



**Food and Agriculture  
Organization of the  
United Nations**



**The International Treaty**  
**ON PLANT GENETIC RESOURCES  
FOR FOOD AND AGRICULTURE**

## **Item 10 of the Provisional Agenda**

### **EIGHTH SESSION OF THE GOVERNING BODY**

**Rome, 11–16 November 2019**

### **Report of the DivSeek Initiative**

#### **Executive Summary**

This document contains the report from the DivSeek Initiative, in response to the invitation by the Governing Body through Resolution 5/2017. It will be recalled that the DivSeek Initiative submitted to the Seventh Session of the Governing Body, a report on the implications for the objectives of the International Treaty of the technologies underlying the DivSeek Initiative.<sup>1</sup>

This report contains an update on recent developments regarding the Initiative and on its current activities. It explains that DivSeek is not itself a research organization, nor does it fund or sponsor research activities. It also states that the role of DivSeek is to facilitate interactions amongst its members and observers via participation in Working Groups and at the annual Roundtable, where Members share updates about their research with other Members and Observers.

Finally, it reports that the DivSeek Task Force is preparing views and other information on ‘Digital Sequence Information’, in response to the general invitation of the Governing Body to be submitted prior to the Eighth Session.

<sup>1</sup> Document IT/GB-7/17/15, available at: <http://www.fao.org/3/a-mt955e.pdf>

*This document can be accessed using the Quick Response Code on this page;  
an FAO initiative to minimize its environmental impact and promote greener communications.  
Other documents can be consulted at [http://www.fao.org/plant-treaty/meetings/meetings-  
detail/en/c/1111365/](http://www.fao.org/plant-treaty/meetings/meetings-detail/en/c/1111365/)*





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Dear Dr. Nnadozie,

I am writing on behalf of the DivSeek International Network (DivSeek) to report on the development and activities of DivSeek for the biennium 2018-19. This report is intended as DivSeek's response to the invitation issued to DivSeek by the Governing Body at its Seventh Session. See Resolution 5/2017, paragraph 6; available at: <http://www.fao.org/3/a-mv103e.pdf>.

We note that in 2017, DivSeek submitted a report to the Treaty in response to a request for information on the "implications for the objectives of the Treaty of the technologies underlying the DivSeek initiative." A copy of that report is attached here as Appendix 1.

I am pleased to report that during the 2018-2019 biennium DivSeek has continued to move forward and develop as an organization. We outline several significant developments below.

## **1. Development of DivSeek**

DivSeek is a global, community-driven initiative that aims to harness the genetic potential of crop diversity using science and technology. DivSeek facilitates networking, sharing of community standards and best practices in order to enable breeders and researchers to mobilize plant genetic variation to accelerate the rate of crop improvement and furnish food and agricultural products to the growing human population. DivSeek has 67 Member institutions representing 28 countries, as well as 4 Observers who participate in DivSeek meetings but do not have voting rights in the organization (<http://www.divseek.org/partners>).

In 2015, DivSeek was established as an informal association of partner organizations with a Charter and a Steering Committee. The organization continued to exist in this informal state until 2018, when DivSeek became a legal entity by incorporating as a not-for-profit corporation under Canadian Law. As a part of this incorporation process, the DivSeek Steering Committee agreed to serve as a Board of Directors for fixed terms. In 2019, DivSeek established a Secretariat in Saskatoon, Saskatchewan (Canada), hosted by the University of Saskatchewan and the Global Institute for Food Security (GIFS). DivSeek is currently funded by Genome Canada, Genome Prairie and GIFS, and is in the process of hiring its first full-time Managing Director.

As a legal entity, DivSeek is now in a position to establish a Memorandum of Understanding (MOU) with the Treaty Secretariat. The MOU would facilitate cooperation between the Treaty Secretariat and DivSeek in areas of mutual interest. A draft MOU has been prepared, and is being circulated among DivSeek partners and within the Treaty at this time. Comments and suggestions will be discussed and incorporated prior to finalization.

One of DivSeek's priorities for 2019-2020 is to initiate the establishment of "DivSeek Regional Hubs" to support networking amongst scientific researchers around the world.

## **2. Activities of DivSeek**

DivSeek is not itself a research organization, nor does it fund or sponsor research activities. The role of DivSeek is to facilitate interactions amongst its members and observers via participation in Working Groups and at the annual Roundtable, where Members share updates about their research with other Members and Observers.

DivSeek's Working Groups are designed to actively engage Members in addressing issues of interest. The Working Groups established by DivSeek are currently focused on:

- Data Standards for Interoperable Tools, FAIR Data
- Genebank Information Management System(s)
- Genomics for Genebanks
- Phenotyping for Seed Diversity
- Semantics for Harmonizing Trait and Agronomic Data
- Translational Approaches for Minor and Underutilized Crops

The DivSeek Working Groups are in their early stage and have not yet produced reports or recommendations.

