



# The International Treaty

ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE



## INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

### FIRST MEETING OF THE EXPERT CONSULTATION ON THE GLOBAL INFORMATION SYSTEM ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

San Diego, USA, 7-8 January 2015

### The Vision Paper for the Global Information System on Plant Genetic Resources for Food and Agriculture

#### EXECUTIVE SUMMARY

1. *The current document consolidates the information and analysis contained in the documentation for the meeting and proposes a draft vision for the Global Information System on Plant Genetic Resources for Food and Agriculture and a roadmap with operational activities leading to the elaboration of the first Programme of Work requested by the Governing Body in Resolution 10/2013.*

2. *The document also summarizes the main findings of two Surveys conducted in 2014 on the major elements for the Global Information System, and outlines some relevant developments, including in relation to plant genetic resources and genomics and the mainstreaming of agricultural research through genomics.*

3. *The document also expands on the concept and operational framework of interoperability and partnerships, and provides an overview on standards and other normative work, with a particular emphasis on the adoption of permanent unique identifiers. It introduces a number of policy and institutional considerations of relevance to the development of the Programme of Work on the Global Information System.*

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*Appendix 1: Draft Vision for the Global Information System on PGRFA*

*Appendix 2: Draft Roadmap for the Programme of Work on the Global Information System*

*Appendix 3: Draft Terms of References for the Scientific Advisory Committee on the Global Information System of Article 17*

## I. INTRODUCTION

1. An effective Global Information System (GLIS) for plant genetic resources for food and agriculture (PGRFA) is an essential component for completing the overall design and implementation of the Treaty and for reaching its ultimate objectives for food security and sustainable agriculture. It holds the potential for facilitating the rationalization of conservation both in situ and ex situ, and for spurring sustainable utilization. It also opens the desirable perspective of an evolution of the Treaty that will keep the Multilateral System and the other components of the Treaty relevant to users. “Dematerialization” of the use of PGRFA is an increasing trend where the information and knowledge content of genetic material is extracted, processed and exchanged in its own right and with technology-intensive methods, detached from the physical exchange of the plant genetic material.<sup>1</sup> Such dematerialization of the use of PGRFA results in information and knowledge management, rather than access to physical material per se, being a significant source of value. The GLIS becomes an opportunity not only to revamp networking cooperation for gathering and sharing more, and more qualitative, PGRFA information, but also to enhance the usefulness of the Treaty Systems for its users and to implement multilateral governance in the exchange and use of PGRFA-related information.

### Article 17 of the International Treaty and the Global Information System

2. The GLIS is regulated by the International Treaty, under Part V, “Supporting Components”. According to Article 17:

*“Contracting Parties shall cooperate to develop and strengthen a global information system to facilitate the exchange of information, based on existing information systems, on scientific, technical and environmental matters related to plant genetic resources for food and agriculture, with the expectation that such exchange of information will contribute to the sharing of benefits by making information on plant genetic resources for food and agriculture available to all Contracting Parties”.*<sup>2</sup>

3. Other paragraphs of Article 17 deal with early warning about hazards that threaten the efficient maintenance of plant genetic resources for food and agriculture, and cooperation with the Commission on Genetic Resources for Food and Agriculture on the periodic state of the world’s PGRFA to facilitate the updating of the rolling Global Plan of Action.

4. Article 17 offers two elements of guidance for the development of the GLIS. First, it refers to existing information systems, thus envisioning a unified but distributed system of interoperable databases that contain scientific, technical and environmental information related to PGRFA. Accordingly, avoiding duplication of efforts becomes a priority of GLIS. Second, it introduces the benefit-sharing dimension, with the natural link to information exchange as a form of non-monetary benefit-sharing under the Multilateral System of Access and Benefit-Sharing (MLS). The need for international cooperation to generate and share information on plant germplasm and to promote the availability and utilization of such information is an essential complementary narrative to the core mechanisms of the Multilateral System for the transfer of the underlying genetic resources, which are embedded with the Standard Material Transfer Agreement (SMTA).

### The Process

5. The Governing Body started considering the GLIS at its Third Session in 2009. It requested the Secretary to collaborate with FAO and other relevant stakeholders to facilitate their contribution to the continuous development of GLIS in order to promote greater access to relevant information and information systems by Contracting Parties and other relevant stakeholders. It requested the

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<sup>1</sup> See, Appendix I.2, “Report of the Secretary”, *Report of the Fifth Session of the Governing Body of the International Treaty*, 2013, p.4-6

<sup>2</sup> Article 17.1, *International Treaty on Plant Genetic Resources for Food and Agriculture* (2001)

Secretariat to develop a vision paper to take stock of existing information systems and outline a process for the development of GLIS.

6. At its Fourth Session in 2011, the Governing Body reviewed a synthesis of some of the major information systems on PGRFA and determined the need to set up a consultation process for the effective development of GLIS. It called for cooperation with the Clearing House Mechanism of the Convention on Biological Diversity.

