



Nagoya Protocol and Africa's willingness to share biological control agents, are we deterred by barriers instead of using opportunities to work together?

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Abstract Amongst members of the biological control community there is a range of perceptions regarding the Nagoya Protocol, at best it will hinder access to natural enemies of pests and invasive plants and at worst implementation of the Protocol will prevent access to these resources. In this preliminary study of Africa's preparedness to implement the Nagoya Protocol and control access to potential biological control agents, we found that several countries have not yet established procedures and policies in this regard. Several factors including lack of awareness, insufficient relevant information and lack of capacity may cause delay in countries implementing access and benefit sharing legislation and processes. The lack of preparedness provides an opportunity for the research community to work with government officials to

facilitate future access to natural enemies to act as biological control agents on invasive plants and agricultural pests. Collaboration between researchers, managers and bureaucrats in support of African countries could lead to collective action that develops policies and implements processes to foster exploration of African biodiversity. This collaboration could also foster the sharing of biological control agents that will benefit Africa through integrated pest management in agriculture, protection of human lives and livelihoods, and reduction of the impact of invasive alien species on biodiversity and environmental infrastructure.

Keywords Nagoya Protocol · Access · Natural enemies · Policy · Africa

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Introduction

The Nagoya Protocol is a supplementary agreement to the Convention on Biological Diversity (CBD). The protocol provides a framework for the effective implementation of the fair access and equitable sharing of benefits (Access and Benefit Sharing (ABS)) arising out of the use of genetic resources, including biological control agents. Classical biological control, broadly defined as the use of natural enemies (arthropods and pathogens) to reduce populations of crop pests and invasive alien weeds, is becoming an increasingly important management option as

