

# Policy Framework for Utilization and Conservation of Below-Ground Biodiversity in Kenya

C. Achieng, P.F. Okoth, A. Macharia, and S. Otor

**Abstract** The reasons for the lack of inclusion of below-ground biodiversity in the Kenyan policy and legal framework were sought through a purposeful survey. Gaps were identified in the relevant sectoral policies and laws in regard to the domestication of the Convention on Biological Diversity (CBD). Below-ground biodiversity had no specific schedule in any of the sectoral laws. Most sectoral laws were particular about the larger biodiversity and soils but had no specific mention of below-ground biodiversity. Material Transfer Agreements and Material Acquisition Agreements that are regarded as tools for the domestication of the CBD to guide transfers, exchanges and acquisition of soil organisms lacked a regulating policy. The lack of regulating policy could be attributed to the delay in approval of draft regulations by the Ministry of Environment while the lack of specific inclusion of below-ground biodiversity in Kenya's legal and policy framework could be as a result of lack of awareness and appreciation among stakeholders.

**Keywords** Below-ground biodiversity · Convention on biological diversity · Material acquisition agreement · Material transfer agreement · Policy framework

## Introduction

Concerns about the loss of soil biodiversity related with land use change have been raised in many studies. Even as agricultural intensification becomes a real occurrence, it has received relatively little attention in Kenya (Okoth, 2004). The reduction of below-ground biodiversity (BGBD) decreases agricultural productivity (resulting in a higher number of hectares having to be used to get the same yield) (Altieri, 1999) and also decreases the resilience of agricultural ecosystems so that they are more vulnerable to erosion, pests, diseases, and the general degradation of the land (Ibid). Despite these concerns, BGBD has been given very little attention by stakeholders (UNEP, 1995).

There is a need to keep agricultural ecosystems as healthy and sustainable as possible so that the biodiversity loss, which is usually so high in agricultural systems, is reduced (Swift, 1997). Nevertheless, if higher priority is to be given to the conservation and management of the soil and its associated biota, then policy makers need a better understanding of the soil-based ecosystems' services and of their commercial values (Giller et al., 1997). In many countries, enacting of laws formulated to protect the soil has not kept pace with measures intended to protect other natural resources, such as air and water. The same case applies to Kenya where there is no specific policy or legislation to guard soil organisms and yet they are affected by land use change and agricultural intensification. What exist are sectoral laws which are not encompassing.

A policy framework that stipulates appropriate land use systems and provides guidelines on transfer, exchange, acquisition, commercialization, utilization, and conservation of BGBD is needed. Such a policy framework would ensure abundance and diversity,

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which would in turn increase BGBD functions in the soil. Increased activities result in adequate nutrient supply for crop growth, hence increased food production (Swift, 1997). Increased food production ensures enough food for subsistence and commercial purposes, thus helping to alleviate poverty. The objective of this study is to propose an improved policy framework for the enhancement of biodiversity and sustained utilization of its components. Sustainable utilization of biodiversity is stipulated in the Environmental Management and Co-ordination Act (1999).

## Materials and Methods

Several methods were used in the data collection, ranging from reports and publications, survey data from field visits to Gatunduri and Kibugu sub-locations of Embu District. Use of meta-data to relate land to below-ground biodiversity was done. A survey was carried out with 120 farmers in the two sub-locations; interviews were conducted with 30 scientists handling BGBD and 12 institutions dealing with the same in Nairobi and Embu. Key informants were also interviewed to get specific information about different aspects of BGBD.

### Use of Meta-data to Relate Land to Below-Ground Biodiversity

The use of meta-data in this research was to obtain general information on the effects of land use systems and intensities on the diversity and abundance of soil organisms in Embu. Such data are found in literature, in published papers, and in gray literature existing in institutions. In the case of this study, current information was obtained from work done by an ongoing project (the conservation and sustainable management of below-ground biodiversity) in Kenya and in six other tropical countries (Indonesia, Brazil, Mexico, Uganda, India, and Côte d'Ivoire).

