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Government of Malawi
Ministry of Agriculture, Irrigation and Water Development

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Policy brief

Impact of soil loss in Malawi: macroeconomic effect on GDP, sectoral adjustments and poverty

GLOBAL SOIL PARTNERSHIP

Background

The economy of Malawi is heavily dependent on its renewable natural resources. These resources support the agricultural sector, which is the backbone of the country's economy. It is estimated that over 84% of the population is currently involved in subsistence agriculture. There is considerable evidence, however, that the renewable natural resources on which the country's economy depends, namely soils, are degrading at an alarming rate. Soil erosion is estimated to reach up to 40 tons per hectare per annum. Most poor people who reside in rural areas and are directly dependent on agriculture lack the capacity to cope with the impacts of soil loss and hence are mostly affected by the loss in agricultural productivity resulting from soil mining and environmental degradation.

This policy brief combines findings from a recent independent report based on microeconometric and computable general equilibrium analysis. The study aims to assess both direct and indirect economic impacts of soil loss at the aggregate level, providing effects on the GDP, Poverty, terms of trade and sectoral production. Moreover, the mitigation effects on soil loss by anti-erosion practices are estimated.

Data & methodology

The direct costs, those related to the primary impact on the agricultural production, are calculated by relying on estimates of the impact of soil loss on agricultural productivity. For the indirect costs, which account for adjustments in other economic sectors, we input this loss into a computable general equilibrium (CGE) model.

We also measure the impact on individuals in poverty caused by an increase in soil loss by measuring variation in crop profits generated by the reduction in maize productivity.

Both direct and indirect impacts are calculated for three scenarios that assume three different increases in soil loss with respect to the current situation: 10% (SL10), 25% (SL25) and 50% (SL50).

For the econometric estimates, different sources of data are employed. First, socio-economic data at the househould level are included in the Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA). Second, the Soil Loss Assessment in Malawi (Vargas and Omuto, 2016) provides information at both plot and enumeration area (EA) level on measures of soil loss.

For the CGE analysis, we use the database and the static model developed by the Global Trade Policy Analysis Project (GTAP). The version of the model employed is the standard GTAP (Hertel, 1997), with the database being the latest one released, version 9.2 (Aguiar et al., 2016) with a base year of 2011. This loss in agricultural productivity is expected to affect the whole agricultural sector of the Malawian economy, with no other shocks affecting the rest of the regions of the World.

Findings

The direct impacts are reported in Figure 1 in terms of GDP. A 10% increase in soil loss would lead to monetary losses of about 0.26% of the Malawian GDP and 0.42% of the total agricultural production value. Higher soil loss values produce larger impacts: in the second scenario, a 25% increase in soil loss would lead to monetary impacts of about 0.64% of the GDP and about 1% of the agriculture production. Under the worst scenario, a 50% increase in soil loss yields monetary losses corresponding to about 1.28% of GDP and 2.1% of the total agricultural production value, which correspond to around 50 billion of MWK.

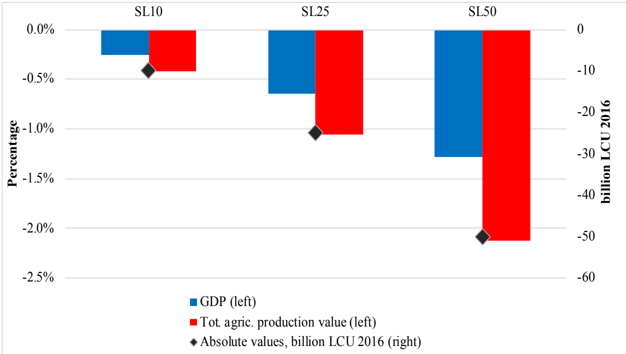

Figure 1: direct impacts (%) of soil loss according to different scenarios.

For to the indirect impacts, results of the model simulations show that welfare and GDP decrease due to the resulting declines in land productivity with an increase in crop prices. In terms of GDP, losses induced by the contraction in the agricultural sector are estimated to range between 0.10% and 0.55% relative to 2011.