DivSeek held Roundtable meetings in January 2018 and January 2019 during the Plant and Animal Genomics Conference held in San Diego, California. Both of these meetings were well attended by Members and Observers and featured a series of brief research updates shared by Members. The January 2019 DivSeek Roundtable also included presentations from Treaty representatives, Daniele Manzella, entitled, "Policy Developments in the Treaty relevant to DivSeek, and Marco Marsela, entitled "Implementation of the Global Information System (GLIS)."

We note that Members publish independently on research that is pertinent to DivSeeks' mission and goals. In this context, we highlight the following recent publications which are attached to this report:

- Mascher, M. et al., Genebank genomics bridges the gap between the conservation of crop diversity and plant breeding, *Nature Genetics* **51: 1076–1081 (2019)**.
- Marden, E., International agreements may impact genomic technologies, *Nature Plants* **4: 2-4 (2018)**.
- Halewood, M., T. Chiurugwi, R. Sackville Hamilton, B. Kurtz, E. Marden, E. Welch, F. Michiels, J. Mozafari, M. Sabran, N. Patron, P. Kersey, R. Bastow, S. Dorius, S. Dias, S. McCouch and W. Powell. Plant genetic resources for food and agriculture: opportunities and challenges emerging from the science and information technology revolution. *New Phytol* **217(4): 1407-1419 (2018)**.

DivSeek Members are also engaged in policy discussions on digital sequence information (DSI) taking place in the context of the Treaty and the Convention on Biological Diversity. Several members of the DivSeek Board of Directors attended the Convention on Biological Diversity Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in Montreal in July 2018. In addition, a DivSeek delegation will be in attendance at the Treaty Governing Body meeting in Rome later this year.

Finally, a DivSeek Task Force is preparing a response to the Treaty's "Invitation to submit views and other information on 'Digital Sequence Information.'" This response will be submitted prior to the Governing Body meeting.

DivSeek looks forward to working productively with the Treaty during the next biennium.

Sincerely,



Susan R. McCouch  
Chair, DivSeek Board of Directors



# The implications for the objectives of the Treaty of the technologies underlying the DivSeek initiative

A report by DivSeek stakeholders to the Secretary of the International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty)<sup>1</sup>

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## Summary and conclusions

The technologies underlying DivSeek<sup>2</sup> have the potential to bring major benefits for the objectives of the Treaty. They have the power to transform our ability to better conserve Plant Genetic Resources for Food and Agriculture (PGRFA) and our ability to more sustainably use PGRFA. They can bring major enhancements to the fair and equitable sharing of benefits. In addition, by participating in the use of Digital Object Identifiers (DOIs) for Plant Genetic Resources (PGR), the information systems developed by DivSeek partners can contribute to the Global Information System, a key supporting component of the Treaty.

## Background to DivSeek

DivSeek is a research community-driven effort that aims to apply digital data and information to unlock the potential of crop diversity around the globe for food and nutritional security, and to work with other stakeholders to contribute positively to the social and economic well-being of individuals, communities, and societies. The mission of DivSeek is to bridge the information requirements of genebank curators, plant breeders, farmers and upstream biological researchers to facilitate the use of plant genetic

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<sup>1</sup> This report is being submitted in response to an invitation issued by the Secretary of the Treaty “to report on the implications for the objectives of the Treaty of the technologies underlying the DivSeek initiative,” in compliance with resolution 3/2015 para 6 of the Governing Body of the Treaty. The first draft of the report draws heavily on the discussions at the meeting “Plant genetic resources and the Sustainable Development Goals: needs, rights and opportunities”, funded by the Rockefeller Foundation 28 November – 2 December 2016, which brought together a small number of participants with very divergent perspectives and expertise, including stakeholders with no direct association with DivSeek. Further inputs were sought from DivSeek Partners and other participants at and after the DivSeek roundtable meeting in San Diego California 13 January 2017. Numerous partners provided input over several iterations, resulting in extensive revisions. The report was finalised by members of the DivSeek Steering Committee in consultation with all those that provide input and does not necessarily reflect the views of all contributors to the discussion or drafting.

<sup>2</sup> The technologies referred to here are those used by DivSeek partners and the wider research community to organize and disseminate digital data and information about PGRFA in a user-friendly way.

resources for accelerated crop improvement, thus contributing to the global effort to enhance farmers' ability to provide food and agricultural products for a growing human population.