7. At its Fifth Session in 2013, the Governing Body called for an expert consultation (COGIS) in order to:

- (i) facilitate the assessment of needs and advise the Secretary on the identification of activities and priorities for information exchange;
- (ii) conduct a review of major ongoing initiatives, projects and programmes at national, regional and international levels of relevance for the development of Article 17 of the International Treaty
- (iii) identify information gaps on scientific, technical and environmental matters on PGRFA;
- (iv) identify best practices and appropriate methodologies for the strengthening of an effective global information system;
- (v) conduct and publish the necessary background study papers, in cooperation with Contracting Parties and relevant stakeholders and subject to availability of resources, an online survey on the major components of the Global Information System;
- (vi) advise the Secretariat in the drafting of the vision paper on the Global Information System referred to in Article 17 of the Treaty as a conceptual basis for a programme of work to be presented to the Governing Body at its next session for its consideration.<sup>3</sup>

8. In early 2014, the Secretariat received funds from the Government of Germany to prepare the Consultation and initiated a round of discussions with partner organizations to gather inputs and identify the main areas and elements to be further developed, building on experiences accumulated by those partners and with a view to facilitating access, exchange and use of PGRFA data and information.

### **This Vision Paper**

9. This Vision Paper consolidates the information and analysis contained in the documentation for the meeting, and presents the major findings resulting from the surveys conducted of the community in 2014 on the major elements for the GLIS. It outlines some relevant developments, including in relation to plant genetic resources and genomics and the mainstreaming of agricultural research through genomics., expands on the concept and operational framework of interoperability and partnerships, provides an overview on standards and other normative work, with a particular emphasis on the adoption of permanent unique identifiers. The Vision Paper introduces a number of policy and institutional considerations of relevance to the development of the Programme of Work.

10. A resulting draft vision of GLIS and a roadmap with some elements for the first Programme of Work are also included in *Appendixes 1 and 2*, respectively. Draft terms of references for the establishment of a Scientific Advisory Committee on the Global Information System are in *Appendix 3*.

## **II. CORE PGRFA DATA DOMAINS AND INFORMATION SYSTEMS**

11. The challenges to be addressed by the Governing Body with the development and implementation of the Global Information System to improve conservation and sustainable use of PGRFA are of an evolving nature and present multi-dimensional aspects. At the same time, the

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<sup>3</sup> Annex, Resolution 10/2013, Appendix A.10, *Report of the Fifth Session of the Governing Body of the International Treaty*, 2013, p.66

GLIS, understood as a non-monetary benefit-sharing mechanism of the Treaty, will have to focus on delivering impact within a flexible framework able to expand and promote interoperability, which includes, but extends beyond the technical dimensions among systems, key stakeholders, policy makers and groups to improve products and services.

12. In this context, the Global Information System presents an opportunity for the Governing Body to address the multi-dimensional nature of the interface between science and policy across the entire production chain based on PGRFA to increase agricultural productivity, accelerate agricultural development, and minimize the effects of natural disasters and climate change over seeds and other planting material. There is at global level a growing interest and recognition of the value of a joint multi-sector approach to improve the adaptability and response capacity to every aspect of the livelihoods of populations, particularly in rural areas, with a territorial perspective, particularly in terms of their livelihoods, water resources management and the need for sustainable agri-food systems.

13. In developing the Global Information System and adopting a Programme of Work for it, the Governing Body should take into consideration that interoperability does not refer only to system-to-system communications and that it is also oriented to improve products and services for the users' active participation. This is often summarized with the term "semantic interoperability".

14. In the Programme of Work these requirements can be translated into the development of human capacity and into activities which facilitate the linking of information across sectors, for example exploring the overlaps between agricultural and environmental data, or activities which integrate geo-spatial dimensions of the information - as already exemplified by the agroecological zone-based Strategic Action Plans funded by the Benefit-sharing Fund and as already demonstrated with the Programme for the Strengthening of Capabilities in National Plant Genetic Resources Programmes (CAPFITOGEN).

15. As part of the documentation for the Expert Consultation, the Secretariat has prepared a document with information on the different aspects of the interoperability<sup>4</sup> and with the proposal to establish a Stakeholder Platform to improve collaboration among all stakeholders and decision makers at the science and policy interface. Linking scientific research results to the policy process in an effective way will help to identify operational functionalities for the Global Information System, key partnerships and its web portal in addition to those already being implemented.

16. The Stakeholder Platform, intended as a network of members and stakeholders (plant breeders, farmers, researchers, public authorities, economic, industrial, local and indigenous communities and the civil society) will help to consolidate user communities with specific thematic or territorial dimensions and to obtain structured participation in activities of the Global Information System.

17. For the development of the Programme of Work, the Secretariat would like also to seek advice on the way to optimally promote, encourage and foster the use of open data for PGRFA information, and on other functions to improve access to datasets and information systems to ensure impact on conservation and sustainable use of PGRFA.

### **III. ANALYSIS OF THE INFORMATION NEEDS OF THE DIFFERENT STAKEHOLDERS**

18. To collect views and information from the community, and in collaboration with other partners and initiatives, the Secretariat prepared and launched in 2014 an online consultation through two surveys:

- a. Survey 1 - Landscape Survey on the major components of the Global Information System

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<sup>4</sup> IT/COGIS-1/15/4, *Improving Interoperability of PGRFA Data within the Global Information System*. Available at: <http://www.planttreaty.org/sites/default/files/cogis1w4.pdf>

b. Survey 2 - Survey on Genomics, Phenomics and Data Sharing and Exchange

19. These two surveys constitute the most systematic, comprehensive, and regionally inclusive articulation of the community's views and needs in the field of plant genetic resource information systems, genomics and phenomics. The Secretariat has made available the results of the community surveys as an information document.<sup>5</sup> The document illustrates the way in which the surveys were prepared and circulated among the community, and also presents the major findings for each one in order to lay the foundation for further work. Some of these findings and elements have been incorporated in the draft vision paper and the experts are invited to take them into account when providing advice on both the vision and the Programme of Work.

