POLICY BRIEF

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From input subsidies to compensating farmers for soil health services

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Key messages

- In many countries in Southern and Eastern Africa, input subsidy programmes are common, often focussing on inorganic fertiliser. These programmes often do not achieve their food security objectives, partly because soil health is in decline as a result of years of application of inorganic fertilisers in the absence of other soil ameliorative measures.
- Solutions to soil health decline are well known, and include various combinations of fallowing, crop diversification, intercropping and crop rotations (especially legume rotations), soil organic matter additions, liming and applications of the appropriate inorganic fertilisers. But many of these come with significant socio-economic and technical challenges to farmers.
- A way forward is through compensating farmers for soil health services, which will generate a multitude of private and public benefits. This would be a form of Payment for Environmental Services (PES), as supported in the global initiative CompensACTION,[1] led by the German Federal Ministry of Economic Cooperation and Development (BMZ).
- Nine recommendations for implementing a soil health payment scheme are presented, some of which focus on the broader enabling environment.
- Development partners can support the implementation of Payments for Soil Heath Services schemes by: assisting countries in establishing pilot schemes for lessons learning; supporting longer-term monitoring of soil health changes; supporting government efforts to repurpose subsidy policies; and facilitating public-private partnerships to leverage in private sector investment in activities that will enhance soil health.

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Executive summary

In many countries in Southern and Eastern Africa, input subsidy programmes are common, most focusing on inorganic fertiliser. These programmes often do not achieve their food security objectives. As an example, Malawi has a long history of subsidies, with years in which 50% or more of the agricultural budget was spent on fertilisers. Despite this, Malawi continues to struggle with malnutrition and food insecurity, and crop yields remain low. Many of the soils in the region come with challenges for crop cultivation as they are highly weathered, sandy, acidic, low in organic matter and inherently nutrient-poor, and in general insufficient nutrients are being applied to maintain soil nutrient levels. Inorganic fertilisers are important but must be part of a package of wider public support measures. One explanation for the generally poor outcomes of fertiliser use is that the budgetary focus on inorganic fertiliser crowds out the needed support for other agricultural and rural services.

Soil health in the region is in decline. Constant applications of inorganic fertiliser—in the absence of other soil ameliorative measures—make the soils even more acidic. And in cases where crop residues are constantly removed and insufficient fertilisers applied, we get declines in soli nutrients. Organic matter is easily lost through tillage, further reducing nutrient-holding capacity. In Malawi, the response to inorganic fertiliser has declined over time. This is a sign of soil health decline, though contributory factors likely include the increased number of extreme weather events and late applications of fertiliser.

Solutions to soil health decline and acidification are well known. These solutions include various combinations of fallowing, crop diversification, intercropping and crop rotations (especially legume rotations), soil organic matter additions, liming and applications of the appropriate inorganic fertilisers. Many of the soil health practices come with major socio-economic and technical challenges (e.g., land too small for rotations, lack of sufficient organic materials).

If applied, soil health solutions have positive outcomes for food security, nutrition and climate change adaptation and mitigation. For example, increased legume cultivation adds nitrogen to soils, is good for household nutrition and diversifies production (which is positive for climate change adaptation). However, soil health improvement is not a silver bullet to food security or climate change adaptation, and comprehensive solutions to food insecurity and climate vulnerability need to go beyond the farm and even beyond agriculture.

A way forward is through compensating farmers for soil health services, which will generate a multitude of private and public benefits. There are many examples of schemes where landholders are paid for providing national and global public environmental services, so-called Payments for Environmental Services (PES). However, there has not been much focus on soil health in PES so far.

The global initiative CompensACTION seeks to promote PES innovation at large scales to facilitate positive environmental outcomes.[2] CompensACTION was launched in July 2022 under German G7 Presidency led by the German Federal Ministry for Economic Cooperation and Development (BMZ) and supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and

Clim-Eat. Its vision is that agricultural producers worldwide, especially smallholders in developing countries, receive adequate compensation for their multifunctional services. This requires compensation mechanisms that combine income from agricultural production with a payment for positive externalities. One of CompensACTION's goals is therefore to contribute to the diversification of financial instruments and thus leverage public and private funding for the maintenance of ecosystem services while improving the income of smallholder-farmer.