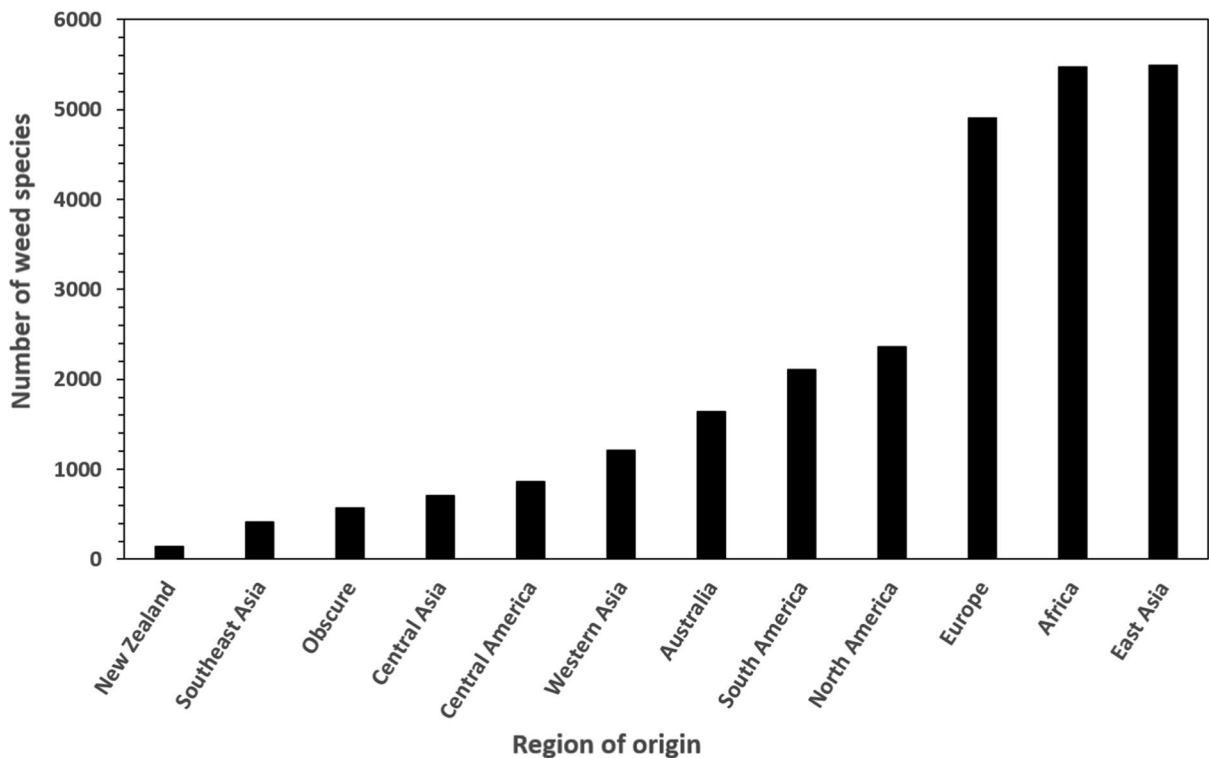


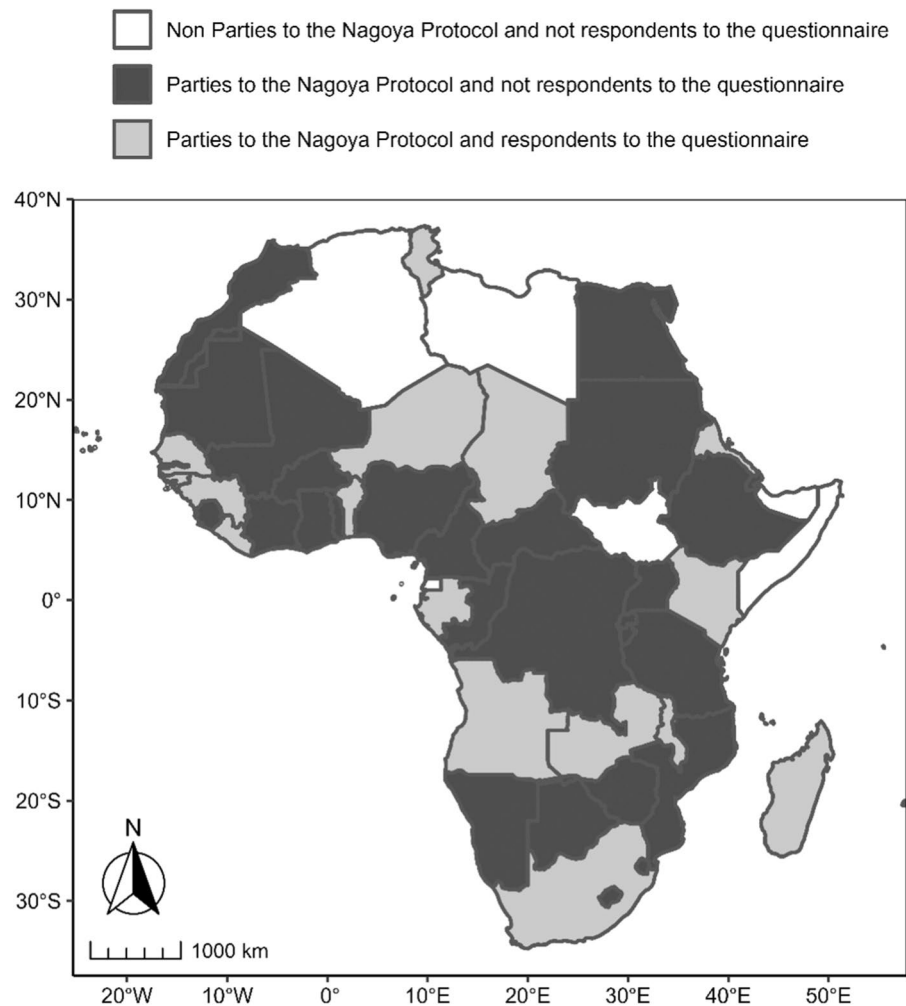
Fig. 1 Number of weeds listed per continent or region of origin in Randall's global compendium of weeds. After: Randall (2017) who has granted permission to use this graph (and other graphs and tables) from this publication

agriculture reduces its reliance on conventional pesticides (Kenis et al. 2017). However, Cock et al. (2010) stated that the recent application of the principles of ABS might make it difficult or impossible to collect and export natural enemies for classical biological control research in many countries.

One of the main concerns regarding the Nagoya Protocol is the lack of systems and capacity to implement it efficiently in resource-poor countries. Of the 54 countries and island states that form Africa, 48 are parties to the Nagoya Protocol (CBD 2022a). Both Party and non-Party states have established national focal points for ABS. Silvestri et al. (2020) assessed the potential consequences of the implementation of Nagoya Protocol for classical weed biological control globally although this study only considered South Africa within the African continent. The study found that whilst South Africa had a process and policies in place, they were cumbersome and confusing. They do conclude, however, that the export of potential agents of classical biological control of weeds from South Africa was “relatively easy”. The delayed or

possible prevention of access to likely biological control agents from Africa is potentially problematic for management of invasive alien plants and agricultural pests on other continents. Randall (2017) (Fig. 1) indicates that after East Asia, Africa is the second largest “donor” of weeds to the rest of the world, with just under 5500 plant species from Africa recorded as present and posing a menace to landscapes where these plants have been introduced. Similarly, The Global Naturalized Alien Flora database records Africa as the third largest “donor” of plant species that have become naturalized elsewhere in the world (van Kleunen et al. 2015). Africa has benefitted significantly from classical weed biological control (Neuenschwander et al. 2003), but as the continent is also the source of so many globally invasive weeds, is it likely to be the source of suitable natural enemies to reduce the impact of these species. It is thus vital that there are the policies, processes and capacity in place in Africa to ensure equitable benefit sharing of and access to potential biological control agents for weed biological control. In this study, we conducted a

Fig. 2 Map of Africa showing which countries are Parties to the Nagoya Protocol and those who responded to the questionnaire on ABS (Prepared by G. Sutton, Centre for Biological Control, Rhodes University)



preliminary assessment of the policies and processes within African countries to deal with the Nagoya Protocol.

