DISCUSSION PAPER

Uses, Benefits, Tracking and Trade-offs — A Botanical Collections Perspective

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Fair and equitable benefit-sharing is a central objective of the CBD and of the International Regime. But with so many sectors seeking access to genetic resources for such a wide variety of potential uses, which in turn may generate many different kinds of benefit, the terms 'benefit sharing' and 'benefits' end up being used in policy discussions as abstract notions. To some these terms represent the whole range of potential monetary and non-monetary returns, while to others they may signify commercially-oriented IPRs, milestone payments and royalties.

Another term that needs closer examination is 'tracking' in relation to genetic resources, especially when considering the practicality and feasibility of certificates of origin/source/legal provenance. As well as considering the type of material to be tracked (e.g. individual specimens, batches, genes, MTAs or other entities), it is very important to be clear about what processes people are proposing to track: transfer? use? benefits? It would be extremely premature to consider tracking individual specimen uses or benefits in the future, and the perceived advantages of doing so rely on an underlying assumption that particular benefits arise directly from the use of particular specimens. It is crucial that we consider possible impacts on conservation and basic research of additional detailed tracking which diverts resources from collaborative work and the delivery of benefits.

To ensure that benefits continue to be created in the first place, and to maximise their utility for conservation and sustainable use, we need to think very practically about how collections work with genetic resources, and what results they produce.

On this note, I wish to provide some examples of benefits that are actually generated by basic research on non-profit botanical collections such as herbaria, DNA banks and living collections, and to explain how they may be shared. I also wish to dispel any idea that individual specimen use and benefit-sharing are frequently coupled. Further, I wish to argue that detailed tracking of specimen use and benefits is extremely resource-intensive, with insufficient benefits to outweigh transaction costs. For non-commercial research, for which the vast majority of specimens are collected, such tracking would be counter-productive to the CBD's objectives, as it would necessitate the reallocation of resources needed for use and consequent benefit-sharing.

The CBD refers to the sharing of benefits arising out of the utilisation of genetic resources. In some cases, it is clear that certain uses of particular specimens may generate benefits – interesting compounds or structures may be elucidated, or an attractive plant may be selected for horticultural development. However, I would argue that for most non-profit scientific collections, significant benefits are usually produced in more diffuse ways.

[1] The views expressed in this paper are those of the author and do not necessarily represent those of the Royal Botanic Gardens, Kew.

Many important benefits (including some set out as examples in the Bonn Guidelines) arise at the **access** stage, rather than through the actual use of particular genetic resources. Capacity-building benefits generally do not come about directly from use, but instead from **institutional services** such as provision of higher education or training programmes which are based on a broad range of collections. Perhaps the most significant benefits for conservation arise out of the **broad and comparative use** of global and regional collections.

Examples of benefits linked with access include monetary ones such as permit fees, but also a whole range of more non-monetary benefits arising from partnership activities. The process of negotiating mutually agreed terms for access and use can provide a chance for partners to identify national and institutional needs and priorities. Finding funding for fieldwork is often a problem for host country institutions, and joint field trips are valuable opportunities not just for enriching in-country collections (it is standard practice for the top set of herbarium specimens to remain in a host country collection, unless otherwise agreed), but for exchanging skills and expertise and for professional networking. There may also be training courses, workshops or other knowledge-sharing opportunities offered in association with joint fieldwork.

The biological collections sector can often provide a wide range of other capacity-building activities, few of which arise from the direct use of particular genetic resources. Staff exchange programmes provide simple but effective opportunities for transfer of skills and know-how. Some institutions have strong educational programmes, and may be able to offer places on in-house courses, or degree supervision. Many of these activities help overcome acknowledged barriers to the implementation of the Convention.

The extent to which these types of access- and education-related 'benefits' can be offered depends on the capacities (expertise, facilities, funding) of the collaborating partners – providers and initial users. We should not expect further users of genetic resources down the chain to share the same benefits with providers, if any scheme to track MTA terms is developed.

