although the rate of forest use is acknowledged as unsustainable, the lack of alternatives in energy supply and employment will ultimately drive on-going deforestation until the forest disappears. As a result, potential solutions to reduce charcoal production are themselves complicated and must address the multiple factors driving the sector. These include, among others, the following:

- **Shifting urban energy demands away from forest sources**. Urban household electrification reduces charcoal consumption to between 1.5 and 3 times.[10] Such energy system changes should include reasonable tariffs and reliable provision of electricity in urban areas, followed by expansion into rural areas. This may best achieved through locally based public-private partnerships, focused on decentralized technologies including micro-hydro, biomass gasification, and solar.[11] Large-scale electrification will require significant investment in generation and grid infrastructure. Could be incorporated in REDD+ programs, where revenue generated from carbon sequestration can be used in infrastructure and technology upgrades.[12]
- **Technology improvements in charcoal production**, including higher efficiency kilns. Traditional kilns have 12% energy conversion, whereas new designs have >30% conversion efficiency, producing charcoal with a higher energy content.[13]
- **Improved government and communal/local land management**, requiring assessment of charcoal production and distribution system to determine shortcomings as well as recognition and equitable distribution of environmental services (or rents derived from them).

Land tenure

Zambia's cultural system of rural land tenure has been shown to have significant impacts on deforestation, whereby recent immigrants to communities feel incentivized to clear forest cover thereby demonstrating their occupation of the land. Generally, land is controlled by local chiefs but seen as a communal resource, not as a commodity with secure rights to be held by an individual. "Unused" (i.e. forested or uncleared) land in communities is subdivided based on decisions by the chief and headman and allocated

[8] Malakata, Michael. Electricity price hikes set to fuel Zambia deforestation. *AlertNet.* 5 October 2010.
[9] Kutsch et al. 2011.
[10] Mulombwa, John. 1998.
[11] Kutsch et al. 2011.
[12] *Ibid.*
[13] *Ibid.*

to farmers. Chiefs attempt to attract immigrant farmers because increased population translates into more power in the Zambian government's Council of Chiefs. New immigrant farmers are allotted land by chiefs and subsequently clear around the borders of their allotted parcel, working inwards thereby clearing the entire parcel and establishing clear evidence of land occupation and associated tenure. (In contrast, the traditional local practice is of clearing only what is needed for planting that season.) Migrants see land rights granted by the local headman as tenuous and fear that land could later be taken away by the headman should he change his mind, despite there not being a shortage of land in the community. Alternatively, in land scarce situations, youth coming of age and new immigrants can request "unused" (i.e. forested) land be reallocated, even if that land is part of another person's claim. In such cases, forested land is a liability for losing control of tenure, even if the forested areas are being used for grazing, later inheritance, wood gathering, or other household uses. In this case, clearing land reinforces land tenure by showing that the land is being used.[14] The "clearing to claim" process results in Zambia's ranking as the fourth highest country in terms of annual net loss in forest area. According to John Unrhu, "land tenure [in rural Zambia] is not based on paper titles, registries and 'proper channels.' It is based on complicated things like world view, culture, identity, food security, personal security and group belonging."[15]

Conferring ownership of land and resources is often essential in creating incentives for sustainable management, though this can be difficult given the cultural complexities of land tenure and benefits access. For example, local communities do not normally support activities that attempt to conserve forest resources, such as maintaining land under tree cover, particularly when they result in reduced access to resources, employment and income.[16] One potential solution is a hybridized form of formal and indigenous law where chiefs allocate land but courts are able to hear and settle disputes, thereby relying on traditional systems as foundation while including moderating security measures to reduce unpredictability.[17] This system may prove sustainable and preferable to central government issued land rights. Care must be taken to include and transfer rights in a secure way that does not prohibit local households from realizing benefits of new land tenure. Exclusion of local communities may lead to massive conversion of forest land to cultivated land by entrepreneurs and excessive concentration of communities on customary lands.[18]

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[14] Unruh, Jon; Cligget, Lisa; Hay, Rod. Migrant land rights reception and 'clearing to claim' in sub-Saharan Africa: A deforestation example from southern Zambia. *Natural Resources Forum* 29 (2005) 190–198.
[15] Blatchford, Andy. This Land Is Your Land? *Headway* (McGill University) (2008) vol. 3, no. 1, pp. 20-22.
[16] Weston F. Mwase, Åsmund Bjørnstad, James M. Bokosi, Moses B. Kwapata and Brita Stedje. The role of land tenure in conservation of tree and shrub species diversity in miombo woodlands of southern Malawi. *New Forests* (2007) Vol. 33, No. 3, Pp. 297-307.
[17] Blatchford. 2008.
[18] Weston et al. 2007.

