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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 3 of the Provisional Agenda

INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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MONITORING THE IMPLEMENTATION OF THE SECOND GLOBAL PLAN OF ACTION FOR PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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I. INTRODUCTION

1. Overall progress in the implementation of the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (Second GPA) and the related follow-up processes are monitored and guided by governments and other FAO members through the Commission on Genetic Resources for Food and Agriculture (the Commission).[1] In order to discharge this function the Commission, at its Fourteenth Regular Session, planned the review of the implementation of the Second GPA as well as the review of the Second GPA itself within its Strategic Plan 2014-2023.[2]

2. For monitoring the implementation of the Second GPA the Commission adopted indicators as well as three targets for plant genetic resources for food and agriculture (PGRFA) at its last session.[3] The Commission requested FAO:

- to elaborate higher-order composite indices (HCIs) for each of the PGRFA targets.[4] The Commission requested its Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture (the Working Group) to review the HCI and to make recommendations;[5]
- to finalize the reporting format for monitoring the implementation of the Second GPA (Reporting Format);[6] and
- to upgrade the existing computer application for monitoring the implementation of the Second GPA in order to enable the use of the indicators.[7]

3. In response to the Commission's request, this document proposes three possible HCIs for the three PGRFA targets, for consideration by the Working Group. It reports on the finalization of the Reporting Format and on the status of upgrading the computer application for monitoring the implementation of the Second GPA. Finally, the document briefly recapitulates the process for reporting on the implementation of the Second GPA which is integrated with the preparation of *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (Third Report).

II. HIGHER-ORDER COMPOSITE INDICES FOR THE PLANT GENETIC RESOURCES TARGETS

4. The Commission requested FAO to elaborate HCIs for each of the three PGRFA targets, basing them on data collected from the indicators for monitoring the implementation of the Second GPA.[8] The Commission, at its last session, adopted three mutually supportive targets[9]:

> **Target 1 - PGRFA Conservation**. By 2020, an increasing proportion of the genetic diversity of cultivated plants and their wild relatives, as well as of wild food plant species is maintained *in situ*, on farm and *ex situ* in a complementary manner;

[1] Second GPA, paragraph 315.

[2] CGRFA-14/13/Report, *Appendix I*.

[3] CGRFA-14/13/Report, *Appendix C*.

[4] CGRFA-14/13/Report, paragraph 27.

[5] CGFRA-14/13/Report, paragraph 27.

[6] CGRFA-14/13/Report, paragraph 24.

[7] CGRFA-14/13/Report, paragraph 26.

[8] CGRFA-14/13/Report, paragraph 27.

[9] CGRFA-14/13/Report, Appendix C

Target 2 - PGRFA Sustainable Use: By 2020, there has been an increased use of plant genetic resources for food and agriculture to improve sustainable crop production intensification and livelihoods while reducing genetic vulnerability of crops and cropping systems; and

Target 3 - PGRFA Institutional and Human Capacities: By 2020, many more people are aware of the values of plant genetic resources for food and agriculture and institutional and human capacities are strengthened to conserve and use them sustainably while minimizing genetic erosion and safeguarding their genetic diversity.

5. The purpose of HCIs is to assess progress towards the three PGRFA targets and to facilitate the comparison of performance across time, countries and regional areas. The implementation of the Second GPA as a whole contributes to the achievement of the adopted targets, and each priority activity covers a particular dimension of and contributes to one of the three targets. Priority activities 1 to 7 of the Second GPA contribute to Target 1, priority activities 8-12 to Target 2, and priority activities 13-18 to Target 3. Progress in the implementation of each priority activity of the Second GPA is assessed through a set of indicators adopted by the Commission.

Development of a composite index

6. According to the OECD Handbook on Constructing Composite Indicators, "composite indicators are much like mathematical or computational models. As such, their construction owes more to the craftsmanship of the modeller than to universally accepted scientific rules for encoding."[10] Peer acceptance as well as their fitness for the intended purpose are essential for composite indicators or indices.

7. The development of a composite index follows an ideal order of pre-defined steps, including: *the development of a theoretical framework, data selection, imputation of missing data, normalization, weighting* and *aggregation*. During each of these steps, different choices are possible and the choice in one step may have important implications for the following steps. The choices depend on the aim and the specific characteristics of the indicators and together they define the overall modelling approach.