Methods

The focal points for each country in Africa were accessed (CBD 2022b). Survey Monkey (<https://www.surveymonkey.com/mp/audience>) was used to develop an online questionnaire in English (see Supplementary Information) and French, which was e-mailed to all of the focal points in Africa. The questionnaire broadly dealt with the focal points' understanding of invasive alien species and classical weed biological control. Specifically, questions asked how each country was hoping to comply with the Nagoya

Protocol, whilst still being available as a donor and recipient of natural enemies for the purposes of classical biological control. The data were analyzed using descriptive statistics (percentage and means).

Results

Sample size

Of the 54 states in Africa, 48 are parties to the Nagoya Protocol and six are not (Fig. 2), 53 have ABS focal points listed on the ABS Clearing House (CBD 2022a). South Sudan does not have a focal point listed. Of the 29 English-speaking focal points invited to take part in the survey, 13 opened the survey and read the introduction to the questionnaire, and only

nine (31%) respondents completed the section requiring contact details. Of the 23 French-speaking focal points and the single Portuguese-speaking focal point, 14 opened the survey, and 10 (42%) respondents completed the section requiring contact details. However, one country had two respondents so we gathered information for nine of the French-speaking countries. In total 18 of 53 (34%) focal points from African countries responded to the questionnaire (Fig. 2). Only one of the 18 respondents indicated that in order to share information they had to get permission from another government official, the majority indicated that they had a mandate to share information about access and benefit sharing. Four of the 18 respondents indicated that they were not the focal point for access and benefit sharing. Each of the respondents in this case gave the name and contact details of the relevant focal point for their respective countries. When the initial respondent indicated that this was appropriate, we sent the questionnaire on to the new focal point.

Responses

In response to the question “What policies does your country have in place with regards to access to biodiversity resources?” fourteen countries submitted links to documents relating to the policies applied in their countries. Three others indicated that either their countries had not yet published policies or had not passed ABS laws, or that they used the provisions of the Convention for Biological Diversity. Thirteen countries provided an indication of the process that research institutions must follow if they intend to “undertake research into natural enemies of plants for possible biological control agents” and four were able to provide electronic copies of permit application forms for this purpose. Only five of the countries indicated that they were aware of applications to “access natural enemies of plants” and one of these indicated that this was for “research” purposes only.

There was some confusion among respondents regarding the question: “Are you aware of any plant or animal species from your country (or neighbouring countries) that are invasive elsewhere in the world?”. Eight respondents indicated that they were aware of plants from their country that are invasive elsewhere, but the examples given included only one African species and the remainder were species invasive in Africa. Likewise, in response to the

request to “list species names on which research had been undertaken”, there was either no information forthcoming or a list of species invasive to Africa, which researchers were investigating. This suggests that either the question was ambiguous or there is simply a lack of knowledge concerning invasive alien plant species in these countries.

Seventy eight percent (14/18) of the respondents would be either “very” or “extremely” interested in learning from other countries in Africa who have established processes and policies in place to support ABS of biodiversity assets for biological control of invasive species. These respondents would also be willing to share policies and processes with other African countries (three of these countries had certain conditions for sharing their policies).

Six of the 18 respondents indicated they knew of examples of biological control used within their countries. However, the range of examples (“the fight against locusts”, “biological agents against *Salvinia molesta*” and “agents for blue gum pests?”) suggests there is a need to provide further context to this question. Respondents described the successful biological control of *Salvinia molesta* D. Mitch. (Salviniaceae) in Africa (e.g., Cilliers et al. 2003), but not efforts on *Pontederia crassipes* Martius (Pontederiaceae) (De Groote et al. 2003; Wilson et al. 2007) nor the well-known work on Cassava mealy bug, *Phenacoccus manihoti* Matile-Ferrero (Hemiptera: Pseudococcidae) (Neuenschwander 2001), which suggests a lack of institutional knowledge or a lack of public awareness of these programmes.

The final question of the survey asked respondents: “Do you have any further questions regarding Nagoya Protocol and Access and Benefit Sharing?” In response to this, respondents raised the following questions (verbatim or verbatim translated from French):

- What are the advantages of the country and the ABS focal point in the project? How can this project help the country to better develop the Nagoya Protocol? What are the other stages (next steps) of the project?
- No questions, we are going to create conditions for the application of this law, first by its publication in the Official Journal of the Government.