20. The Landscape survey was divided into two segments and was mainly addressed to the national focal points of the International Treaty. It was also circulated by email to all of them. The second survey was addressed to stakeholders and organizations involved in genomics, phenomics and data-sharing and exchange. It was also promoted through an official Notification, and circulated in collaboration with partner organizations to a wider audience, including participants of technical meetings on the subject matter<sup>6</sup>.

21. In responding to the landscape survey, the community agreed on the following statements "*The System will be open, innovative, dynamic, decentralized, collaborative, community-driven, user-centric, and quality-focused*", which has been incorporated in the Vision presented in *Appendix 1*. It is to be noted that some respondents also indicated that while they supported the principle of decentralization, there is the need for a central platform or portal at international level with certain elements of a core system.

22. Their proposal is incorporated in the draft Programme of Work, under operations, to establish a Global Seed Portal and lists some of the core functions taking a conservative approach. Respondents indicated that the portal or central platform should be easy to use and understand and it should take into account the needs of the current users, but also the fact that it may need to evolve over time. To capture the needs of users and stakeholders the draft Programme of Work put forward the idea of establishing an informal mechanism like a Stakeholder Platform to be able to capture the evolving needs of users and the gaps and obstacles in the implementation of the System.

23. Respondents also suggested taking into consideration the issue of expanded interoperability beyond technical aspects, which has been included as one of the principles and has been the further object of analysis for the preparation of documents IT/COGIS-1/15/4 and IT/COGIS-1/15/3.

24. The top challenges and priority areas indicated by respondents have also been taken into account for the elaboration of the draft Programme of Work contained in *Appendix 2*. It is to be noted that half of the respondent indicated that they would like the GLIS to provide tools to manage and analyze large-scale genetic diversity and genomics data.

25. The Second Survey elicited views and opinions from interested stakeholders and collected responses from 46 participants from all regions. Most of them declared to be users of the MLS and to be involved in genotyping, sequencing or phenotyping work. They indicated to be involved in activities related to wheat, rice and maize, followed by Arabidopsis, cassava, barley, wild species, or just cereal and forages.

26. Almost 40 % of the respondents declared to be involved in genetics and genomics work with PGRFA and 14% indicated that they outsource this kind of activities. In fact, concrete partnerships were indicated in this area, as many institutions do not have facilities for molecular biology work they partner with universities and centres with appropriate capacity (e.g. diversity arrays technology). Others indicated that the genomics work was not directly their mandate or that they

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<sup>5</sup> IT/COGIS-1/15/Inf.1, *Analysis of the landscape and genomics surveys in the context of the Global Information System*. Available at: <http://www.planttreaty.org/sites/default/files/cogis1Inf1.pdf>

<sup>6</sup> Including the participants of the San Diego Meeting on the advancement of plant genomics, the SeedSeq Initiative, and others that have converged into the DivSeek Initiative.

require such work to be done but still lack the necessary financial and technical infrastructure and capacity as well as the technical expertise and knowledge.

27. The Survey also for the first time provides global and systematic information on the major tools, format and systems used to sequence, store, analyse and share genomics and phenomics data in all the different regions of the world with their different capacities and needs. This information has also been shared with the other partners of the DivSeek Facilitation Unit and it has been taken into account in the preparation of section IV of this document and the Background Study 5 on *Plant Genetic Resources and Genomics*<sup>7</sup>. Activities to address them have been reflected in the draft Programme of Work.

#### **IV. RECENT DEVELOPMENTS ON GENOMICS RELEVANT TO THE GLOBAL INFORMATION SYSTEM**

28. For the present expert Consultation, the Treaty Secretariat has prepared extensive documentation on genomics and the Global Information System. In particular, the Secretariat conducted the above-mentioned Survey<sup>8</sup> on genomics and supported the drafting of a Background Study on genomics and plant genetic resources for food and agriculture. The Study also outlines some of the challenges which the Global Information System will address in relation to genomics, phenomics and data sharing in the coming years.<sup>9</sup>

29. Recording high-resolution genomic data in the Global Information System will allow integrating data across experiments, which will facilitate reaching the sample sizes needed to make robust discoveries based on the use of PGRFA under the Treaty, given the large amount of existing environmental variables.

30. The data produced by the different genomics approaches is usually stored in large files and a few popular types are emerging as de-facto standard, while other new formats are appearing. The genome sizes of rice, maize and bread wheat are 400Mb, 2.5Gb, and 17Gb respectively. Larger genomes obviously require more sequencing, thereby increasing the actual sequencing cost.

