A data standard to integrate farmers' knowledge and science

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Abstract

Bioversity International and its partners have developed descriptors to provide a standard format for the gathering, storage, and exchange of farmers' knowledge about plants. The descriptors document key characteristics, uses and (cultural) values of cultivated and wild plants as described by farmers and other people in farming communities and are designed to complement the agro-morphological and agronomic data gathered with more conventional descriptors developed by Bioversity and the International Union for the Protection of New Varieties of Plants (UPOV). The novelty, and challenge, of this effort lies in its attempt to combine a documentation system used in controlled environments (genebanks, breeding institutes) with an approach that involves people and their knowledge 'in the field'. Although the descriptor list is primarily targeted at the plant genetic resources community, its goal is to create a lingua franca among farmers and scientists that enables the documentation and sharing of information and the integration of biological and traditional knowledge. Expected benefits of this tool include uniformity and consistency of documentation, increased visibility and use of farmers' knowledge in plant genetic diversity conservation, and a better ability of scientists and farming communities to work across geographic and knowledge boundaries.

Introduction

Farmers worldwide are faced with growing demands to increase crop productivity and develop varieties that are better adapted to challenges posed by changing environments. With global climatic and socio-economic changes altering the growing conditions of plants, pushing them beyond geographical and cultural boundaries, farmers and breeders, in order to meet these challenges, need access not only to a large diversity of plant genetic resources, but also to the knowledge that will allow them to use and adapt these plants to new environments. This knowledge, which incorporates both 'practical' facts about growing conditions and specific traits and more 'subjective' information about, for example, the health and cultural values of plants, is crucial to the dissemination, adoption, and acculturation of crop varieties, but often neglected in mainstream research and development initiatives.

Farmers' knowledge about the plants cultivated on fields and in orchards, and gathered in their surrounding environments represents, together with the (genetic) diversity of these plants, an indispensable asset to the continued viability of smallholder farming systems and to agriculture in general. This rich body of knowledge, which encompasses culture, medicine, economics, agronomy and more, is as important as a scientist's ability to revitalize cryogenically preserved plant material or isolate desirable traits in important crops. But while the two bodies of knowledge are mostly complementary, their holders very often speak different languages and have trouble understanding each other.

Bioversity International and its partners have developed farmers' descriptors to provide a standard format for the gathering, storage, and exchange of farmers' knowledge of plants and their characteristics (Bioversity and TCF, 2009). It aims to document key traits, as described by farmers and other people in farming communities. Wild and weedy plants are covered by this standard since they play a significant role in farming communities, being useful from a socio-economic and ecological standpoint. The succeeding sections explain the need for such a set of standards to address current lacunae in the area of

standards for describing, characterizing, and sharing farmer knowledge, and the benefits of creating an internationally used common set of descriptors for the conservation and increased use of farmers' knowledge.

The need for farmer descriptors

Economic and environmental factors cause many farmers to leave their communities and migrate to cities. The traditional knowledge they hold, about the characteristics, uses and values of cultivated and wild species of plants is often not transmitted to younger generations and risks being lost in this process. The value of this information is increasing, as the interest in multiple plant uses, crop adaptation, new foods and nutritional properties, particularly of neglected and underutilized species, continues to grow. These are fields of knowledge in which farmers are important contributors and users. Farmer knowledge is gaining a prominent place in the research carried out by universities and international institutions, including Bioversity, and helps shape future research and development activities.

But farmer knowledge is anecdotal and scattered. Many communities, scientists, NGOs and research organizations have documented their knowledge, but always in different formats, using different information systems that were often developed according to the specific needs of projects, organizations, or countries and are rarely, if ever, connected to each other. Apart from having a disempowering effect on farming communities (knowledge is rarely returned to farmers in a useful form), this means that breeders and especially farmers, for whom access to planting material from seed banks is already difficult, are prevented from effectively identifying desired traits in plant samples held in genebanks around the world.

Scientists and farmers often work with the same crop or wild species, using different terms. Given the recognition of the interdependence of the two knowledge systems, there is a need to standardize farmers' methods of describing characteristics, traits, or cultural values so that the information can be reviewed and compared from different sources. There are many cases where different people measure or record the same characteristic of the same plant in different ways, giving different values for the same traits. This does not mean that one system of knowledge is false or inaccurate and that local perception and units of classification need to be overridden. Rather, a way of 'translating' these observations into more standardized terms so that they can be understood by other farmers and scientists is needed.
Much local plant genetic diversity has global use and value, which can be further enhanced by knowledge of traits and uses of the same species in other environments, a global standard is of immediate value to both genetic resource conservation science and farmers. The new descriptors would thus promote collaboration among scientists and farmers working in different countries. The internationally agreed format and a user friendly language, particularly regarding the description of traditional knowledge about plants, their uses, socio-economic aspects and distinguishing traits is directly linked to existing and accepted descriptors of accession identifying data (called 'passport data') used in genebank collections and can be linked to other global crop information platforms.