### Farmer Interviews and Focus Group Discussions

Another method employed was a survey of farmers' current knowledge on BGBD through interviews and

focus group discussions. One hundred and twenty farmers from both Gatunduri and Kibugu villages were interviewed and the purpose of the questionnaires was to generate perceptions of the farmers on the effect of agricultural intensification on the abundance and diversity of BGBD. The questionnaires were intended to find out if farmers had any knowledge on management and their view of such undertakings in future. A total of three focus group discussions were held. The groups were organized based on gender with the first group constituted mainly by women, the second by men, and the third by both men and women. Each group had a membership of 10 persons, where the last group consisted of 5 women and 5 men. The purpose of the focus group discussions was to further analyze and understand the previously obtained results from individual farmer interviews. The groups comprised farmers of all ages including the youth, middle age, and the elderly farmers.

## Institutional Studies

Institutional studies were carried out in Nairobi and Embu Districts. Among the institutions interviewed were government ministries, lead agencies, non-governmental organizations, universities, and private firms dealing with soil organisms. The use of open-ended questionnaires for this part of the study was to probe the institution for information that would otherwise be restricted, as is the case with close-ended questionnaires. The use of questionnaires enabled the researcher to present questions in a uniform manner, thus reducing bias.

## Individual Scientists' Study

Thirty individual scientists were issued with questionnaires to understand their experiences with BGBD. Such experiences included management, transfers, exchanges, acquisition, and commercialization of BGBD, as guided by existing policies and regulations in Kenya.

## Key Informant Interviews

Interviews with individuals with knowledge on specific issues on BGBD that the researcher sought to find were

**Table 1** Farmers' knowledge of various aspects of BGBD

Knowledge	Numbers	Percentage (%)
Commercialization	Yes: 38/120	31.7
	No: 46/120	38.3
	Needed education first: 36/120	30
Transfers	Yes: 70/120	58.3
	No: 50/120	41.7
	Had witnessed soil samples being picked from their farms: 30/50 did not know	60
Exchanges	Understood as exchange between farmers: 44/120	36.7
	Sought knowledge first: 54/120	45
	Needed an explanation on exchanges first: 22/120	18.3

carried out. Such issues included policies relevant to BGBD, revision and improvement of policies to incorporate BGBD issues, intellectual property rights, and individual handling of BGBD.

## Results and Discussions

### ***The Role of Policy in BGBD Conservation, Management, Preservation, Maintenance, Acquisition, Transfer, Commercialization, Benefit Sharing and Intellectual Property Rights (IPR)***

#### **Farmers' Perceptions**

Farmers were asked if they knew if soil organisms can be used in trade, if properly identified for type and function in the soil. The purpose of this question was to get insights on farmers' knowledge in commercialization with BGBD. The following responses were obtained: 31.7% (38 out of 120) said yes, 38.3% (46 of 120) said no, while 30% (36 out of 120) said that they would be in a better position to answer this question, when educated about such issues before hand. Out of the 120 farmers interviewed, a significant 70 had an idea of what transfer of soil organisms was. Out of the 70, a significant 36 said it was the removal from one farm to another, while 40 said, it was the movement of soil organisms from one farm to another. The remaining 50 farmers had no idea about transfers at all. This implies that farmers lack knowledge in BGBD issues, hence the need to educate them. These results are shown in Table 1.

From the last column of the row on transfers in Table 1, more insights were obtained from farmers during focus group discussions (Kreuger, 1988) and the results are as shown in Box 1. The transfers that farmers were more familiar with were those in which soil organisms are carried in manure, for example, the case of the dung worm – locally known as “marindi.” Other organisms transferred in manure were enumerated as small black ants, big beetles, millipedes, centipedes, termites, earthworms, and nematodes. The other significant transfer was from their farms to the University of Nairobi and the Kenya Agricultural Research Institute (KARI), for research. One farmer shared his experience, as in Box 1.

#### **Box 1**

“We do not know where they were taken since people in a team came and took samples from our plots and never returned. They even put pegs which are still here up to now, but did not explain, what the pegs were for! Soil samples have been picked on a number of occasions, but we have no idea what was extracted from such samples.”

*Source:* Interview with one of the farmers in Gatunduri sub-location

This is an outcry that transfers of BGBD occur mainly in form of soil samples being taken away from farmers' farms. When this is done, the farmers are not made aware of what is obtained from such samples and whether they are beneficial or not. Therefore,

they do not get any benefits in case such organisms are used for commercial purposes. This act is unethical because it overlooks the advice given by the CBD on prior informed consent, when handling biological resources from one individual to another or one institution to another or one country to another (<http://www.biodiv.org>). National regulations/guidelines on prior informed consent would guide such a process and serve all stakeholders equitably. Regulations on prior informed consent have been formulated, but are still in draft form and have not been approved by the Minister for Environment. They are found in schedule II of the (conservation of biological diversity and biological resources, access to genetic resources and benefit sharing, and the protection of environmentally significant areas) regulations (Republic of Kenya, 2005, Third National Report).