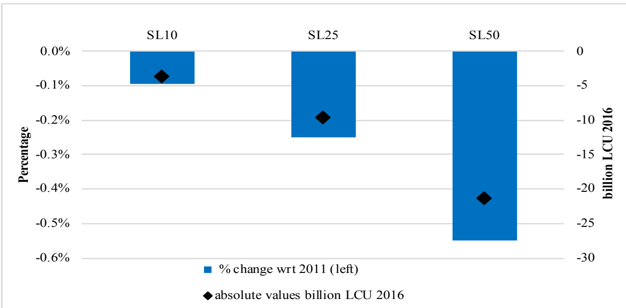

Figure 2: indirect impacts (%) of soil loss according to different scenario on GDP.

Among the different GDP components, consumption shows the higher level of contraction (around 16 MWK 2016 billion in the SL50 scenario). Notice that the values of GDP losses are lower than the values of agricultural production losses.

The total agricultural production loss due to soil erosion ranges from -0.47% to -2.67%. The decrease is larger in the "rest of agriculture" aggregate (where all sectors, excluding maize, are considered), particularly for "plant fibres" (i.e. cotton, flax, hemp, sisal and other raw vegetable materials used in textiles) and "other crops" (a GTAP aggregate which includes the tobacco plant). The reductions are -4.1% and -5.3% respectively in the SL50 scenario.

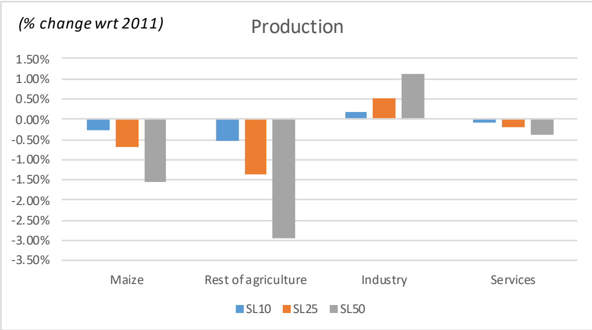

Figure 3: the impact on Production (% changes for 2011)

Turning to the rest of the economy, the industry sector shows a small increase in production (between 0.2% and 1.1%) while in services, the changes are negligible. These sectors can "benefit" from a decline in agricultural production, which in turn induces a decline in labour demand, a reduction in wages and, finally, a shift of unskilled workers to industry and services.

Lower levels of agricultural productivity result in an increase in production costs and consequently in an increase in market prices. The decline in land productivity increases the demand for land, therefore, market prices for this factor increase in the ranges of 4.3% - 24.3%. This implies a reduction in land demand in the meat (between -1.5% and -7.7%) and timber (between -0.5% and -2.5%) sectors.

Changes in market prices for the rest of the factors are negative. Returns to unskilled labour decrease more than returns to skilled labour (-0.6%-3.3% and -0.4%-2.5%, respectively). Thus, the decline in agricultural productivity substantially harms both agricultural and non-agricultural households.

The table below reports the current percentage of population and the number of individuals who live with less than $1.9 dollar per day. In the lower part of the table, we see the worsening of the current situation caused by an increase in soil loss. We can see that under the worst scenario, Malawi risks having an additional half million of individuals living in poverty.

Table 1: Variation of percentage of population below the poverty line caused by an increase in soil loss

Rural Poverty	Poverty headcount ratio at $1.9 a day	Number of Individuals in poverty
Current soil loss	71.40%	12,916,974
	Delta Poverty headcount ratio	Additional individuals in poverty
Soil loss +10%	+1.5%	+271,365
Soil loss +25%	+2.1%	+379,911
Soil loss +50%	+3.1%	+560,821

Mitigation impact of agricultural practices

The study also identifies the agricultural practices that can effectively contribute to mitigate the negative impacts of soil loss on agricultural production. In each of the three soil loss scenarios, as well as in the status quo (current loss rate), the most effective practices are represented by the planting of vetiver grass and the establishment of terraces. In particular, in the status quo, the adoption of these two practices increases the current maize productivity by about 275 kg/ha and 200 kg/ha with respect to the non-adoption, with all other variables remaining constant. These increases correspond to about 10% and would lead to an equivalent monetary benefit in terms of agricultural income. Tree belts and erosion control bunds result in much lower impacts on growth productivity, which range from about 80 to 120 kg/ha, depending on the severity of the soil loss scenario.

