THE ECONOMICS OF LAND DEGRADATION

Policy Brief

Namibia Case Study: Bush control generates economic and environmental benefits

Background

Namibia's largest economic sectors – mining, fishing, tourism and agriculture – are very closely linked to its land. This conjunction often involves challenges. In case of agriculture, one of the major challenges is bush encroachment.

Bush encroachment is defined as the invasion or thickening of woody species, resulting in a reduction of the natural grass vegetation, a decline in biodiversity, and a decrease in agricultural carrying capacity (De Klerk, 2004).

This phenomenon has increased significantly in Namibia. The scale is alarming. It is estimated that more than 30 million hectares (30 per cent of country size) of farmland are affected by bush thickening.

Nine of the fourteen political regions of Namibia are affected, but the densest encroacher bush areas can be found in the regions of Otjozondjupa, Oshikoto, Kavango West and Omaheke[1]. The increasing sprawl can have significant impacts on ecosystems and on the services they provide, which offer multiple benefits to humans[2]. While concerns about agricultural productivity are usually well recognised, the impacts on ecosystem services such as groundwater recharge or tourism are often less considered, but no less important.

Challenges and opportunities of bush encroachment

Bush encroachment occurs in most regions of Namibia, affecting different ecosystems and land uses. This makes it a complex problem. Impacts can vary, depending on the surrounding environment (e.g. types of soil, other vegetation, wildlife), how the land is used and could be harnessed (e.g. cattle farming, tourism) and how many people depend on the land.

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Contrast between rangeland with regular bush control (front) and intense encroachment by woody species (back) in central Namibia.

There are many interlinked factors contributing to bush encroachment, but overgrazing is thought to be one of the key drivers. Depending on the area and nature of encroachment, other factors might include the displacement of browsers, suppression of high-intensity fires, climatic conditions, low population pressures and increased CO_2 concentrations.

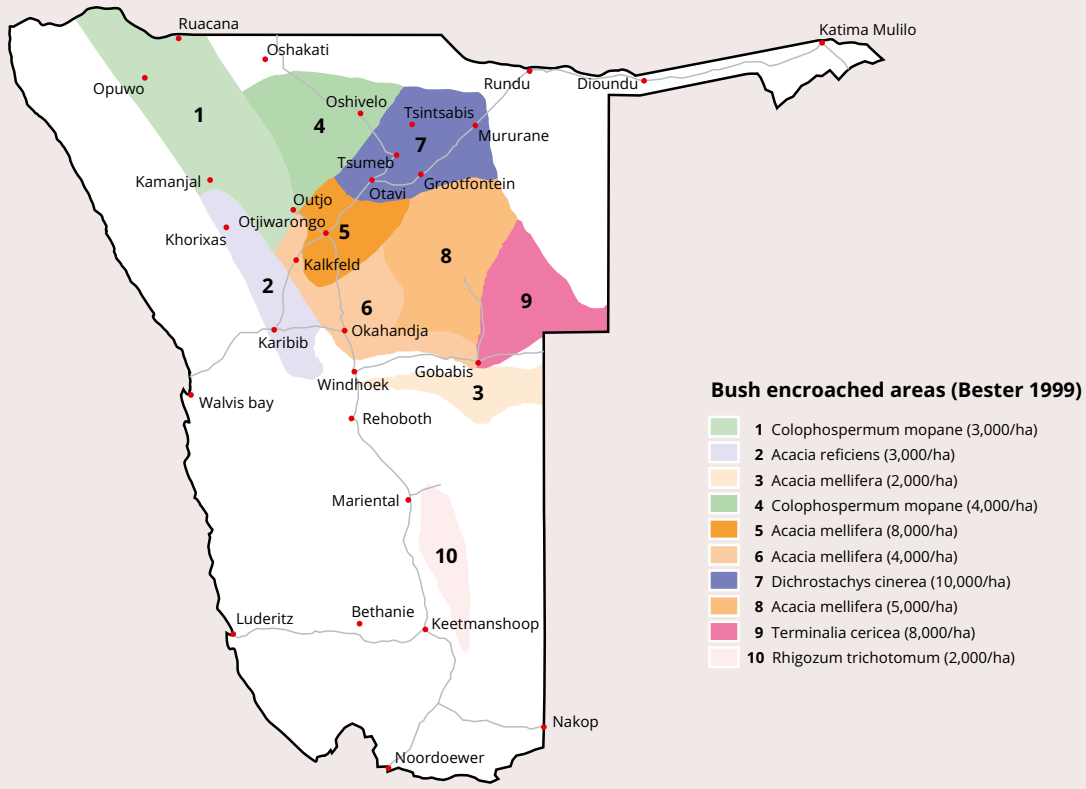
Experience shows that the rapid spread of bush encroachment becomes an overwhelming problem for commercial and communal agriculture in Namibia.