As contribution to the CompensACTION Initiative, we identify nine recommendations for establishing a Payments for Soil Heath Services scheme, some of which (7-9) focus on the broader enabling environment that is needed to facilitate a payment scheme.

Development partners can inform the implementation of Payments for Soil Heath Services scheme by:

- Establishing pilot schemes in which lessons are learnt about targeting, payment levels, digital systems, verification systems and soil health practice portfolios.
- Supporting longer-term monitoring of soil health changes, given that payment schemes must be kept as simple as possible and cannot include costly monitoring.
- Support government efforts to repurpose subsidy policies and build an enabling environment for implementation of soil health practices.
- Facilitate public-private partnerships to leverage in private sector investment in activities that will enhance soil health.

Nine recommendations for a Payments for Soil Health Services scheme

1. Provide bonus payments to farmers for soil health practices, as part of a Payments for Soil Health Services scheme.

2. Link soil health payments to a long list of soil health practices, allowing farmers to select which practices are appropriate for their circumstances.

3. In the payment scheme, target smallholder farmers who will, as a result of the scheme, increase productivity and contribute to national food security.

4. Use digital tools to (i) administer flexible subsidies, (ii) register participation in the payment scheme, (iii) record soil health practices, and (vi) make payments for soil health practices.

5. Explore possible monitoring, reporting and verification (MRV) systems, including remote sensing as a low-cost mechanism to track changes in soil health.

6. Link the payments scheme to carbon finance but ensure sustainability through the national budget.

7. Repurpose public support by reducing subsidies, especially on inorganic fertilisers, to free up resources for a soil health payment scheme, crucial agricultural services and social protection.

8. Provide flexible subsidy vouchers and other mechanisms to support farm diversification and soil health improvement.

9. Provide incentives to the private sector to enhance the accessibility and affordability of organic fertilisers, lime and appropriate inorganic fertilisers.

1. Input subsidy programmes are often not achieving their food security objectives

In many countries in Southern and Eastern Africa, input subsidy programmes are common, and the region also shares many agroecological similarities. Inorganic fertilisers are essential as soils are highly weathered, sandy, low in organic matter and inherently nutrient-poor (Figure 1), and in general insufficient nutrients are being applied to maintain soil nutrient levels.[3]

Most countries in the region have a long history of input-based subsidies. For example, in Malawi, the Affordable Inputs Programme (AIP) was introduced in 2020 and follows from the Farm Input Subsidy Programme (2005-2019).[5] Malawi has one of the highest allocations of national budget to agriculture, and of that more than 50% has gone to inorganic fertiliser in the past,[6] probably dropping to 30% in the 2023/24 season. Despite the subsidy programme, Malawi continues to struggle with malnutrition and food insecurity, and crop yields remain low. While some smallholder farmers use the fertilisers efficiently and get good yields, others have low yields that do not justify the use of costly inorganic fertilisers. There are widespread critiques of the input subsidy programmes by, for example, economists, agronomists, political scientists and even the beneficiary farmers.[7, 8, 9] To make the point that fertiliser use efficiency needs to improve, De Weerdt and Duchoslav (2022a) showed that for the 2021/22 growing season in Malawi, it would have been up to five times cheaper to import maize than import fertiliser for maize production.[6]