Agriculture

Much of Zambia's soils are unsuitable for continuous farming, only able to produce acceptable yields one of every four years with no inputs or two to three out of four years with medium to high inputs, leaving land fallow the rest of the time. As farmers transition from long fallow periods to shifting cultivation practices (where land is cleared, farmed intensively, then abandoned to be reused later) and population density increase in rural areas creating land shortages, fallow periods are shortened, long-term fertility suffers, and deforestation results.

The variety of crops grown by Zambian farmers has also influenced deforestation and forest health. Long fallow periods and rotation agriculture, present for hundreds of years, changed in the mid-1900s to monocultures. The result was "a change from an ingenious rotation of cereals, legumes and fallows to the monoculture of fingermillet with quite obviously decreasing periods of rest between cultivation sequences."[19] Cassava became popular in the first half of the 20th Century and allowed population densities to increase because of its low inputs and labor requirements. The short-term effect of cassava introduction initially reduced deforestation by increasing output per hectare, but ultimately increased deforestation as communities grew thanks to the ability to support higher population density. Introduction of maize reduced deforestation by increasing yield and reducing labor requirements. However, lack of credit, crop reliability, and access to inputs made cultivating large areas of maize difficult.[20] Continual cultivation of land under monocultures, made possible by fertilizer inputs, result in erosion, acidification, and fertility loss, and ultimately lead to the abandoning of land and further expansion into woodland.[21]

Tobacco

Though little information is available on tobacco cultivation's impact on Zambia's woodlands, there is ample documentation of the crop's destruction of *miombo* forests in neighboring Tanzania. Land area here dedicated to tobacco cultivation in 1990 was 20,000 ha, and grew to 65,000 ha in 1995. This has been solely attributed to trade liberalization policies in Tanzania, which started in late 1980s and early 1990s with entrance of multinational tobacco companies. In 1984, 7.8% of land that had been converted to tobacco cultivation in 1984 had regenerated forest cover by 1995, while in

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[19] Holden, Stein. A Century of Technological Change and Deforestation in the Miombo Woodlands of Northern Zambia. In (eds) A. Angelsen and D. Kaimowitz *Agricultural Technologies and Tropical Deforestation* CAB International 2001.

[20] *Ibid.*

[21] World Rainforest Movement. "Zambia: Causes of deforestation linked to government policies." *World Rainforest Movement Bulletin* Nº 50, September 2001.

1995 – 2000 only 2.4% of land regenerated. Total cleared land for tobacco growing and curing is projected to double by year 2016 in Tanzania.[22]

Tobacco cultivation and processing also impacts woodlands by requiring substantial quantities of firewood to cure the tobacco in curing barns. Traditional barns use 43 m^3 of fuelwood for 1,400 kg of cured tobacco. The ratio of kg wood to kg cured tobacco is approximately 20:1, but can be as high as 25:1 to 31:1. In Zambia, the Zambia Leaf Tobacco has planned to introduce fast growing tree species to reduce pressure on wood collection from standing woodlands. The company established tree nurseries and training programs to promote alternative wood sources for curing tobacco.[23] Technological solutions to the firewood issue are also in development. ProBEC rocket tobacco curing barns are a joint project with the Southern African Development Community (SADC) and GTZ. The new barn improves on the existing, widely used design and reduces firewood input by 66% (from 12 kg of firewood to 4 kg per 1 kg of cured tobacco). The advanced design can reduce the ratio of kg wood to kg cured tobacco (depending on size of barn) to 3.7:1 to 2.3:1. The barn's design encourages selection of smaller diameter wood, thereby reducing incentive to cut large diameter trees. Costs for the rocket barns are comparable: estimated USD 350 for traditional compared to USD 250-400, not including reduced maintenance costs and reduced likelihood of barn fires.[24]