- How to get and share the benefits from using genetic resources. Whether monetary and non-monetary benefits?
- We would like to know if you have any information on the experiences of other countries, which have successfully implemented the Nagoya Protocol on access and benefit sharing.
- Regulatory aspects related to the management and sharing of genetic resources.
- No question but we suggest capacity building should be promoted for developing countries.
- Request for already existing information on the control of invasive species. Our country is having challenges to control a number invasive species.

Discussion

A 34% response rate may not be sufficiently comprehensive to draw very accurate conclusions about the readiness of African countries to share biodiversity resources, but it does give some indication of the effort required to better prepare countries for research into potential biological control agents. While several countries have policies to facilitate ABS, it is not yet clear how practical these are and whether they will help researchers to access natural enemies of targeted plants. The existing policies require further examination and comparison to each other and policies of other countries elsewhere in the world. However, it is very clear that the focal points who responded to this questionnaire are keen and willing to improve both policies and practices relating to ABS in their countries.

It is clear that the majority of African countries are keen to learn more about appropriate policies and practices to facilitate access and benefit sharing. Countries are also willing to share their experiences and policies with other African states and this needs coordination. The biological control research community could be responsible for assisting African countries to get access to appropriate policies and develop practices that support work on potential biological control agents. Any training or support must address the questions raised by respondents, particularly those around monetary benefit, capacity building and information on control of invasive alien species. Funding is required to develop and deliver suitable training programmes that will assist focal points to address

the issue of access to biological control agents from Africa.

A clearer understanding is required of what plants from Africa are introduced, naturalized and invasive elsewhere in the world. Working on specific case studies may make this theoretical treatment of ABS both more practical and better understood by focal points across Africa. There are a number of Africa plant species, in particular grasses, that are under consideration for biological control elsewhere in the world (Sutton 2019) and thus there is an urgency to ensure that the systems are in place and working efficiently. The biological control programme on the indigenous African tulip tree, *Spathodea campanulata* P. Beauv. (Bignoniaceae), for which researchers and environmental managers have introduced agents into the Pacific Islands (Paterson et al. 2017), could be an instructive example. While the questions relating to examples of biological control in Africa may have been poorly framed, resulting in answers that suggest restricted knowledge, it is apparent that increased awareness and understanding of the science of biological control is required amongst not only the focal points for ABS but for all environment managers across Africa.

We believe that Cock et al. (2010) concluded prematurely that the proposed ABS regulations would restrict access to natural enemies for biological control. Current hindrances to researchers' access to natural enemies from Africa include:

- Poor understanding of biological control amongst government officials responsible for management of environmental and agricultural regulations,
- Insufficient capacity to implement processes that allow access,
- Rapid turnover of capacity within the focal points resulting in loss of continuity, and
- Enforcement of regulations that are not designed for this purpose or absence of adequate regulations promulgated into law.

Researchers should further develop the approach of Smith et al. (2018) with African partners and deliver these in a way that the benefits of sharing natural enemies for biological control of invasive plants and agricultural pests are overt but not onerous on the researchers and unrealistic. Smith et al. (2018)

highlights common factors that have led to success in accessing genetic resources:

- Obey the law, by performing “due diligence regarding ABS”,
- Work with in-country partners, who will assist in understanding the law,
- Deposit samples of natural enemies and target plants at in-country repositories,
- Deliver “Centre for Agriculture and Bioscience International (CABI)” benefits (if commercial benefits arise “negotiate new use and agree terms on benefit”), and
- Transparent implementation of best practices.

This approach would involve working with countries to establish and endorse best practices. We as researchers and practitioners of biological control have begun the process of working with ABS focal points. We plan to continue this work to review the existing policies and practices that countries have developed, to share these with focal points across Africa and work with countries to develop clearly understood and easy to implement policies and practices that support benefits from and access to genetic resources for biological control. The onus is on research organisations to work with focal points to support their roles in implementing the Nagoya Protocol.

The survey demonstrates that several African states are in the process of developing or testing appropriate policies and practices for ABS. The biological control community needs to foster and nurture these efforts. A suggested approach would be to use actual biological control projects as case studies from which all countries across the continent can learn.

We recommend that the International Organisation for Biological Control work with African countries to share information, develop policies and practices, and demonstrate best approaches through several case studies undertaken in Africa. This survey has demonstrated the interest of African countries to develop and implement appropriate policies that support ABS. Researchers must now work together with the focal points to support this interest.

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Author contributions All authors contributed to the study conception and design. PJI and SNKV prepared the questionnaires undertook the data collection and analysis. PJI wrote the first draft of the manuscript and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflict of interest The authors declare that there is not conflict of interest.

Informed consent The opening questions of the survey enabled respondents to give prior informed consent. See supplementary information in the paper.

Research involving human and/or animals participants This work involved requesting information from government institutions, not personal information from individuals. This is similar to requesting a fellow scientist for their latest paper, as we are asking a designated official for official government policies and processes on the Nagoya Protocol in their country.

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