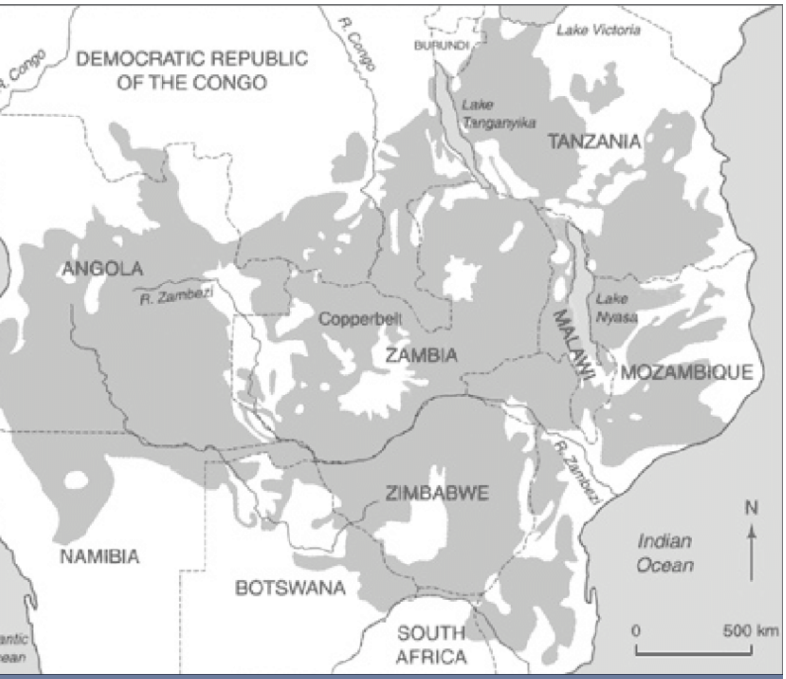

Figure 1. The distribution of miombo woodlands in Southern Africa[4] which corresponds to the distribution of weathered, nutrient poor, acidic, generally sandy soils with challenges for crop cultivation.

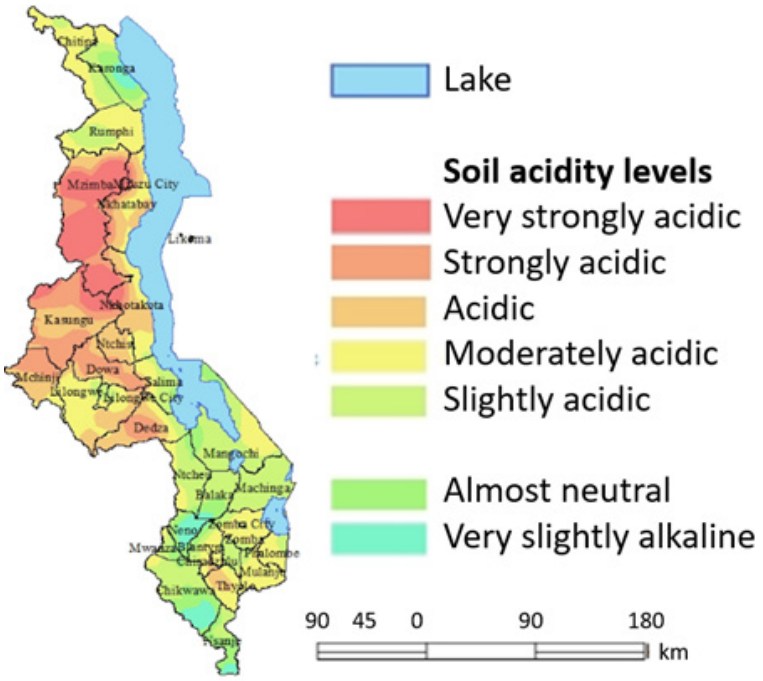

Figure 2. Soil acidity in Malawi (after Munthali et al. 2021)[12]

2. Inorganic fertilisers are important but must be part of a package of public support measures

As Giller et al. (2021)[10] note, crop productivity, and thus the food security and/or incomes of farming households, is tightly constrained by nutrient availability because of the nature of the soils, and the limited availability of inorganic fertiliser, manure and compostable organic matter. But inorganic fertilisers do not always make sense, e.g., when the risk of crop failure due to drought or unreliable rainfall is high (a trend that is intensifying under climate change). Inorganic fertilisers also do not make sense when soil health declines, because crop response to the inorganic fertiliser may be too poor to justify their high costs. One explanation for the generally poor outcomes of fertiliser use is that the budgetary focus on inorganic fertiliser crowds out the needed support for other agricultural and rural services. Inorganic fertilisers should be part—a small part—of a wider package of public support measures for farmers.

3. Soil health is in decline

Much of Southern Africa is dominated by weathered granite sands. There is a vast literature from the region on crop cultivation on these soils. Constant application of inorganic fertiliser—in the absence of soil ameliorative measures—makes the soils even more acidic. And in cases where crop residues are constantly removed and insufficient fertilisers applied, we get declines in soil nutrients. Organic matter is easily lost through tillage, further reducing nutrient-holding capacity.

