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INVASIVE PLANTS AND FOOD SECURITY IN AFRICA: THE POTENTIAL OF EARTH OBSERVATION DATA

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EXECUTIVE SUMMARY

The spread of invasive plant species has serious consequences for Africa. Toxic weeds and harmful shrubs significantly shrink rangelands and lower the productivity of major grain foods such as maize (in some instances by up to 45%).[2] Toxic weeds suppress the growth of staple crops and take over fields that could otherwise be used for agriculture. The UN Sustainable Development Goals emphasise the need to better manage land degradation and biodiversity loss and develop strategies to combat poverty. However, the invasion of rangelands and croplands by harmful non-native species is not specifically mentioned in the UN sustainability framework as a significant and emerging environmental issue. Equally, the AU Commission (AUC)[3] sounds the alarm over rising food insecurity in Africa, but there are no tools or coherent strategies on how to address the challenges posed by invasive

RECOMMENDATIONS

1. Amendments to existing and future policy frameworks, such as the CBD and the AUC strategy, are required to emphasise the need to develop more effective and coherent protocols for the management of invasive species.
2. Spatial occurrence maps of invasive species should be used by decision-makers to better understand and manage their effects on cropland and rangeland productivity, and ultimately food security in Africa.
3. Policymakers and decision makers need sound evidence on the local uses and impacts of invasive species in order to become aware of their costs and benefits.
4. International bodies that promote the use of EO for societal benefit areas (such as GEOSS and UN SPIDER) must include invasive species mapping in their outreach and training agendas. This should be facilitated by country- or region-specific case studies that help to show the potential of EO products to more effectively manage invasive species across borders.

species in the context of enhancing food security. This briefing highlights the significance of earth observation (EO) data for the development of tools and strategies to curb the increasing spread of invasive species.

INTRODUCTION

Invasive species have a detrimental effect on biodiversity, crop production and livelihoods across Africa. They affect the livestock industry by lowering forage yields and quality, interfering with grazing, poisoning animals, increasing the costs associated with livestock production and reducing land value. They also affect wildlife habitat and forage, deplete soil and water resources, and reduce plant and animal diversity.[4] Some invasive species have human health implications, such as providing sugar feeding possibilities to mosquito vectors such as those of malaria.[5]

Invasive species threaten the recent gains made in Africa around improving land use sustainability and combating hunger. The AU recognises that significant challenges still face the continent. In the context of food security, the 2014–2017 AUC strategy emphasises that declining agricultural productivity is an area of focus for future research and development, with one major constraint to Africa's agricultural productivity being invasive species.[6] Although the strategy raises concerns about rising food insecurity on the continent, clear approaches and policy interventions to address the impact of invasive species on land productivity are still missing.[7] Therefore, the development of coherent intervention and land management strategies that look at ways to curb the increasing spread of invasive species is paramount.

The challenge with invasive species is that there is no quick solution, and thus issues around their management and use may be put into the 'too hard' basket. However, EO tools can play a vital role in effectively identifying priority zones and future spread and risk areas, for the deployment of pre-emptive containment measures.[8]

Although invasive species contribute significantly to environmental land degradation and their effects are usually irreversible, they are generally not viewed as a critical environmental issue. Consequently, they do not receive adequate attention from policymakers. However, the spread of invasive species poses a major threat to the livelihoods of many small-scale farmers and pastoralists in Africa.[9] The poor are the most vulnerable to land degradation caused by invasive species, as they are generally directly dependent on biodiversity-based goods and the associated ecosystem services for their livelihoods. In Africa, for example, agriculture provides 60% of all employment, rising to 80% for populations in rural areas.[10] Since the spread of invasive species impedes the provision of ecosystem services while also reducing crop yields and income from livestock, it contributes significantly to social instability and economic hardship, placing constraints on sustainable development, economic growth and poverty alleviation.[11]

THE POTENTIAL OF EARTH OBSERVATION TO MAP INVASIVE SPECIES' PROPAGATION AREAS

EO technology can provide information feeds on environmental conditions and changes in vegetation composition that are up to date, temporally and spatially uniform, and synoptic.[12] The wide-area monitoring aspect of EO makes it a very effective technology when compared with 'traditional' ground-based hand or global positioning system mapping methods, which are limited in their spatial coverage and more time consuming and costly.[13] Vegetation maps derived from EO usually cover larger and more inaccessible areas. They can also be updated at intervals as determined by the intervention needed. The development of geo-information systems provides an important opportunity for developing countries, which generally have poor data, technology and capacity to synoptically assess cropland and rangeland productivity constraints. Recently, EO has been recognised as a synthesising tool for the management of interventions aimed at invasive species control through mapping and visualising invader distribution corridors and areas that are at risk of being invaded in future.[14] Although the full extent of the effects of invasive species on agricultural productivity is as yet unclear, EO technology offers one means to assess the affected area and the changing patterns of invasive species propagation over time.