But how are specimens themselves actually used back at a museum or herbarium? They are made available to, and examined by, a range of resident and visiting experts, who assign taxonomic names, and these names are sent back to partners in the country of origin to be affixed to the top set(s) (it is vital that collections are well-named, or they have no use). Specimens are filed first by taxonomic affinity (not by country of origin or MTA), and are consulted (i.e. looked at, measured, compared) and in some cases sampled (for characteristic pollen, structures, DNA or other compounds). It should be noted though that many years, even decades, may pass before any single specimen is examined again after its initial collection and identification – this depends on the research interests of present and future staff, visitors, and scientists from elsewhere who request loans or samples of material. Increasingly, but depending entirely on available staff resources and funding, herbarium specimens may be scanned or photographed, and images may be made available in the form of a 'virtual herbarium', and label information may be databased (bearing in mind that some label data may be more sensitive and not suitable for wider dissemination).

Typical research outputs arising from these collections include floras (which pull together and describe all plant species in a given region) and systematic revisions (which explore evolutionary and taxonomic relationships within and between groups). These are important information sources that in turn are used to create useful secondary products such as interactive identification keys, field guides and Red Data Lists.[2] There is a growing range of conservation-focused uses for global and regional collection data. Using GIS technology, location and phenological (time of fruiting/flowering etc.) data gathered from labels can be used to create distribution maps for conservation assessments,[3] vegetation maps for land management,[4] guides to enable efficient location of target species for conservation, and analyses of ecological change over time.[5] Phylogenetic studies can guide efforts to conserve areas with high genetic diversity. Virtual herbaria can be linked to initiatives such as the Global Biodiversity Information Facility, enabling further study by conservation practitioners worldwide.

Projects such as these involve data collection from hundreds or thousands of specimens, which may make some potential scientific benefits, such as co-authorship, impractical below a certain level of basic collaboration and acquaintance. They involve limited use of 'genetic' characteristics – DNA sequences are used to uncover relationships but cannot create new organisms or products. Digitised information (images and data) and conservation tools can be shared with institutions in countries of origin, and all of this research is increasingly initiated and carried out in close collaboration between provider and user country institutions.

Institutions vary in the extent to which they are currently able to track the transfer and use of individual specimens. All institutions can determine where most of their specimens were acquired (though historic specimens may pose problems), and the majority have systems to record where they have sent material (though not necessarily at the level of individual specimens). Some may be in a position to record certain uses (such as sampling of living or preserved specimens), while other uses, such as simple consultation, are currently unlikely to be tracked by any institution. There is increasing use of Material Transfer Agreements as awareness of the CBD has risen, and institutions using MTAs can store these, refer to them, and link their terms to specimens using available systems. However, detailed tracking at the level of individual specimens involves far greater curatorial, administrative and IT investment, and funds for such system change are difficult to find. Though it is important to continue to improve record-keeping, a high priority should be given to continue efforts to raise institutional awareness worldwide and to the development of standard implementation tools such as clear policies, MTAs, and staff training and guidance.

I hope it is clear that there is rarely any point in expecting major economic returns from any one specimen in such a collection. Instead, most benefits arise from long-term partnerships, improved networks and communication, generation and dissemination of conservation tools, and raised awareness of all the responsibilities that come with working on global biological material. When resources are limited it is better to create a strong collaborative framework for research and capacity-building, within which providers are kept involved and informed, rather than construct a resource-intensive administrative system unlikely to provide real benefits, commercial or otherwise.

[2] Golding, J.S. (ed.), 2002. *Southern African Plant Red Data List*. Southern African Botanical Diversity Network Report Series, No. 14. pp. 135-156. National Botanical Institute, Pretoria, South Africa.

[3] Willis, F., Moat, J., and Paton, A., 2003. *Defining a role for herbarium data in Red List assessments: a case study of Plectranthus from eastern and southern Africa*. Biodiversity and Conservation. 12:1537-1552

[4] Du Puy, D., and Moat, J., 1998. *Vegetation mapping and classification in Madagascar (using GIS): implications and recommendations for the conservation of biodiversity.* Pp 97-117 in: C. R. Huxley, J. M. Lock, and D. F. Cutler (Eds). Chorology, Taxonomy and Ecology of the Floras of Africa and Madagascar. Royal Botanic Gardens, Kew.

[5] www.kew.org/gis/projects/mad_veg/index.html