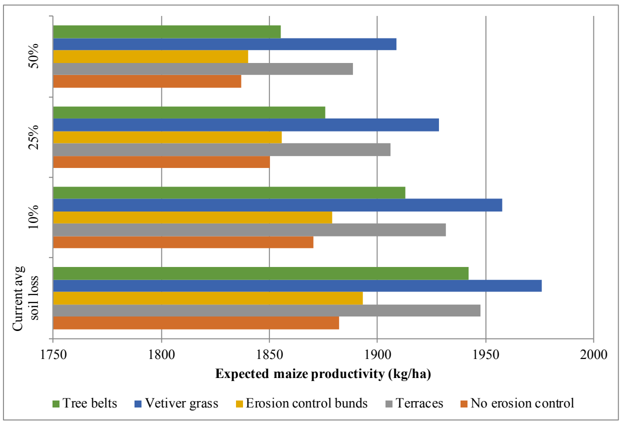

Figure 4: Expected maize productivity with the adoption of anti-erosion measures, by scenarios of soil loss

Thus, in terms of GDP, considering a loss of 0.260% (for the first scenario) when no anti-erosion practices are adopted, the adoption of Vetiver grass by the average of the population results in a reduction of this loss (and thus an increase in monetary national benefits) of 0.012%, reducing the GDP loss from -0.260% to -0.248% (corresponding to around MWK 468 million).

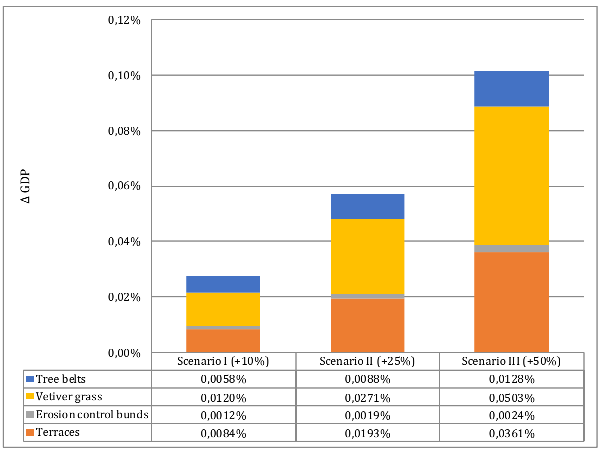

Figure 5: reduction of GDP loss due to anti-erosion measures with respect to the case with no measures taken, for different soil loss scenario

Final remarks and recommendations

The negative impact of soil loss on national GDP ranges between 0.1 and 2.1% according to the severity of the erosion phenomena. While the economy reacts and adjusts to the initial soil loss shock by shifting production to other sectors, the economic loss for the agricultural sectors cannot be avoided without additional mitigation measures.

The total agricultural production loss caused by soil erosion can "benefit" the industry sector and shows a small increase in production (between 0.2% and 1.1%) while in the services, changes are negligible.

Autonomous farmers' adaptation to soil loss events as estimated with a general equilibrium model might reduce GDP costs by up to 70%, suggesting that the Government should prioritize policies that promote labour sectoral mobility and investments in education.

The impact of a severe scenario of soil loss on poverty could be dramatic; with a projected risk of having an additional half a million individuals below the poverty line.

The **Poverty-Environment Initiative (PEI)** Malawi of the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) supports country-led efforts to mainstream poverty-environment linkages into national development planning and budgeting. PEI provides financial and technical assistance to government partners to set up institutional and capacity-strengthening programs and carry out activities to address the particular poverty-environment context. PEI is funded by the governments of Norway, Spain, Sweden, the United Kingdom, and the European Union and with core funding of UNDP and UNEP.

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The **Global Soil Partnership (GSP)** was established in December 2012 as a strong interactive partnership to promote sustainable soil management. It is a mechanism that fosters enhanced collaboration and synergy of efforts between all stakeholders, from land users through to policy makers. Its mandate is to improve governance of the planet's limited soil resources in order to promote the sustainable management of soils and guarantee healthy and productive soils for a food secure world, as well as support other essential ecosystem services. Awareness raising, advocacy, policy development and capacity development on soils, as well as relevant implementation in the field are among the main GSP activities.