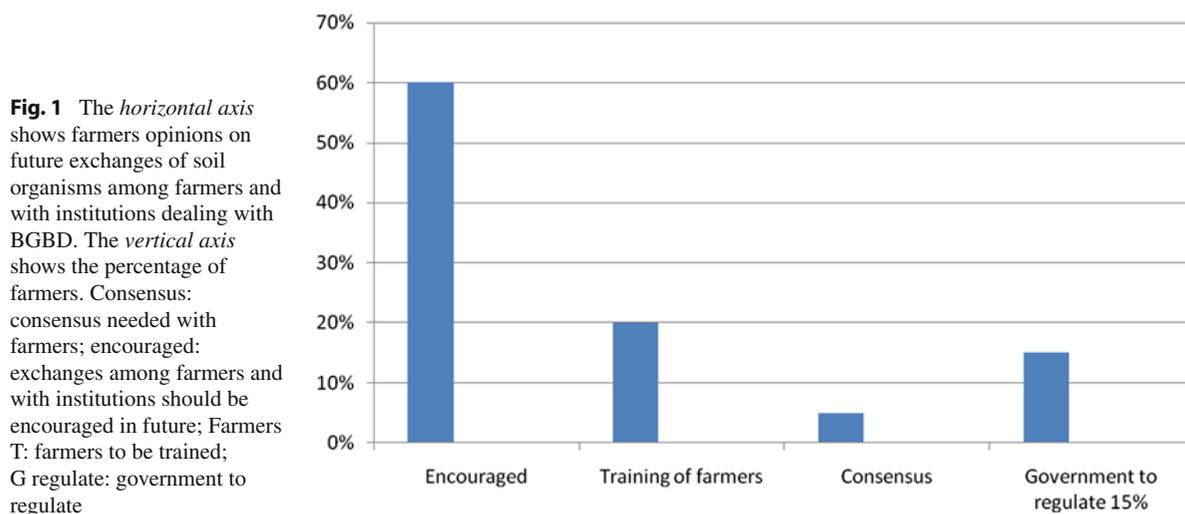
Also, farmers' opinions on future exchanges of BGBD were requested. The purpose of this question was to gather information that would enable the inclusion of farmers, as relevant stakeholders in exchanges of BGBD. Such information would also be useful, when formulating guidelines on BGBD issues. The results obtained are shown in Fig. 1.

## Institutions' and Scientists' Perceptions

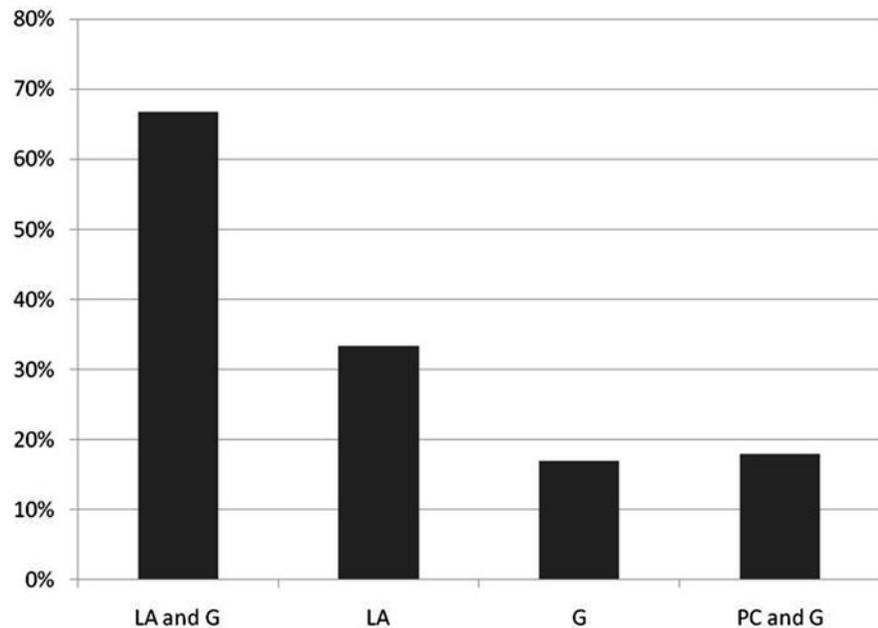
### Material Transfer Agreements (MTA) and Material Acquisition Agreements (MAA)