1 *Data collected by the Namibian Land Degradation Neutrality (LDN) pilot project in 2016.*

2 *The underlying studies adopted the Common International Classification of Ecosystem Services (CICES) in order to remain consistent with the draft Inventory of Ecosystem Services in Namibia (2015) and the UN System of Environmental-Economic Accounting: Experimental Ecosystem Accounting (SEEA-EEA, 2014).*

FIGURE 1

Illustration of the ten bush-encroached zones originally identified by Bester (1999) and reassessed by Honsbein et al. (2009); defined by location and average density and specified by dominant species.



Livestock production in particular, at both large- and small-scale, is undermined by a reduction of the carrying capacity of land, as the densification of bush decreases the accessible pasture lands and the available fodder. Livestock carrying capacities have been drastically reduced to the detriment of farmer incomes and profits. This also compromises food security and nutrition, especially in communal areas. Furthermore, bush encroachment negatively affects many other important ecosystem services for Namibia, such as tourism and recreation (e.g. game viewing and hunting) and groundwater recharge. The latter is of utmost importance in a semi-arid to arid country with limited water resources and growing water scarcity.

The importance of functioning ecosystems and their services for Namibia has been recognised in the Government's Vision 2030, with Chapter 5 stating: "*The integrity of vital ecological processes, natural habitats and wild species throughout Namibia is maintained whilst significantly supporting national socio-economic development through sustainable low-impact, consumptive and non-consumptive uses, as well as providing diversity for rural and urban livelihoods.*"

BOX 1

Otjozondjupa Region

In Otjozondjupa, Namibia's fourth biggest region covering more than 10.5 million hectares, bush encroachment affects the majority of the land area. *Acacia mellifera* and *Terminalia sericea* are the dominant encroacher species in this region. The highest recorded density was over 25,000 individual bushes per hectare in the north-east of the region. Bush encroachment has an impact on multiple ecosystems in Otjozondjupa, including the Highland Acacia Savanna, Northern Kalahari Savanna, Karstveld, Dry Kalahari Woodlands and small parts of the Western Highlands.

One technique to restore bush encroached land is through thinning of undesirable woody plants. Bush control measures could generate substantial net benefits for livestock production, groundwater recharge and tourism. Addressing this problem effectively will also offer considerable secondary and multiplier effects such as employment opportunities and local value addition. However, at the same time, bush control entails costs in form of thinning operations and can lead to losses of soil organic carbon. Mechanical means of control can disrupt the soil and non-encroacher vegetation, while chemical means have the potential to poison non-target vegetation and water sources. Furthermore, additional livestock could contribute to increased emissions. In conclusion, the appropriate method, range, and scope of bush control activities depend on the local context and local demands.

Economic and environmental benefits from bush control

In the framework of a bilateral cooperation, the Namibian and German governments are implementing a comprehensive national programme for bush control and biomass utilisation, the *Support to De-bushing Project*. On behalf of the project and based on the ELD Initiative's approach, the *Namibia Nature Foundation* conducted two studies to investigate the economic benefits of possible bush thinning programmes at national and regional level (Birch et al., 2016; Birch and Middleton, 2017).

Economic assessments were conducted to quantify and value various key ecosystem services and land use options that are threatened by bush encroachment, but could potentially generate benefits to Namibia's welfare. Moreover, options for the use of harvested encroacher biomass were identified and economic profits estimated.