DivSeek aims to collaboratively establish a worldwide community of practice that defines standards regarding the acquisition, storage, retrieval and analysis of digital data related to plant genetic resources. These data may comprise digital data from various disciplines. At this stage, the types of data and information envisioned would include DNA sequence and methylation, phenotypic characterization and variety identification, agronomic /ecological adaptation and value for cultivation and use (phenotypic information is used here in its broadest sense, including biochemical, physiological and anatomical as well as morphological information, gene expression and transcriptomics, metabolomics, proteomics, and phenomics). The scope of digital data may evolve as DivSeek gains momentum. DivSeek will assist the community to integrate and cross-reference data from diverse projects and disciplines, make information broadly available, and make data access more user-friendly.

As a community of practice, DivSeek does not sequence genomes, manage germplasm collections, construct databases or store any data. Rather, these activities are undertaken by DivSeek partners who independently acquire project funding. Under the umbrella of DivSeek, partners form Working Groups to bring together a broad range of expertise and experience via the projects in which they are involved. The Working Groups are the primary mechanism by which DivSeek partners actively advance the mission and aims of DivSeek. The goal of the Working Groups is to increase the efficiency and impact of projects undertaken by DivSeek partners, limit redundancy of effort, enhance the potential for data integration and interoperability, and ensure appropriate association of digital data with plant germplasm.

## **The objectives of the Treaty**

The Treaty has three objectives as defined in Article 1.1:

- (1) the conservation of PGRFA;
- (2) the sustainable use of PGRFA;
- (3) the fair and equitable sharing of the benefits arising out of [the use of PGRFA], in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security.

This report considers the implications of the technologies underlying DivSeek for these objectives, as elaborated in relevant articles of the Treaty, namely:

- (1) Article 5 defines the obligations of Contracting Parties to promote, subject to national legislation, an integrated approach to the exploration, conservation, and sustainable use of PGRFA. Article 5.1 calls for six specific activities in this area, and article 5.2 calls for steps to minimize or eliminate threats to PGRFA.

- (2) Article 6 defines the obligations of Contracting Parties to develop and maintain appropriate measures that promote the sustainable use of PGRFA, including seven suggested measures outlined in article 6.2.
- (3) Article 13 defines the provisions for benefit-sharing in the Multilateral System of the Treaty, through five modalities specified in Articles 13.1 and 13.2. Article 13.3 specifies that benefits “should flow primarily, directly and indirectly, to farmers in all countries, especially in developing countries, and countries with economies in transition, who conserve and sustainably utilize PGRFA.”

## Implications for the conservation of PGRFA

One major challenge for safeguarding the diversity of PGRFA is to quantify that diversity. As conventionally defined and measured, diversity is comprised of three dimensions: (1) the number of entities (species, varieties, etc.) (2) the evenness of their representation and (3) the distinctness between entities. Modern varieties, particularly those protected by plant breeders’ rights, are typically subjected to “DUS” tests to demonstrate that they are Distinct from all other varieties, genetically Uniform within and between samples, genetically Stable from generation to generation, and that they are named uniquely. Hence one modern cultivar corresponds to one genetic entity (within limits determined by the breeding and propagating system of the species), and the cultivar name thus serves as the basis for assessing all components of diversity.

Traditional varieties, on the other hand, are by their very nature genetically variable within and between samples and from year to year. This is an essential element of their adaptability. Moreover, there is generally no regulatory system governing the names of traditional varieties. Thus, the same genetic entity can be assigned different names (synonyms) by different communities, and different genetic entities can be assigned the same name (homonyms), making it difficult to measure the diversity of traditional varieties, based on such local names. Many attempts have been made to design meaningful indicators but, to date, it has been difficult to quantify diversity in any reliable way without further knowledge of the genetic makeup of these materials. If we cannot quantify the diversity existing *in situ* and the diversity conserved *ex situ*, we cannot quantify gaps or risks to conservation or set priorities objectively. This information gap is something DivSeek is keen to address.

The technologies utilized by DivSeek partners and the wider research community make it possible, for the first time, to quantify genetic diversity objectively and fully in terms of DNA sequence diversity. We can identify the genes in a crop gene pool, in all their variants and organization. This will transform our ability to conserve PGRFA rationally, efficiently and effectively, both *in situ* and *ex situ*. Member countries and local and indigenous communities will be able to use these analyses and information to quantify more accurately and holistically the diversity they hold *in situ*, identify diversity that is most at risk and identify which diversity is unique to the country, community, or farmer. Such information will enable stakeholders to partner on developing conservation priorities. Monitoring *in situ* populations at the gene level also allows the study of how populations respond to change of temperature, water,

fertilizer, nutrients, management etc. It will facilitate better dynamic conservation of genetic diversity responding to climate change. Genebanks will be better able to quantify success in conserving diversity *ex situ*, objectively identify gaps and unnecessary duplication, and design cost-effective strategies for conservation. By facilitating the use of this information, DivSeek hopes to bring a quantum leap forward in the ability of the Treaty to address its objective of conserving PGRFA.