Information about familiarity with MTA and MAA was sought from institutions and scientists dealing

with BGBD. The purpose of this question was to find out how many institutions know about MTA and MAA. Familiarity with MTA was at 83.3% (10 out of 12), while unfamiliarity was 16.7% (2/12). For the MAA, it was 50% (6 out of 12) for familiarity against 50% (6 out of 12) for lack of familiarity. Most of the agreements termed as MTA and MAA were actually Memorandum of Understanding (MoU). This shows that transfers were more commonly taking place than acquisition. This explains the fact that soil organisms were mostly used for research between and among institutions rather than such institutions claiming to own the organisms through acquisition. The signatories to these agreements were given as lead agencies and governments 66.7% (8) and lead agencies only 33.3% (4); the rest were as shown in Fig. 2. The difference in the percentages explains the fact that both agreements were considered at the same time without separating them. It can also be explained that a lead agency in a government would sign an agreement with a lead agency in another government or from the same government without the governments of such countries being part of such agreements. It was found out that there were a number of flaws in the existing MTA/MAA/MoU. First, they were not strictly adhered to, because there were no legislative appendages in such agreements. The draft regulations on access to genetic resources and benefit sharing outline various forms of punishment to offenders who violate the draft MTA regulations (Draft regulations, Part V, Section 35.1, 35.2, 36, and 37). These regulations once approved by the Minister for Environment and gazetted will ensure proper adherence to MTA and



**Fig. 2** MoU signed between institutions dealing with biological resources in Kenya. The *horizontal axis* shows the type of institutions while the *vertical axis* shows the percentage of agreement types signed by different institutions. LA and G: lead agencies and government; LA: lead agencies; G only: governments only; PC and G: private companies and governments



MAA. Secondly, MTAs and MAAs accessed lacked an outline on benefit sharing, hence it would be difficult for the stakeholders involved to claim any benefit accruing from the genetic material in question.

## Conclusions

From the information obtained from the three groups of stakeholders (farmers, scientists, and institutions dealing with genetic resources), it is clear that there is need to include all the key stakeholders in the process of BGBD policy formulation. This is because all have different and important stakes in BGBD issues. In this regard, the proposed ways and means include, first, having prior informed consent of all the stakeholders involved when handling BGBD and in particular the farmers. Farmers also need to be educated on various aspects of BGBD. Secondly, having incentive measures to ensure proper utilization and conservation of BGBD have to be considered. Such incentive measures need to be outlined in a national policy document or in regulations, formulated by relevant authorities. Thirdly, there is a need to have specific BGBD regulations on equitable benefit sharing. Lastly, the guidelines stipulating the formulation of MTAs

and MAAs should be approved sooner than later to guide institutional arrangements in relation to transfers, exchanges, acquisition, and commercialization of BGBD in Kenya.

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## References

- Altieri MA (1999) The ecological role of biodiversity in agro ecosystems. *Agric Ecosyst Environ* 74:19–31
- Environment Management and Coordination Act (EMCA) (1999) Kenya Gazette supplement No. 3 (Acts No. 1)
- Giller KE, Beare MH, Lavelle P, Izac AMN, Swift MJ (1997) Agricultural intensification soil biodiversity and agro ecosystem function. *Appl Soil Ecol* 6:3–16. <http://www.biodiv.org/convention/article.asp>. Accessed 26 Feb 2007
- Kreuger RA (1988) Focus groups: a practical guide for applied research. Sage, London
- Okoth SA (2004) An overview of the diversity of microorganisms involved in decomposition in soils. *Trop Microbiol* 3(1):3–13
- Republic of Kenya (2005) Third national report to the conference of parties to the convention on biological diversity on the implementation of the convention, 2005
- Swift MJ (1997) Agricultural intensification, soil biodiversity, and agro ecosystem function on the tropics. *Appl Ecol* 6: 1–2
- UNEP (1995) Global biodiversity assessment. Cambridge University Press, Cambridge