BOX 2

The term "bush control" refers to the active management of bush densities and thus constitutes a counter-measure to bush encroachment. Bush control involves preventative measures (e.g. sustainable rangeland management), active rehabilitation measures (e.g. bush thinning through harvesting of a defined number of bushes per hectare) and follow-up measures (i.e. aftercare). The term bush control does not refer to the clearing of all bushes.

Those values were entered into a cost-benefit model. Thereby, the possible aggregated net benefits of bush control compared with a business-as-usual scenario of no bush control are estimated.

The underlying research discusses two scenarios: a national Namibian study case and a study case focusing on the Otjozondjupa region, which is severely exposed to bush encroachment.

In the valuation of ecosystem services, the national study covers groundwater recharge, grazing land for cattle (carrying capacity), carbon sequestration and biomass utilisation. Concerning the extracted biomass, the national analysis incorporates the optional use for firewood, charcoal and electricity production (benefits estimated on an aggregate level, not considering trade-offs). It further considers benefits of leaving a proportion of the residual biomass on the ground, to protect the soil and return nutrients.

The regional study builds on this approach and includes two more usage options for biomass: animal feed production and thermal power generation for industrial use. For the handling and processing of biomass, the

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BOX 3

The *Economics of Land Degradation (ELD) Initiative* is a global initiative established in 2011 by the *United Nations Convention to Combat Desertification*, the *German Federal Ministry for Economic Cooperation and Development*, and the *European Commission*. It is supported by a broad network of partners who aim at transforming global understanding of the economic value of productive land and at improving stakeholder awareness for socio-economic arguments to accelerate sustainable land management. ELD offers a universal approach to quantify the costs of land degradation as well as the economic benefits of sustainable land management. The initiative is coordinated by the ELD Secretariat, hosted by *Sector Project Soil protection, Desertification, Sustainable land management (BoDeN)* at *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)*.

regional assessment suggests and calculates the costs of a bush bank[3]. Moreover, it factors in benefits of hunting (game products) and wildlife viewing. Multiplier effects from increased income and employment are taken into account as well.

By using a Total Economic Valuation framework, the national study only values the costs and benefits for ecosystem services from bush control against the direct cost of bush control operations. It does not take into account the investments required to unlock the potential benefits of bush control (e.g. purchase of additional livestock to utilise extra carrying capacity). In the regional Otjozondjupa study case, however, estimated financial costs of increased livestock production and other services are included.

Some key assumptions underpin the valuation of ecosystem services for both studies under a scenario of bush control:

- A time horizon of 25 years[4] serves to calculate the net present value.
- Calculations are based on real prices in Namibian Dollar (base year 2015[5]) with a discount rate of 6% per annum.
- 60% of the identified bush-encroached areas are assumed to be targeted for bush control and 5% of the targeted bush encroached land to be thinned per annum at both national and regional level.
- Encroacher bush densities are assumed to be reduced by up to 67% in order to attain a 33% average density in the national case and 90% in the regional case.

In the case of the national study, cost-benefit analysis suggests a programme of bush control to generate an estimated and aggregated potential net benefit of around **N$ 48.0 billion (USD 3.8 billion)** (2015 prices, discounted) over 25 years when compared with a scenario of no bush thinning (see Table 1)[6]. This implies a net benefit of around N$ 2 billion (USD 0.2 billion) (2015 prices, discounted) per annum in the initial round of 25 years.

For the Otjozondjupa study, the estimated total potential aggregated net benefits amount to **N$ 4.9 billion (USD 385 million).**[7] A table with all underlying individual values can be accessed in the ELD case study report (www.eld-initiative.org) or in the regional study (www.dasnamibia.org).