Current frameworks for crop descriptors

Bioversity is recognized as a leader in the development of international standards for the documentation of plant genetic resources. Since 1977, almost 100 descriptor lists were produced for a variety of major food crops in a number of languages. Bioversity acts as a facilitator of wide consultations with international crop experts, national and international research organizations and crop networks. Its work is recognized under the International Treaty for Plant Genetic Resources for Food and Agriculture and includes the FAO/IPGRI List of Multi-crop Passport Descriptors (MCPD) and the List of Descriptors for Genetic Marker Technologies. All descriptors and derived standards have been produced in partnership

with other CGIAR[1] centers (i.e. CIP, CIAT, IRRI, ICARDA, ICRISAT and IITA), ECPGR[2] Crop Networks, Tropical Fruits Networks and/or National and International Organizations (i.e. UPOV, The International Organization for Vitis; The Asian Vegetable Research Organization).

Regarding data standards for the documentation of farmers' knowledge, only few initiatives exist. One approach to farmer documentation of crop and livestock diversity, including useful species in the wild, is the Community Bioversity Registers. Pioneered in Asia and Latin America they have been recognized as an important way to document and protect local rights and continued use of plant genetic resources (UNDP 2005). They list plant varieties, animal breeds and species as well as local sources of knowledge and expertise. Many important indigenous biodiversity NGOS such as LI-BIRD[3] Nepal, ANDES[4] in Peru have been effectively linking local Community Biodiversity Registers with national and international collections and data on plant genetic resources. However, this has also highlighted the need for a more standardized set of descriptors of farmer knowledge to facilitate the exchange and comparison of information and data across countries and between communities and genebanks. Other examples of attempts to systematize farmers' characterization of crop diversity include the *Training Guide for In Situ Conservation On-farm* (Jarvis et al., 2000), a minimum set of questions developed to understand the abundance and distribution of landraces and the processes maintaining them. Lastly, an initiative of the University of Perugia, Italy, in collaboration with the Romanian Plant Resources Genebank (Suceava, Romania) produced the 'Minimum descriptors list for the documentation of on-farm conservation and management activities' for European countries. These initiatives where done specifically in the context of projects and related to the communities and crops that were covered in those projects.

Impact of this standard

Since its web publication in May 2009, the Descriptors for farmers' knowledge about plants has seen a large spread and uptake by various partners. Beside through the Bioversity website and the Platform for Agrobiodiversity Research, the list has been distributed through a wide variety of networks and organizations such as the ECPGR, *Der Verein zur Erhaltung der Nutzpflanzenvielfalt* (German NGO for the Conservation of Crop Diversity), The international website for Farmers rights (Norway), the *Ethnobiology of Europe Research Network* (United Kingdom), the *Beythe István Pannon Society for Traditional Knowledge on Nature* (Hungary), and the *Piano Nazionale Biodiversità* (Italy).

The tool was received with thanks by a large number of scientists, some inside and many outside of Bioversity, but also a number of small NGOs working with farming communities. It is currently being used and field-tested by a group of farmer communities around Shimla, India, by scientists in Kyrgyzstan, Tajikistan, Afghanistan, Malaysia, Thailand and Indonesia, and will be used in a four-country Bioversity project on tropical fruit tree diversity funded by UNEP-GEF. Particularly in traditionally more conventional research environment such as Tajikistan, Afghanistan and Kyrgyzstan, the tool has enabled scientists to see and use 'soft' data (e.g., cultural values) as valid and valuable scientific information, contributing to a gradual shift in the mentality of these researchers.

Some of the intended future benefits of the use of this standard can be summarized as: increased uniformity of documentation, increased visibility of farmers' work and scientific validity of farmers' knowledge; increased ability to work across geographic and knowledge boundaries; a strong contribution to the development of databases and a common platform for the sharing of farmers' knowledge.

[1] The Consultative Group on International Agricultural Research
[2] The European Cooperative Programme for Plant Genetic Resources
[3] Local Initiatives for Biodiversity, Research and Development
[4] Associación para la Naturaleza y el Desarollo Sostenible