Structural adjustment

The relationship between deforestation and macroeconomic policies is documented in the literature. Using data set from less developed countries, deforestation rates and structural adjustment policies dictated by the International Monetary Fund and World Bank are strongly associated.[25,26] One potential explanation for this link is that poor nations boost natural resource extraction and cut government spending for environmental protection under structural adjustment policies.[27] In the case of Zambia, IMF-mandated privatization of electricity resulted in prohibitively high prices for households and the adoption of fuel wood by urban families for cooking.[28] For example, in 2010, a 40% increase in electricity costs for domestic customers forced people to switch from electricity to fuel wood for cooking and heating.[29]

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[22] Yanda, Pius Z. Impact of small scale tobacco growing on the spatial and temporal distribution of Miombo woodlands in Western Tanzania. *Journal of Ecology and the Natural Environment* (2010) vol. 2, no. 1, pp. 010-016.

[23] "Zambia Leaf Tobacco strives to curb deforestation." *Times of Zambia*. 1 Jan 2005.

[24] Scott, Peter. *Development of Rocket Tobacco Barn for Small Holder Farmers in Malawi, Tanzania, and Zambia.* 2007. ProBEC (GTZ and SADC).

[25] Shandraa, John M.; Shircliff, Eric; London, Bruce. The International Monetary Fund, World Bank, and structural adjustment: A cross-national analysis of forest loss. *Social Science Research* 40 (2011) 210–225.

[26] Culas, Richard J.. Debt and Deforestation: A Review of Causes and Empirical Evidence. *Journal of Developing Societies* (2006) vol. 22, no. 4, pp. 347-358.

[27] Shandraa; Shircliff; London. 2011.

[28] World Rainforest Movement. 2001.

[29] Malakata, Michael. Electricity price hikes set to fuel Zambia deforestation. AlertNet. 5 October 2010.

In Zambia's agriculture sector, structural adjustment policies eliminated government subsidized inputs, transport, and credit. Privatization of inputs and value chains led to increased fertilizer and seed prices, higher interest rates, and tightening of credit, all resulting in the return to clearing-based agriculture and dispersion of populations into forested areas where costs were lower and land was available for clearing to make a livelihood. Structural adjustment policies reduced market integration and increased deforestation in northern Zambia, as technological change and development went 'in reverse'.[30]

Additional solutions

In addition to the solutions addressing specific factors, a number of broader policy solutions have been proposed. In the context of a comprehensive report on Zambian deforestation, the Center for International Forestry proposes the following actions to address poverty and poverty related degradation of *miombo* resources:

- Work with decentralized/local governments and development organizations to define, measure, and protect *miombo* resources to preserve benefits captured by local inhabitants.
- Strengthen local government accountability to citizens to protect rights to resource access with legal and regulatory enforcement by state institutions to avoid monopolization of *miombo* benefits by a few wealthy individuals/groups.
- Reduce risk from lack of rents realized from forests by investing in local producer groups and value chains, and establish benefit sharing for rents from payment for environmental services regimes.
- Manage for multiple uses: non-wood forest products and rotational grazing in conjunction with conservation practices.[31]

The establishment of a transboundary peace park also offers the opportunity for sustainable conservation of woodland resources. The Kavango-Zambezi Transfrontier Conservation Area (KAZA Peace Park) was created to manage regional forest of 278,132 km^2 between Angola, Zambia, Botswana, Namibia, and Zimbabwe. The Climate Change Unit of the Peace Parks Foundation is helping establish REDD program to generate carbon credits from avoided deforestation and added value to wood products to use more of cut trees. In June 2009, the Zambian Secretary of Ministry of Tourism, Environment, and Natural Resources signed an accord with Peace Parks Foundation for climate change project in his country's part of KAZA Park with the following objectives: "1) the development of land-use change activities on the ground (avoided deforestation, forest rehabilitation and fire management) that will provide benefits to local communities through alternative livelihoods and income streams, as well as private sector investment and employment opportunities and 2) the development of a financial vehicle that will ensure the inclusive, transparent sale of generated carbon

[30] Holden. 2001.

[31] Abbot, P. G. and Ogle, A. 2007. *PAPER II: Policy Options for Miombo Woodlands*. Center for International Forestry Research.

offsets and the flow of generated income streams to deserving parties on the ground."[32] Conservation of Zambian woodlands through international agreements, and reinforced by local accords and benefits sharing programs, have the potential to reduce deforestation while still providing local communities with access to woodland resources and derived benefits.

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