31. The costs related to the quick shotgun assembly of a genome are cheaper than a few years ago and the procedures more straight-forward, while significant additional work will be needed to produce a high-quality assembly and even more to “finish a genome”. It is to be noted that a finished, high-quality reference genome is of enormous value for crop research, genetics and breeding. The support of projects aiming at producing high-quality reference genomes has been requested by the community as a funding priority, and building on the explorative work already included in the Third Call for Proposals, the Governing Body could take it into account in future rounds of the Benefit-sharing Fund under the established funding window of “Co-development and transfer of technologies”.

32. In this context, new data structures are crucial for what the Global Alliance for Genomics and Health<sup>10</sup> is trying to achieve and it will be also relevant for the crop science communities. Nevertheless, crop genetics will be different with respect to the technological details because of differences in the levels of heterozygosity, ploidy, effective population size, life history traits and strategies (annuals, perennials), confidentiality of data, etc.

33. The scope, content and usability for each crop repository vary greatly and largely depend on financial means. This is an area in high demand for intervention by policy as targeted funding is needed to develop or adopt procedures, methods, data standards, and example repositories, which can

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<sup>7</sup> *Plant Genetic Resources and Genomics: Mainstreaming Agricultural Research Through Genomics*. Available at: <http://www.planttreaty.org/content/cogis1>

<sup>8</sup> IT/COGIS-1/15/Inf.1

<sup>9</sup> *Plant Genetic Resources and Genomics*. Background Study 5. Available at: [http://planttreaty.org/sites/default/files/ITPGRFA\\_BS005e.pdf](http://planttreaty.org/sites/default/files/ITPGRFA_BS005e.pdf)

<sup>10</sup> <http://genomicsandhealth.org/>

serve as templates and skeletons for customized crop repositories in the context of the Global Information System. Based on the Governing Body's decision that "Exchange of Information, Technology Transfer and Capacity Building" is the first funding priority of the Benefit-sharing Fund, the Bureau of the Sixth Session of the Governing Body installed in the Third Call for Proposals a dedicated financing window with a focus and outcomes related to the generation and interpretation of genomic data and related identification and contribution of needs of agricultural stakeholders, including farmers, to the development of such data repositories and other components of the Global Information System under Article 17.<sup>11</sup> The requirements from the different crops will be different and ideally, customization could be achieved by combining modules.

34. In terms of storing and making accessible genomic information of population-sized datasets, new approaches are needed. Current methods do not scale. When framing the Global Information System, the Governing Body and the scientific and technical community working within the enabling policy space created by the International Treaty will be able to learn from experiences from other online repositories. Some prominent examples from existing initiatives are provided in the Background Study Paper on genomics and plant genetic resources. Some of the most promising ones in the context of the International Treaty are DivSeek, the Global Alliance for Genomic and Health, the African Orphan Crop Consortium, iPlant, transPLANT and Google Inc.

35. From a genomics perspective, uncertainty with respect to intellectual property rights (IPRs) is likely to create limitations with regard to participation in data sharing and for freedom-to-operate for possible downstream innovation, hence addressing the intellectual property rights associated with genomic information gathered from PGRFA and related policy questions is central to encourage participation. Anyone holding DNA sequence data should be put in good conditions to make it publicly available.

36. Data upload from sequencing machines into public repositories will soon likely be an automated process. In addition, since much of the downstream analysis on the data is of statistical nature, the information contained in the Global Information System should be as correct, complete and unbiased as possible.

37. Adding genomics, genotypic and phenotypic data can be analysed together by methods such as genetic mapping, QTL-mapping and Genome-Wide Association Studies (GWAS). This yields Genotype-Phenotype associations, which establish causality between a particular trait and one or several loci in the genome. With this information the breeding outcomes can be predicted.

38. This process accelerates breeding by shortening the breeding cycle, reducing cost and making accessible PGRFA in which the desired phenotypes had been masked and hence overlooked. It is to be noted that information on the species-wide genetic variation allows for efficient pre-breeding. This function of the Global Information System would also benefit and connect with the activities included in the Programme of Work on Sustainable Use as adopted by the Governing Body of the International Treaty in 2013.

39. The Global Information System should have a component to reliably link an accession stored in a genebank and its associated passport data to its genomic information. Ideally, entire genebank collections will undergo genomic characterisation. The role and relevance of genebanks could quickly be affected by modern genomics and the International Treaty on PGRFA could help to develop an enabling scenario for collaboration. One element needed is awareness of these interactions and increased capacity in the context of the programme of work of the Global Information System and the related supporting initiatives and programmes.

40. The fundamental idea is that better data and knowledge linked with the germplasm will improve its use and, consequently, the fundamental link to be established is for the Treaty to connect the operations of the Multilateral System with those of the Global Information System - as foreseen in the Treaty provisions and recently operationalized by the Secretariat through multiple initiatives

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<sup>11</sup> See, *Third Call for Proposals of the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture*, Window 3, p.4-6. [ftp://ftp.fao.org/ag/agp/planttreaty/funding/call2014/cfp\\_3\\_2014\\_0\\_en.pdf](ftp://ftp.fao.org/ag/agp/planttreaty/funding/call2014/cfp_3_2014_0_en.pdf)



and partnerships such as Easy-SMTA, Capfitogen, DivSeek and others, as well as the new funding Window of the Benefit-sharing Fund under the guidance of the Bureau of the Sixth Session.