The applicability of EO in this context is especially pertinent given that new satellite datasets are currently available for free (for example Sentinel-2), with better mapping accuracies than ever before. These datasets are particularly valuable and provide a unique opportunity for monitoring vegetation species shifts in inaccessible areas across Africa.

POLICY INTERVENTION POSSIBILITIES

Several political programmes worldwide deal with invasive species. For Africa there is, most importantly, the

Convention on Biological Diversity (CBD), specifically Article 8, which encourages parties to prevent the introduction of alien species and suggests implementing measures to control or eradicate invasive species that threaten ecosystems, habitats or native species.[15] The CBD also stipulates that by 2020, invasive species and their pathways should be identified and prioritised. The AUC's Agenda 2063 emphasises declining agricultural productivity, but no specific reference is made to the effects of invasive species on food security. The Inter-African Phytosanitary Council of the AU[16] has set out a strategic objective for 2014–2023 to mitigate the loss of biodiversity through the improved management of invasive species within key spread and risk areas on a transboundary scale.

At a country level in Africa, there are a few localised invasive species programmes. Regionally, however, there are no standardised recommendations and guidelines on how to deal with the containment and further spread of invasive species.[17] In many African countries there are inadequate policy frameworks for preventive measures and a general lack of technical capacity in the deployment of appropriate invasive species management strategies. There is also a significant shortfall in funding to deploy 'on the ground' measures.[18] This is partly attributable to the lack of quantifiable information or empirical evidence on how invasive species interrelate with the environment and the possible trade-offs (costs and benefits) that are associated with their spread.[19]

Awareness needs to be created about the utility of EO information in providing credible, objective and wide-area information on the spread, distribution and abundance of invasive species for country-specific biodiversity reporting and action plans, specifically in the context of the CBD. The EO-derived information would help to consistently manage the spread of invasive species across country boundaries. Invasive species' propagation pathways, mapped from EO, can be effectively linked to perceptions of their local impacts, uses and management options. This comprehensive knowledge can lay the foundation for cost and benefit analyses and the possible commercial use of products from invasive species (such as charcoal from invasive trees).

For better decision-making on the possible uses and consequences of invasive species, international programmes such as AfriGEOSS[20] and UN-SPIDER[21] should facilitate case studies linking local-scale environmental and socio-economic invasion effects to invasive species occurrence maps. Both programmes promote the use of EO for better policy reporting and decision-making within key societal benefit areas, such as food security. The case studies developed through these programmes will also help to improve the understanding of the ecology of the invasive species. The need to facilitate case studies for key use cases was recently acknowledged at the first AfriGEOSS Symposium, held in April 2016 in Zimbabwe.

The CBD can do more to promote the spatial assessment of invasive species management priority areas in view of their effects on local scale biodiversity, possibly also exploring the inclusion of a clause on this topic as an amendment to Article 8 of the CBD text. The AUC should urgently address the lack of protocols and capacity for prioritising invasive species in existing legislation and control measures. As part of any policy amendment, country-level institutional and legal frameworks need to be assessed.

OUTLOOK AND CONCLUSION

AU strategies on food security and agriculture should place greater emphasis on the use of EO to objectively identify priority, buffer and containment zones for more effective, regionally based management of invasive species. This should be seen in the light of attempts to improve food security and foster regional collaboration and data exchange efforts. International frameworks, particularly the CBD, should also play a greater role in promoting the use of EO in addressing challenges related to invasive species. Programmes such as AfriGEOSS should seize the moment and call for the development of case studies that demonstrate the importance of mapping products in developing better policies for the effective management of invasive species. These case studies should be facilitated for various sites throughout Africa.

In Africa, policy mechanisms on invasive species are not being used because of an inadequate policy environment, a lack of technical capacity and funding to effectively implement control measures, and a lack of knowledge on the risks and benefits posed by invasive species. Policymakers need to make a case for spatially coherent information feeds, many available at no cost, to support land policies that mitigate land productivity risks through better invasive species management.

This briefing shows the possibilities of EO data in supporting policy mechanisms that aim to curb the

increasing spread of invasive species. This is an urgent priority in view of the food security situation of thousands of small-scale farmers and pastoralists across Africa.

ENDNOTES

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