## Implications for the sustainable use of PGRFA

One component of sustainable use is to develop improved varieties (including farmer-bred varieties) to address hunger and malnutrition, and adapt agriculture to climate change. This includes broadening the genetic base used in breeding, combining the yield potential of exotic varieties with local varieties adapted to specific environments, as specified in Treaty Article 6. The technologies underlying DivSeek will enable us to develop improved varieties much more rapidly and effectively.

However, developing improved varieties will lead to sustainable use only if appropriately deployed in farming systems that are economically, socially and environmentally sustainable. The goal is not only to produce more and better food but also to ensure that improved agricultural productivity also improves the livelihoods of the poorest farmers and that sufficient volumes of nutritious food reach the poor, hungry, malnourished and needy, through systems that are resilient and adaptable, meeting market needs and responding to emerging challenges and opportunities.

Thus the technologies underlying DivSeek have the potential to greatly enhance the sustainable use of PGRFA, but only if integrated with the many other components of sustainable agriculture.

## Implications for the fair and equitable sharing of the benefits arising out of the use of PGRFA

1. Facilitated access to PGRFA is itself recognized as a major benefit (Article 13.1).

As discussed above, the technologies underlying DivSeek will enable DivSeek partners to contribute to increasing the rate of crop improvement, by helping to identify the genotypes that underpin desirable crop traits. Provided this work is integrated with the broader programme of work on sustainable use, the benefits to farmers in developing countries will be enhanced.

2. Information on PGRFA in the Multilateral System is to be made available through the Global Information (GLIS) System of the Treaty, as provided for in Article 13.2a.

DivSeek is based on and underpinned by the sharing of information on PGRFA and thus directly enhances benefit-sharing through this mechanism. In addition, at the DivSeek Assembly in June 2015, DivSeek partners agreed in principle to promote the system of Digital Object Identifiers (DOIs) being developed within the 6-year programme of work on the GLIS adopted by the Governing Body at its sixth session (GB6 resolution 3/2015). DivSeek's positive contribution to this benefit-sharing mechanism could be enhanced by formalizing the role of DivSeek as contributing to the Treaty's GLIS in a form of a collaborative agreement.

3. Access to and transfer of technology. Contracting Parties undertake to provide and/or facilitate access to technologies for the conservation, characterization and use of PGRFA which are under the multilateral system, as provided for in Article 13.2b.

The technologies underlying DivSeek present new opportunities for access to and transfer of technology. Such activities are undertaken by DivSeek partners as appropriate to their own missions and mandates and in accordance with their funding situation and relationship to the Treaty. There could be an opportunity to promote such technology transfer at the level of the whole DivSeek community.

4. Capacity building, as provided for in Article 13.2c.

Similarly, the technologies underlying DivSeek present new opportunities for capacity building. Such activities are undertaken by DivSeek partners as appropriate to their own missions and mandates and in accordance with their funding situation and relationship to the Treaty. There could be an opportunity to promote such capacity building at the level of the whole DivSeek community.

5. Sharing of monetary and other benefits of commercialization.

Under 13.2(d)(i) Contracting Parties agree to take measures to achieve commercial benefit-sharing through certain means identified in that article. To the extent that the technologies underlying DivSeek enhance, as appropriate, opportunities for generating commercial benefits, these have the potential to expand opportunities for Contracting Parties to enhance commercial benefit-sharing.

Under 13.2(d)(ii), a recipient who commercializes a product that is a PGRFA and that incorporates material accessed from the MLS, shall pay into the Benefit-Sharing Fund an equitable share of the benefits arising from the commercialization of that product, except whenever such a product is available without restriction to others for further research and breeding, in which case the recipient who commercializes shall be encouraged to make such a payment. To the extent that the technologies underlying DivSeek will enhance opportunities for generating such products, additional opportunities for generating monetary benefits that will accrue the Benefit-Sharing Fund might also arise.

DivSeek notes that knowledge acquired from the study of PGRFA is transferable between samples of PGRFA. Such knowledge acquired from the study of a PGRFA sample accessed from the MLS can be applied to develop products that do not incorporate material accessed from the MLS. Such products would not trigger the obligations listed under SMTA article 6.7. DivSeek notes that this applies to all forms of knowledge acquired from the study of PGRFA, not only to knowledge acquired through the technologies underlying DivSeek.