41. The further development of the Global Information System will have a positive impact on the Programme of Work on Sustainable Use and on its breeding and pre-breeding priorities, including the activities listed in the Global Plan of Action on PGRFA. For that the System needs to:

- i. link phenotypes to genetic variants. This is achieved by genetics experiments, which make use of high-density genotype data and data from phenotyping trials.
- ii. facilitate that the ideal parental lines as allele donors for the desired traits are selected. The breeding targets are still combinations of phenotypes. But since traits have been associated to genomic loci, they can now be translated to a combination of genome segments that need to be combined.
- iii. monitor inheritance of the genomic segments in the progeny with the use of molecular markers. The molecular markers are developed based on the genomic information

42. The expectation and aim expressed by stakeholders in the breeding community is that a Global Information System will enable joining datasets across experiments to reach sample sizes and the statistical power needed to establish the robust genotype-phenotype associations that are required.

43. The Global Information System will also help to determine breeding goals. With a catalogue of allelic and phenotypic variation of a crop species, it can be known ahead of time whether or not a desired trait actually segregates in the species and hence if the breeding goal is realistic. It also enables translating knowledge between species and crops and their wild relatives, which may then need to be used as donors for the desired trait.

44. The potential contribution of a global information system for pre-breeding has also been documented at large. If a PGRFA or a breeding line gets lost, but its genotype is known and a database of genetic data from other PGR is available, then it is rather straight-forwards to identify the closest relative, which can then be used as replacement. More generally, the boundary between genomic information and actual germplasm might blur in the future. Based on existing provisions of the Treaty and its Standard Material Transfer Agreement, Contracting Parties have therefore suggested in various Treaty fora to connect the daily processing of accession-level information about transferred germplasm within the information infrastructure of the Multilateral System with the processing of genomic information in the context of the Global Information System on an ongoing basis. This would reflect the relevant existing provisions in the Treaty and its Standard Material Transfer Agreement, reflect the wider needs and trend for integration between these datasets, and make the germplasm in the Multilateral System, including related information made available through the Global Information System, more valuable to users and agricultural stakeholders.

45. The Governing Body of the International Treaty has the opportunity to increase interactions with the various stakeholders to conceptualise a system of the Global Information System able to receive, store and make publicly available genotype and phenotype and any other relevant PGRFA data, starting with the material being exchange within the Multilateral System of Access and benefit-sharing and expanding. This will require the development of data standards, incentives to contribute, example repositories and a data sharing policy. The System should also provide the means to enable data to be (re-)analysed in the future.

46. To enable data sharing, the issue of intellectual property rights of genomic data, in particular whole genome DNA sequence data of PGRFA must be addressed. PGRFA holders producing genomics data and, in particular, DNA sequence data from a PGRFA within the Multilateral System should be put in a condition to make this information publicly available for the benefit of the entire community. Legal uncertainty in this regard will negatively impact participation.

47. Based on the needs expressed by the community, the development of data structures that enable efficient representation of crop pan-genomes should also be considered as an area of strategic investment within the Global Information System.
48. The International Treaty, in framing the Global Information System could initiate and promote the development of standards and Crop Ontologies, in partnership with FAO and international projects and initiatives. Public expertise in the field can be found within the CGIAR system, especially at Bioversity International.

## **V. THE ADOPTION OF STANDARDS AND THE PERMANENT UNIQUE IDENTIFIERS FOR PGRFA**

49. Both the Treaty and the Standard Material Transfer Agreement (SMTA) require improved access to information on the PGRFA being transferred as a critical components of daily operations of core Treaty systems and in order to facilitate the use of PGRFA under the Treaty.
50. Effective sharing of information in turn implies a coordinated effort on standards that are adopted by the community to properly identify and describe the PGRFA being transferred - mainly in the form of accessions - , as well as to make non confidential associated information on them available to the recipient. That is accrued through subsequent transfers and developments, where research in the form of characterization and evaluation is performed, generating datasets and information objects that could be easily discoverable and manageable in an automated way.
51. The Global Information System, based on already existing information systems and Treaty's mechanisms, would be critically dependant on the effective integration of such diverse information and knowledge sources for which standards, sometimes already available within various user communities, need to be adopted or further developed. Their adoption and use in connection with the transfer of PGRFA material would also facilitate SMTA reporting. While there are multiple existing options identified for the adoption of PUI, the international community would benefit from an agreed common standard, particularly to facilitate data integration.
52. An important first step in this direction is the adoption of a Permanent Unique Identifier (PUI) to be attached to each individual accession of interest within the Multilateral System. Document IT/COGIS-1/15/3 outlines the main characteristics of some of the many PUI types currently available and focuses on the Digital Object Identifier (DOI) as one of the most promising candidates for adoption. Beside other significant advantages, DOIs are designed to integrate other existing PUI types, thus preserving any investment that participating organizations may have already made.
53. Once assigned to an accession, a PUI (and specifically a DOI) allows the accession to be unambiguously identified and facilitates access to and discovery of information about it stored anywhere on the Internet.
54. Assigning a PUI to an accession or, in general, to an object of interest, requires accurate identification through agreed upon criteria and using descriptors that have the same meaning for everyone. For this reason, as the documentation prepared for the consultation indicates, adopting a PUI type needs to be complemented by the adoption of a set of terms and rules. These are needed to identify and describe the object which the PUI refers to. Such sets of terms and rules are called *Controlled Vocabularies* or *Ontologies*. The paper proposes to investigate the adoption of a suitable ontology, promising candidates are Darwin Core or the Crop Ontology.
55. Once the ontology of choice is identified, it will be possible to pursue a strategy to reduce or eliminate altogether the major constraint to a widespread adoption of DOIs, i.e. their acquisition cost, required by the centralised coordination, management and support functions provided by the International DOI Foundation (IDF).
56. For the adoption of any type of PUI, training and capacity building, particularly for PGRFA data managers in developing countries, should also be considered if some impact is to be obtained.