TABLE 1

Cost-benefit analysis – central case of national study

Variable	Amount mN$ (mUSD)
Benefits	**76,137.91 (5,996.72)**
Grazing land (cattle carrying capacity)	6,371.66 (501.84)
Groundwater recharge	51,609.54 (4,064.83)
Biomass utilisation	
Charcoal	4,060.59 (319.82)
Electricity	10,572.07 (832.67)
Firewood	1,186.17 (93.42)
Residual biomass	2,110.00 (166.19)
Carbon offsets	227.88 (17.95)
Costs	**28,116.98 (2,214.53)**
Bush thinning	-26,856.42 (-2,115.25)
Carbon	
Loss of soil organic carbon	-278.55 (-21.94)
Livestock emissions	-982.01 (-91.81)
NET BENEFIT	**48,020.94 (77.34)**

3 *Bush bank refers to a Biomass Processing and Logistics Centre.*

4 *This captures 20 years on the initial bush control cycle and 5 year lag for implementation allowing time for ecosystems to reach their new potential.*

5 *1 USD = N$ 12.6966 (01 August 2015)*

6 *Scenario and sensitivity analysis indicate that the net benefit could range from N$ 28.9 billion (USD 2.3 billion) under a worst-case scenario to N$ 111.9 billion (USD 8.8 billion) under a best-case scenario.*

7 *Scenario and sensitivity analysis suggests net benefit to range from N$ 2.9 billion (USD 228 million) under a worst-case scenario to N$ 10.6 billion (USD 835 million) under a best-case scenario.*

KEY FACTS

Bush encroachment affects more than 30 million hectares (30%) of Namibia's land area, covering nine of the fourteen political regions.

Business-as-usual of no action leads to ongoing decline in carrying capacities and produces estimated national losses of more than 1 billion Namibian Dollar (USD 79 million) per annum.

National bush control in conjuction with biomass utilisation has the potential to generate net benefits of around N$ 48 billion (USD 3.8 billion) over 25 years.

The ecosystem service benefit of groundwater recharge accounts for 67% of the total benefits.

Recommendations

1. Implement a national bush control programme
The studies on the economics of land degradation with regard to bush encroachment in Namibia clearly illustrate that the net benefits of bush control would be significantly positive (in the total economic value sense) at both, national and regional level. Hence, bush control can deliver significant ecosystem service benefits whose value outweigh the direct cost involved and imply wider economic benefits of additional employment and household income.

Thus, holistic bush control programmes are recommended as they can contribute to Namibia's economy and social welfare as well as to the preservation of the environment.

2. Encourage sector and location specific analysis
Significant differences in net benefits of bush control across sectors and regions are likely. Therefore, it is recommended to further investigate sector-specific and location-specific costs and benefits. The location-specific analyses need to be congruent with regional land use plans. Bush-encroached areas differ not only by land use, but also by bush species, ecosystems, soil types, population pressures, proximity to markets, and other factors. These factors should all be taken into account when assessing the impacts of bush thinning.

3. Support sustainable rangeland management
Good rangeland management practices will be crucial in preventing a vicious cycle of bush encroachment, bush thinning, restocking, overgrazing, and back to bush encroachment. Cattle grazing can create both benefits and costs. The sustainable management of pastures crucially decides on the desired outcome. Therefore, the Government and private sector stakeholders should actively follow-up on the implementation of the National Rangeland Management Policy and Strategy, endorsed in 2012.

4. Invest in key industries
The ecosystem services estimated to increase in value will require capital investment in order to realise their potential benefits. Some of the services may even require financial or fiscal intervention by the state. If the net national benefit is positive, the state's intervention can be beneficial in this context.

5. Involve private and public stakeholders

A comprehensive bush control programme deserves support from the private and public sector. The private sector stands to reap returns in the long run, while the public sector benefits from positive social, environmental, and economic developments. Multi-stakeholder platforms can help to leverage synergies and create participatory and sustainable processes.

6. Facilitate research and data collection

The underlying study discusses the potential environmental costs of bush thinning operations, but only vague estimates are available for quantification and valuation. These potential costs could have a material impact on the outcomes. Consequently, accompanying research should focus on the effects of bush control options on relevant ecosystem services that are currently unquantifiable or uncertain with the available information, the environmental impacts of bush thinning, and potential mitigation measures.

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For more information about this ELD study and the findings, please contact:

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