Results from Zimbabwe clearly show the acidification trend, where after independence the government put massive effort into smallholder farming.[11] In the high-potential region this resulted in bumper harvests, but over a decade, this region went from 43% having soils with pH less than 5 (very acidic) to 77%. The seriousness of soil acidity in Malawi is shown in Figure 2, with vast areas of the country having acidic soils. Very acid soils are marked by aluminium toxicity, phosphorous deficiencies, and low fertiliser response.

In Malawi, the response to inorganic fertiliser has declined over time (Figure 3).[13] This is a sign of soil health decline,[14] though contributory factors likely include the increased number of extreme weather events and late applications of fertiliser.[15]

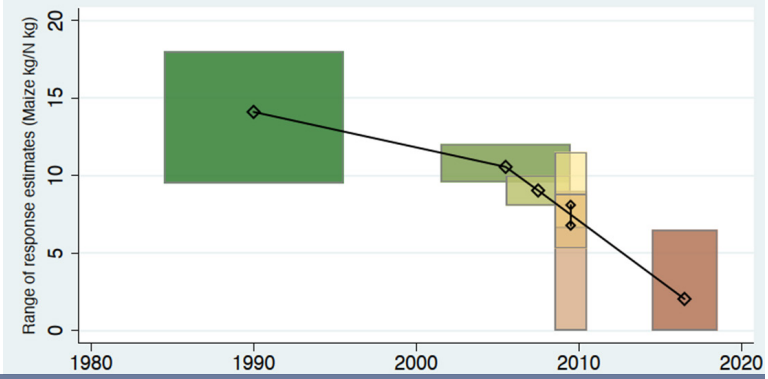

Figure 3. Yield response to nitrogen added on farmer-managed fields over time (1984-2018) in Malawi. This diagram is based on seven different studies, with each box representing the range of yield response estimates on the vertical axis, and the years covered on the horizontal axis. See Burke et al. (2022) for details.[16]

Figure 4. The soil health problem displayed on a single farm (after Giller, 2022).[18] *In the foreground is a heavily depleted soil that will give a poor yield. Close to the homestead there is good yield because of better crop management (e.g., likely due to sufficient nutrient and organic inputs, timely farm operations, etc.) Photo: Ken Giller.*

4. Solutions to soil health decline and acidification are well known, but come with challenges

Solutions to soil health decline and acidification include various combinations of fallowing, crop diversification, intercropping and crop rotations (especially legume rotations), soil organic matter additions, liming and applications of the appropriate inorganic fertilisers.[17] Many farmers lack the resources to implement these practices (Figure 4).

Good agricultural practices come with socio-economic and technical challenges. For example:

- **Fallowing** is often not a widespread option because of very small farm sizes.
- **Crop diversification, intercropping and crop rotation** could be scaled up, though there are issues of lack of sufficient legume seeds, lack of market outlets for the produce and lack of alternatives to maize in terms of income generation.
- **Legumes** can provide a truly renewable source of some nitrogen, but to sustain production in the long term, external sources of other nutrients are required to compensate for the nutrient offtake through harvested crops.[10] Expanding legume production also means having sufficient demand from the market.
- **Crop residues** are insufficient to maintain soil organic matter for the entirety of farms. Crop residues are also in demand for livestock feed, and burning of residues is also prevalent, largely for pest and disease control.
- **Manure** is in short supply, and generally insufficient to cover the entirety of a farmer's field. Manure by itself also does not have sufficient nutrients to maintain high yields.
- **Liming** is a solution to soil acidification when other soil ameliorative measures are not possible (e.g., when there is limited crop rotation, or insufficient organic inputs). However, it adds to the costs that farmers face.
- **Applying appropriate inorganic fertilisers** is limited by lack of access to such fertilisers and, most importantly, lack of soil testing to know what should be applied.

5. Soil health solutions have positive outcomes for food security, nutrition, and climate change

Soil health solutions can enhance food security and human nutrition. If soil health solutions involve legumes and diversification, these generally have positive impacts for human nutrition. Studies in Malawi show that integrating input subsidies and appropriate soil management in Malawi has led to positive outcomes for crop incomes and micro-nutrient consumption.[19, 20] Access to legume subsidies has improved soil health and helped diversity diets.[21] Diversification of the maize-based systems has positive impacts on diets.[22]

Soil heath solutions also have climate adaptation and mitigation co-benefits. It is increasingly important to build climate resilience and greenhouse gas mitigation into farming systems and value chains. Diversification through intercropping and crop rotation for enhancing soil health is appropriate for climate change adaptation. Current subsidy programmes heavily favour maize. It is important to diversify staple crop production—cassava, sweet potato, rice etc. Improved soil organic matter can help farmers get through dry periods in the growing season. Improved soil health will lead to better fertiliser use efficiency and better yields. If this is coupled with good market prices and reasonable costs of inputs, farmer income can increase, which is also important for adaptation, as poverty and climate vulnerability are closely linked. Improved soil health is also a global public good for climate mitigation, through its contribution to carbon sequestration.