The provision of such services could be provided within the Stakeholder Platform or any other training and capacity building mechanism where PGRFA data curator can exchange experiences.

57. The design of a collaborative and community-driven training programme oriented to upgrade the skills of bioinformaticians and other users of relevant PGRFA data repositories is already indicated as one possible area for future collaboration. Contracting Parties have already started, collectively, to consider proposals in support of the implementation of Permanent Unique Identifiers within a specific funding window of the third Call for Proposals of the Benefit-sharing Fund.

## VI. INSTITUTIONAL AND POLICY DESIGNS

58. The GLIS aims to develop a global system of information covering technical, scientific, environmental aspects related to PGRFA, built upon the multiplicity of existing information systems, with a view to ensuring availability and accessibility of information by the agricultural community. Building a common and community-based resource such as GLIS requires the broad participation and contribution of multiple stakeholders, such as providers and recipients of PGRFA under the Multilateral System, producers of data and information on PGRFA, producers of analytical and information technology tools, users of these resources, such as the scientific community, funding agencies, the Secretariat, and the Contracting Parties to the Treaty.

59. For the GLIS to be effective, a necessary premise is the “network effect” of contribution, use and re-contribution of data and information on PGRFA. Such a premise makes possible the simultaneous access, interoperability and use of varied and complementary sources of information otherwise scattered and sometimes inaccessible. It combines and analyses diverse types of data and information in ways in which no single entity or group could on its own, and it potentiates connections and synergies among stakeholder groups with diverse areas of expertise, services and resources otherwise disconnected and unknown to each other.

60. For the network effect to be realised, shared and divided, roles and responsibilities among partners and participants of the GLIS network will be critical for its functioning as a common resource. Partners contributing scientific data, information and analytical tools are needed regardless of the extent of their operations –local, regional, national, international-, the type of data and information shared –passport, phenotypic, molecular, genotypic, environmental, socio-economic, policy, etc.- and the crop or PGRFA worked on. Partners whose contribution is funding, policy guidance, technical advice, management, communication are equally important to the success of the system. Core catalytic funding might also continue to derive from the resources under the direct control of the Governing Body in the Benefit-sharing Fund through the already established and implemented funding window and funding priority.

61. In turn, an effectively operated and funded GLIS will boost the functioning of the Multilateral System of the Treaty by supplementing the transferred genetic material with value-added data for the increased use of PGRFA under the Treaty. Together, the connected and coordinated operations of the MLS and GLIS will render increased benefits to users of PGRFA under the Treaty. Through this complementary development of the MLS and GLIS, the Treaty as a whole may more effectively foster partnerships among its users, beneficiaries and partners, advancing in this way R&D in crops and food for sustainable food production and food security amidst an insecure climate.

62. Accordingly, the institutional designs of the GLIS should follow the following policy principles: (i) a scientific, needs-based, community-driven, collaborative, decentralized, dynamic and user-centric approach; (ii) increased accessibility, availability and transparency of PGRFA-related information systems; (iii) creation of synergy through broad collaboration, sharing and engagement of a wide spectrum of stakeholders; (iv) creation of synergy by connecting GLIS operations with those of other Treaty systems and mechanisms and by implementing GLIS through focused initiatives; and (v) enabling the advancement and innovation of crop research and

development (R&D) at multiple levels –local, regional, national and international- through the ample sharing of the benefits derived from the first two principles.

63. Institutional designs cannot operate in isolation from legal factors. For the institutional design of GLIS to be effective and realistic, it is necessary to take into account the limits on accessibility and availability of information, which may derive, by way of example, from the confidentiality status of the information. Hence, clear terms of engagement, that consider limiting legal factors, for the participation in an open and inclusive community informational resource are critical for the establishment of the GLIS, its uptake among users and providers, its sustainability and use.

64. Practical institutional mechanisms and policy principles that encourage the use and sharing of information among a wide range of actors in all sectors (i.e, government, industry, university and other non-profit) are essential to achieving the objectives of Article 17. To encourage research collaboration, sharing of data, and innovation within various scientific communities and disciplines and across stakeholder groups, the development and adoption of a coherent policy framework, supported by clear terms of engagement, are necessary, and a clear understanding of the institutional and policy settings in which the GLIS is likely to operate is a prerequisite for such normative work to facilitate the effective deployment of the GLIS functions.