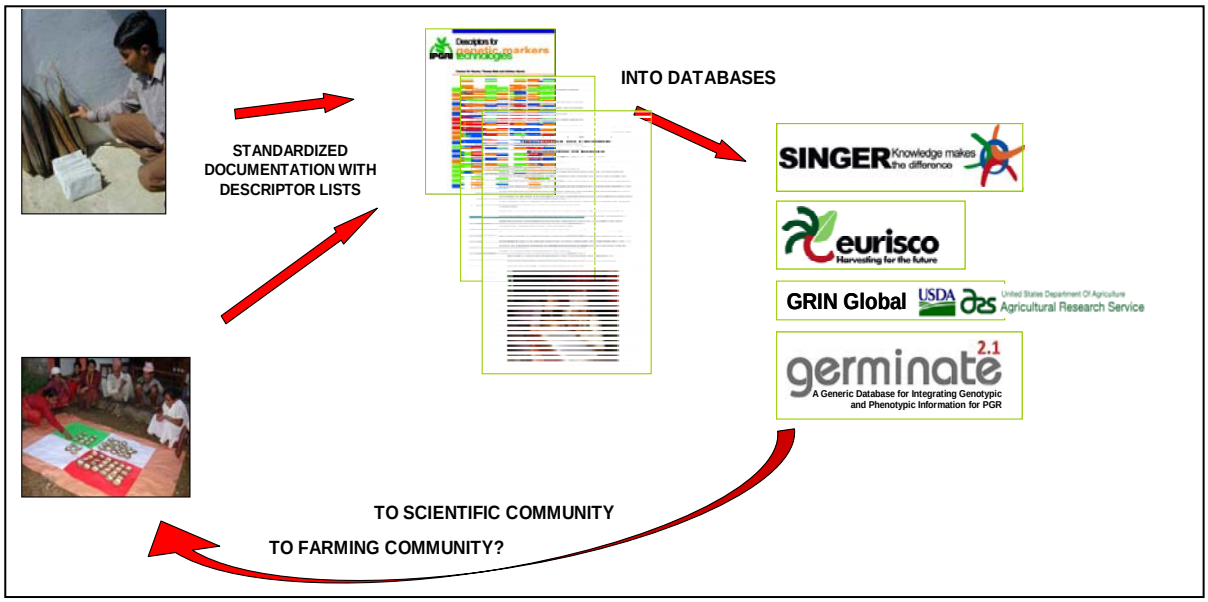

Fig. 1. The link between farmers' knowledge, descriptors and knowledge sharing.

Challenges in using farmer descriptors

Initial responses from users and reviewers of the descriptor list point at four distinct challenges to its more widespread use:

1. While **the tool is designed specifically to be used by both scientists and farmers**, it has proven to be too elaborate for use by farmers without assistance. Data collection takes a significant amount of time and requires a basic level of scientific knowledge and training. A problem raised, for example was the identification of individual landraces: in order for collected data to be useful across sites and countries, consistency in documentation, including variety names, is essential. Many farmers, however, may not be aware of common names attributed to such varieties and may refer to them by using numbers or their own names. A community near Shimla, India, that was interested in using the descriptor list resolved the problem by appointing one community member as leader, who then received training from a nearby research organization.
2. Common to any type of research involving farmers and communities, the challenge of **returning information**, in such a way that it can be useful, remains. While the code of ethics included in the descriptor list (see point 4, below) strongly encourages this practice, it ultimately depends on the motivation and willingness of scientists whether it is put into practice.
3. A **central documentation system** is crucial to the effective sharing of knowledge between farming communities and scientists in different parts of the world. Much work remains to be done to ensure consistent data cleaning and input (given also the different languages of data collected) and the linking of this information to existing data management tools.
4. Just as seeds and genes, farmer knowledge can be and has been appropriated for commercial purposes without consent from the holders of that knowledge. The descriptor list includes a brief statement on **intellectual property rights**, to be discussed between researchers and communities when the list is used for research purposes:

   > *The people or communities participating in this research declare their willingness to share their knowledge provided that they are recognized as the source of the information and that this knowledge remains freely available for their use.*

   Furthermore, researchers are strongly encouraged to adhere to the more comprehensive Code of Ethics of the International Society of Ethnobiology (available at http://ise.arts.ubc.ca/global_coalition/ethics.php).

Notwithstanding the possibility of abuse, inherent in any research methodology, we consider the descriptor list rather as a tool that can assist farmers in protecting their knowledge from wrongful appropriation: documenting knowledge and linking it to communities and territories makes it difficult for external commercial interests to claim ownership over it.

Conclusion

With this effort to produce a standardized method for the documentation of farmers' knowledge about cultivated and wild plants, Bioversity aims to stimulate the use and underline the importance of this knowledge. The widespread adoption of this descriptor list could contribute greatly to plant genetic resource conservation and use. By documenting and making available information not traditionally captured in *ex situ* conservation practices, it can help farming communities in adopting, adapting and acculturating crop varieties and assist scientists in using germplasm in a more effective way.

The rapid growth in the use of this standard warrants increased efforts in joining local and regional networks of information sharing into a global portal that would facilitate the worldwide access to farmers' knowledge about crop varieties. Such an initiative would have the potential to significantly contribute to the implementation of the International Treaty on Plant Genetic Resources for Food and

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