6. Soil health improvement is not a silver bullet to food security or climate adaptation, and comprehensive solutions to food insecurity and climate vulnerability need to go beyond the farm and even beyond agriculture

While the focus in this Policy Brief is on soil health, this is not a silver bullet for farms, livelihoods and national food security. Equally important will be the many other things that need to happen on and off farms, amongst which are attention to weed management, pest and disease control, timely operations (that are often not possible because of labour shortages and late delivery of inputs), improved mechanisation, good advisory systems, affordable inputs, good markets and fair prices for outputs, good market infrastructure etc. Similarly, soil health solutions are only a part of climate change adaptation.

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There are limits to poverty alleviation through stimulating smallholder production. Rainfed agriculture in combination with small farm sizes is unable to bring households out of poverty.[23] An expanded and more productive off-farm sector will be very important for poverty alleviation and rural poverty will remain entrenched if basic rural infrastructure is not in place (access to energy and water, good roads, education and health facilities, internet, etc.). Social protection is crucial for the poorest section of the rural population that lacks sufficient agricultural assets.[24]

7. A way forward is through compensating farmers for soil health services, which will generate a multitude of private and public benefits

There are many examples of schemes where landholders are paid for providing national and global public environmental services, so-called Payments for Environmental Services (PES). The global initiative CompensACTION seeks to promote PES innovation

at large scales to facilitate positive environmental outcomes.[2] PES has been widely used for water, biodiversity and carbon services, but has been much less used for soil health. PES schemes for carbon are quite common in forestry, less so in agriculture.

In the case of payments for soil health services there is a mixture of private, and national and global public goods.

- Private benefits include enhanced on-farm soil health, more efficient and profitable use of inorganic fertilisers, improved yields, diversified production,[25] less variable yields in relation to climate change, enhanced access to credit,[a] higher farm incomes and better household food security and nutritional outcomes.

- A major national public good is the reduced burden on the national budget (in the shift away from subsidised fertiliser and the reduced demand on food relief programmes). Other national public goods are improved national food and nutritional security, a more dynamic agricultural sector, reduced erosion, reduced siltation, and increased water-use efficiency.

- Global public goods include carbon sequestration and biodiversity conservation.[b, 9]

[a] Digital approaches are likely to be important to reducing transaction costs in PES, involving registration, monitoring, reporting and verification. Such a system could be linked to a credit rating system.
[b] Intensified production through subsidies has been shown to reduce deforestation in Malawi, and thus has the potential of contributing to biodiversity conservation, but in general, production improvements must be complemented by enhanced landscape governance.

8. Recommendations for establishing a Payments for Soil Health Services scheme

There are nine recommendations for establishing a soil health payment scheme, some of which (7-9) go into broader issues around establishing an enabling policy environment to support it.

1. Provide bonus payments to farmers for soil health practices, as part of a Payments for Soil Health Services scheme.

To make the most out of costly inorganic fertilisers, it is essential to improve soil health. PES is a possible mechanism to improve soil health but does have challenges. PES payments are usually made on the delivery of a service. In the case of soil health, this would occur after the crop has been grown and the service delivery verified, but farmers need upfront payments for inputs before the season commences. As a step away from fertiliser input subsidies, we suggest upfront assistance to farmers through a reduced input subsidy programme and a bonus payment towards the middle of the growing season if acceptable soil health practices have been applied.

2. Link soil health payments to a long list of soil health practices, allowing farmers to select which practices are appropriate for their circumstances.