## **VII. ADVICE SOUGHT**

65. The experts are invited to provide guidance on the following outputs that the Secretariat is to submit to the Sixth Session of the Governing Body for consideration:

- i. the Draft Vision for the Global Information System contained in *Appendix 1*;
- ii. the roadmap for the first Programme of Work on the Global Information System contained in *Appendix 2*;
- iii. the draft terms of references for the establishment of the Scientific Advisory Committee on the Global Information System contained in *Appendix 3*;

*Appendix 1*

*Draft*  
**Vision for the Global Information System on PGRFA**

**The Global Information System will provide a platform of interoperable data and information services on plant genetic resources for food and agriculture at accession, molecular and population levels, to facilitate conservation, utilization and development of agro-biodiversity by integrating ex-situ, in-situ and on-farm information for the benefit of mankind.**

**The System will be open, innovative, dynamic, decentralized, collaborative, community-driven, user-centric, and quality-focused.**

### **Introduction**

Crop diversity underpins agriculture. It provides the variability needed for agriculture to withstand adverse weather and the ravages of pests and diseases. The deployment of traditional and new crop varieties provides opportunities for farmers, NGOs and others to address some key local, regional and national development goals. The genetic diversity within crops is also the fundamental resource for developing new improved varieties that are more productive, nutritious, stable, and climate smart.

Thus, while ready access to crop diversity is essential for the development and deployment of crop varieties, of almost equal importance is access to information about this diversity. Without this, farmers, plant breeders and other plant scientists, as well as seed companies and development workers are all essentially working in the dark.

A large number of information systems and services are already in place around the world covering a wide range of technical, scientific, environmental and policy topics relevant to the use and conservation of PGRFA. However, many are incomplete, and do not inter-connect with others. Thus, the development of a truly effective Global Information System as foreseen in the International Treaty will involve, *inter alia*: strengthening existing systems and, where gaps remain, establishing new systems and initiatives; promoting inter-connectivity among systems; and providing overarching mechanisms to ensure ready access to the information and services provided.

If information is to effectively underpin and support the use and conservation of PGRFA globally, it is imperative that data standards are agreed and applied, incentives are in place to make information available in a timely manner, and that adequate quality control measures are implemented. Appropriate mechanisms, policies, and monitoring and compliance procedures are all essential, as is adequate finance. Mechanisms are needed to help institutions, especially weaker ones, make available their own data and information as well as to help them gain access to, and use, the information and services provided by others through the System. Ideally the leadership should be closely associated with one or more active components of the Global Information System.

**Thus, our vision is that Contracting Parties and relevant stakeholders engage** in a collaborative process to build a fully effective Global Information System as soon as possible, providing access to high quality data, information, and analytical services relevant to the use and conservation of PGRFA.

The information will cover a wide range of topics including, but not limited to: accession level data and information; passport, characterization and evaluation data; genomic and other molecular data; phenomic and other 'omic data; environmental and relevant spatial data; data on

biotic and abiotic stresses; information on plant breeding practices; and information on associated knowledge; technical information contained in intellectual property information systems; other relevant scientific data; as well as policies and legislation.

The system will capture information produced by the users of the Multilateral System of the International Treaty and connect it with other available information. The information will be accessible via user-friendly, multi-lingual, interfaces that enable cross-searching of the various associated databases and systems.

The Global Information System will have clear policies and procedures in place regarding such matters as: data ownership, intellectual property management, the rights and responsibilities associated with data access and use, and measures for monitoring and promoting compliance with standards. These policies and procedures will have been designed so as to promote maximum participation in the System and offer incentives for the provision of accurate and timely information. Mechanisms and practices that are transparent and involve all key stakeholder groups will have been instituted, as will mechanisms for assisting weaker institutions to interact effectively with the System.

Adequate funds will be available to ensure effective coordination and operation of the Global Information System, through a management unit embedded in, and closely associated with one or more institutions that both provide and use information on PGRFA.

The Global Information System will be fully operational as soon as possible, underpinning the use of PGRFA as a key resource for ensuring local and global food security in the face of growing demand, changing climates and diminishing natural resources.

*Appendix 2**Draft***Roadmap for the Programme of Work on the Global Information System**

The Roadmap for the implementation of the Global Information System lists a series of activities grouped in two mayor areas for the future Programme of Work: i) capacity building and partnerships; and ii) interoperability and web services. While some activities can be implemented through in-kind collaboration with existing initiatives of partners and Contracting Parties or through synergies with other Treaty's operations, its full implementation will depend on the availability of appropriate additional funding.

**A. CAPACITY BUILDING AND PARTNERSHIPS****1) Assisting the community in the implementation of the Treaty's mechanisms through the effective provision of information services.**

To assist Contracting Parties with taking stock of the information services and tools available within the Treaty community and at global level, and particularly national focal points of the Treaty and technical staff with understanding new opportunities for implementing the Treaty's mechanisms at national and regional level. This will include the provision of information and training tools, jointly with the CGIAR Centres, the CBD, FAO and Contracting Parties through workshops and other events. This activity will help generate leadership and empowerment.