Soil health practices are context specific, so the acceptable practices in one region are different from other regions. We suggest that a country identifies a limited number of agro-ecological regions, and for each region provides a long list of practices that could be applied for enhancing soil health. We suggest farmers need to undertake at least one practice from each of the following categories to qualify for a bonus payment. In each category several possible practices would be listed:

- Soil erosion control
- Soil nutrient management
- Soil cover and/or rotation measures

In addition, if farmers wanted to be part of the payment scheme, they would not be able to apply excluded practices, (e.g., residue burning, monocropping with maize).

3. In the payment scheme, target smallholder farmers who will, as a result of the scheme, increase productivity and contribute to national food security.

A key principle of the scheme is that it should be less of a burden on the national budget than the present input subsidy programme and yet deliver more in terms of national food security. Targeting is thus important. The focus should be on the farmers that are likely to become, as a result of the payment scheme, significant contributors to national food security through their increases in production. For example, farms of 1-20 ha are suggested as the target in Malawi. Farmers with very few resources, including land (e.g., 0.3 ha), usually lack the resources to implement many soil health practices (e.g., crop rotation), while farmers with large areas of land should be commercially viable and it is presumed that in their own interests, they are already taking care of their soils.

4. Use digital tools to (i) administer flexible subsidies, (ii) register participation in the payment scheme, (iii) record soil health practices, and (iv) make payments for soil health practices.

Transaction costs of the soil health payment mechanism need to be low, and it is likely that digital tools will be essential. These could also be linked to the way which subsidies are administered (see recommendation viii). Practices that deliver payments could be recorded on a digital tool. It will be important to build a farm database to track soil health practices for the monitoring, reporting and verification (MRV) system. And farm databases could also be used to assess credit risks and facilitate the flow of finance. The payments made to farmers for soil health practices could be digitally transferred. However, we do recognise that previous digital systems have been negatively experienced by farmers, given problems of connectivity.[26]

5. Explore possible monitoring, reporting and verification (MRV) systems, including remote sensing as a low-cost mechanism to track changes in soil health.

A key feature of PES is the MRV system, but verification is usually very expensive. We suggest a two-step system. In the first step, the national extension work registers farmers, records the soil health practices undertaken, and recommends which farmers are due payments because they have implemented their selected soil health practices. In the second step, an independent service provider does verification of a sample of farmers, to check on the soundness of first-step verification. In the pilot testing of the soil health payment scheme, it would also be desirable to do on-farm soil testing linked to remote sensing to explore possible low cost-mechanisms for MRV, as well as to document how practice payments are leading to soil health improvement.

6. Link the payments scheme to carbon finance but ensure sustainability through the national budget.

Carbon finance could stimulate an additional stream of income for a payment scheme, but the amounts going to farmers would be too small to change practices. Assuming a soil health payment scheme covering 200,000 farmers, each of whom devote a third of a hectare to soil health improvement, assuming sequestration at the high end of the known values (2 t/ha per year), and assuming USD 4/tCO2e, the scheme could attract about USD 700,000 per year. If used as payments to individual farmers, the amounts are too small to be attractive to farmers (USD 3 per year). Carbon finance can provide an additional source of financing, but the other benefits of soil health improvement far outweigh the carbon benefits. As such the carbon finance income could be used to help administer the payment scheme, but the bulk of the funding for such schemes would have to come from the national budget through "repurposing public support" (see recommendation 7).

7. Repurpose public support by reducing subsidies, especially on inorganic fertilisers, to free up resources for a soil health payment scheme, crucial agricultural services and social protection.

Sustainable and resilient farming, and lifting farming households out of poverty is predicated on a wide range of public and private support services, including climate-informed advisories. Improved advisory systems need to prioritise: (a) Timely and accessible weather advisories for the agricultural sector; (b) The need for intercropping and crop rotation, especially of legumes; (c) Importance of weed control to boost yields; and (d) Improved extension on fertilisers and soil health. Improved extension on fertilisers and soil health could involve, amongst other things, promoting the use of area-specific fertiliser recommendations, avoiding the use of acidifying fertilisers such as urea, use of up to three split fertiliser applications, liming, growing crops and varieties adapted to local soil and climatic factors, manure application,

rainwater harvesting, physical soil conservation measures and conservation agriculture.[27]

A large portion of the national agricultural budgets in many countries in the region goes to input subsidies. This could be partially reallocated to a soil health payment scheme. Fertiliser allocations to unproductive farmers is an inefficient and costly social protection mechanism. More productive farmers need to be targeted for fertiliser subsidies. The least productive farmers are also likely to be the poorest of the poor and will need to be supported through other social protection measures.

8. Provide flexible subsidy vouchers and other mechanisms to support farm diversification and soil health improvement.

As part of repurposing, reduce the focus on maize to free up resources that foster: diversification of staple production; expanded legume production and expanded tree planting. If subsides are used, these could be flexible vouchers instead of focussing on maize production alone (e.g., subsidised legume seed, subsidised inoculant for legume production and subsidised tree seedlings). Legumes are one part of the solution to soil health as well as being important for nutrition, but to expand their production needs access to seeds, the soil inputs they need (commercially available, high-quality inoculum and appropriate fertiliser blends), appropriate extension advice and good markets. Incentives for legume production and alternative staples could come from a flexible subsidy programme, enhanced access to and affordability of appropriate inputs, and incentivizing the private sector to expand processing facilities for legume production and alternative staples.

9. Provide incentives to the private sector to enhance the accessibility and affordability of organic fertilisers, lime and appropriate inorganic fertilisers.

There is limited access to organic fertilisers and the quality varies widely, and area-specific fertilisers are not common. There are considerable lime resources in the region, but markets for agricultural lime are thin. Governments should provide incentives to the private sector to increase input supply. This could include, e.g., fiscal and monetary incentives for input manufacturers, including value-added tax and tax exemptions/rebates, etc. We need to clearly identify the specific bottlenecks to the supply of diverse soil inputs and design appropriate instruments to deal with them.

9. Recommendations for establishing a Payments for Soil Health Services scheme

Moving away from subsidy programmes is difficult. Fertiliser subsidies have been applied for many years and are well known by farmers and officials. To radically change such programmes will bring much disruption and push-back. In addition, payments for soil health schemes are not common. There is thus a large role for development partners in supporting the change process.

Development partners can inform the implementation of Payments for Soil Heath Services scheme by:

- Establishing pilot schemes. Given the lack of examples of soil health payment schemes and the challenges in shifting away from subsidy systems, support is needed in establishing pilots. These should be at a relatively large scale and designed to learn lessons about targeting, payment levels, digital systems, verification systems and soil health practice portfolios.

- Supporting longer-term monitoring. Given the slow change in soil health and the expense of measuring soil health; given that the payment scheme will be based on practices and not actual soil health outcomes; and given that the pilot schemes should embrace simple and low-cost verification techniques, it will be essential to set up more detailed monitoring to assess progress towards improved soil health.

- Support repurposing agendas. The success of soil health payment schemes will be dependent on an enabling policy environment and thus development partners could support government efforts to repurpose subsidy policies and build such an enabling environment (see recommendations 7 & 8).

- Facilitate public-private partnerships. It will be important to leverage in private sector support and investment to get markets working for smallholders and for soil health. This is needed in diverse areas (see recommendations 8 & 9): commercially available inputs such as legume inoculum, appropriate fertiliser blends, organic fertilisers); expanding processing facilities for legume production and alternative staples.

10. Outlook

The global initiative CompensACTION seeks to promote PES innovation at large scales to facilitate positive environmental outcomes.[2] CompensACTION was launched in July 2022 under the German G7 Presidency led by the German Federal Ministry for Economic Cooperation and Development (BMZ) and supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and Clim-Eat. One of CompensACTION's goals is to contribute to the diversification of financial instruments and thus leverage public and private funding for the maintenance of ecosystem services while improving the income of smallholder-farmer.

As outlined in this paper, one possibility for diversifying the financial instruments is compensating farmers for soil health services. This would advance thinking and action within PES, where soil health has not been a major focus.

Work on designing a soil health payments system has advanced in Malawi with two stakeholder workshops to discuss design elements, and there is hope of a pilot scheme in forthcoming seasons. This paper has benefited from those design meetings (see acknowledgements). The paper outlines nine recommendations to establishing a soil health payment scheme that can be piloted and scaled-up as part of the CompensACTION Initiative, thus creating evidence on the use of PES schemes for the repurposing of public subsidies. Given similar agroecological conditions across vast areas of southern Africa and relatively similar production systems, the Malawi work has relevance for South-South learning with neighbouring countries as well as informing PES innovation more broadly.

Citation

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compensaction.org
for more information

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