**2) Facilitating participation from the community and engagement of partners and stakeholders to significantly expand the GLIS potential network and services.** There are regional and crop-based initiatives as well as global projects and international organizations and groups of stakeholders in both developed and developing Contracting Parties that can significantly contribute to the further designing and implementation of the Global Information System. This component seeks to develop working relationships and concrete synergies among them. Some specific activities are already under way through collaboration with existing partners and Contracting Parties and build on synergies with other operations of the Secretariat. The first comprehensive activity would be the organization of the first meeting of the Stakeholder's Platform to explore opportunities to facilitate scientific and technical cooperation through human networking. It will also help to promote partners' tools, services and capacity to collaborate with others. It will result in the generation of data and information on thematic areas or crops.*Incentives, policies and procedures***3) Conducting research on institutional, organizational, policy and legal factors for PGRFA information access, exchange and use,** based on similar work being conducted in other initiatives, particularly in relation to genomics, phenomics and other 'omics' technologies, but also geo-spatial data and farmers' knowledge. The science and policy interface, projected into a global equity dimension, is an underlying research topic that can be applied to PGRFA-information specific issues. The research can benefit from the support of the academic sector and will be oriented towards providing analysis and policy options for the consideration of the Scientific Advisory Committee and the Governing Body.

## B. INTEROPERABILITY AND WEB SERVICES

### *Operations*

- 4) **Designing and implementing the pilot phase of the Global Seed Portal** to demonstrate information exchange services: 1) in connection with the Multilateral System - Easy-SMTA, aggregated statistics on the flow of PGRFA Material, an enhanced Inclusion and Discovery Facility for PGRFA-; 2) a search engine to find PGRFA information across distributed databases; 3) information from the Treaty's national reporting mechanism on compliance; 4) a directory of projects and initiatives offering open PGRFA datasets; 5) an online library to allow the submission of PGRFA related resources; 6) an user account component allowing users to log in different partner services; 7) an Application Programming Interface (APIs) enabling interoperability and access to data.
- 5) **Continuing participation of the International Treaty in the DivSeek Initiative**, as one of the implementing partners, but also with an active role in its Joint Facilitation Unit with the aim to connecting genomics work with the Treaty and its mechanisms, such as the Multilateral System of the Treaty, the Benefit-sharing Fund and the Programme of Work on Sustainable Use.

### *Standards*

- 6) **Developing, adopting and promoting PGRFA information standards** through the establishment of an *ad hoc* informal working group, in collaboration with interested partners, to adapt common formats and metadata standards to PGRFA information and to promote their adoption. The working group will take into account the guidance of the Scientific Advisory Committee and shall include experts from Contracting Parties and international institutions with experiences in the biodiversity area. At its first meeting, the working group will work on the adoption of permanent unique identifiers for PGRFA.

### *Monitoring and assessment of progress*

- 7) **Monitoring the impact of the International Treaty** and carrying out an assessment of the contribution of the Global Information System, its tools and services, to national processes and identifying gaps and barriers. The Stakeholder Platform can become an adequate mechanism to identify gaps and obstacles together with the information to be made available by national reporting mechanism and the use of online surveys and face-to-face interviews.



*Appendix 3*

***Draft Terms of Reference for the  
Scientific Advisory Committee on the Global Information System of Article 17***

Objectives

The Governing Body provides guidance on the development and strengthening of the Global Information System (System), to facilitate the exchange of information, based on existing information systems, on scientific, technical and environmental matters related to plant genetic resources for food and agriculture.

The Scientific Advisory Committee (Committee) shall, in providing scientific advice to the Secretary for the development and implementation of the System, have the following objectives:

1. Improve the effectiveness and efficiency of the Global Information System as a mechanism to promote scientific, technical and environmental cooperation on PGRFA matters;
2. Promote the exchange of PGRFA-related information and the transfer of publicly available expertise, technology and scientific cooperation;
3. Facilitate the development and implementation of guidance from the Governing Body concerning the scientific and technical components of the Global Information Systems and its Programme of Work;
4. Facilitate and ensure cooperation with other relevant international and regional scientific and technical cooperation and technology transfer initiatives, including the Access and Benefit-sharing Clearing House Mechanism of the Nagoya Protocol;
5. Advise on means to facilitate the implementation of the Global Information System at the national level and the Stakeholder Platform ;
6. Enhance the scientific, technical and environmental cooperation and benefits of all the Treaty activities, including the Multilateral System and Access and Benefit-sharing and the Programme of Work on Sustainable Use.

In particular, the Committee shall:

- make general recommendations of the development and deployment of the System and its components;
- advise on the roadmap for the implementation of the priority activities;
- evaluate pilot activities for the System, upon request of the Secretary, and advise on other initiatives and actions to sustain the operation of the System, and the further update of the Programme of Work;

Subject to the availability of financial resources, the Committee will hold two meetings per biennium.

Composition

The Committee is composed of:

- up to 2 scientific experts from each Region, nominated by the Vice-chairpersons of the Governing Body of each respective Region;
- 10 additional scientific and technical experts appointed by the Secretary, taking into account the balance of stakeholder technical expertise.

The members shall be selected for their scientific expertise and understanding of the global information system and the International Treaty, taking into account the need for specialized and in-depth expertise including: bioinformatics and molecular genetics; the 'omics, in particular genomics, phenomics and proteomics; management of environmental and geo-spatial data about plant genetic resources; scientific, technical cooperation; capacity-building; information exchange and data sharing; and facilitating partnerships with other organizations, institutions and initiatives.

The Committee shall elect its Co-chairpersons from among the experts.

The Secretariat of the International Treaty will facilitate and coordinate the work of the Committee, and prepare and service its meetings.