The *theoretical framework* consists of the theoretical background that provides the basis for selecting and combining variables into a composite index. It describes the multi-faced dimension to be measured and its relationship with the sub-components.

Data selection is the process for the identification of the variables capturing the overall phenomenon addressed by the composite index. Variables should be selected on the basis of their specificity, measurability, availability, relevance and timeliness (SMART).

Imputation of missing data is the procedure to achieve the completeness of data required for computing the index.

Normalization is performed in order to render comparable and aggregable the variables, which can be expressed through different units of measure or scales.

Weighting is a judgment process that determines the contribution of each variable to the composite index. Weighting may have significant effects on the overall composite index. The assignment of weights largely depends on societal views and political standpoints. Most composite indicators rely on equal weighting (EW), *i.e.* all variables are given the same weight. Nevertheless, even the decision to assign equal weight to all variables in defining the composite index should be the outcome of a transparent and participatory process.

[10] OECD (2008). Handbook on Constructing Composite Indicators, p. 14.

Finally, *aggregation* combines the weighted variables into one composite index. One of the most widespread aggregation procedures is the linear summation of weighted and normalized individual indicators.

Challenges in building higher-order composite indices for PGRFA

8. In building higher-order composite indices (HCIs) for PGRFA, a number of challenges requiring appropriate solutions may be identified. Each of the solutions may influence the methodological choices.

Developing HCI model without data
Although a lot of data on PGRFA have been collected by FAO most of the indicators adopted by the Commission are being used for the first time and the HCI model therefore has to be developed at a stage when no relevant data are available.

Data availability
In some cases countries may not provide the relevant data because they are not available or an indicator does not apply to them. The Reporting Format, as requested by the Commission, provides the option to countries to skip reporting on a specific indicators, e.g. because either the indicator is not applicable or relevant data are not available.

Contextualization of the indicators
In developing HCIs for each of the three targets, one faces the difficulty of defining optimum values for the 63 indicators. One of the potential limitations of the indicators adopted by the Commission is that their "optimum" values are not always obvious and not necessarily the same for all countries. For instance, the number of formal seed enterprises does not per se indicate whether or not additional seed enterprises would be beneficial within a particular socio-economic context in a particular country. Similarly, the optimum number of active crop breeders depends on a number of factors and the context. In other words "more" is not necessarily better and "less" not necessarily worse.

The proposed model for HCIs for PGRFA

9. This section proposes a model for HCIs for PGRFA taking into account the challenges identified above. The proposed model is based on relevant literature and has been developed following consultations with experts.

Theoretical framework

10. The Second GPA, its priority activities as well as the targets and indicators adopted by the Commission provide the theoretical framework for the HCIs. Each of the proposed HCIs addresses one of the three targets. Each of the 18 priority activities of the Second GPA which are characterized by a set of 63 indicators (Figure 1) contributes to one of the HCI.

Data selection

11. In order to address the potential drawbacks of the 63 indicators, uncertainties regarding data availability and data accuracy as well as the need for contextualization, the model proposes that in addition to providing the information needed to calculate the indicators, countries also provide an expert judgement on the level of achievement or implementation for each indicator. The expert judgement, it is proposed, would be provided by the National Focal Points. The data provided through the Reporting Format, including the calculation of the corresponding indicators, will continue to be essential as they will guide the NFPs in their expert judgement. The advantage of the proposed

addition of expert judgements is that they will allow to interpret and meaningfully contextualize the quantitative value of the indicators as well as the data collected for calculating them. The expert judgements will allow to mitigate the effects caused by the heterogeneity of the values of the indicators which is due to the different national and environmental contexts. This may help to increase consistency and applicability of the three HCIs, as well as their comparability across time and among countries.

Higher-order Composite Index (HCI)	**Number of priority activities**	**Number of indicators**	**Number of indicators per priority activity**	
			Min	**Max**
PGRFA Conservation	7	24	3	5
PGRFA Sustainable Use	5	20	2	5
PGRFA Institutional and Human Capacities	6	19	2	5

Figure 1. Number of priority activities and indicators for the three HCIs.

Imputation of missing data

12. In order to address the challenge derived from the potential unavailability of relevant data, the proposed model minimizes the use of *missing data* substitution procedures. As between two and five indicators are available for each priority activity of the Second GPA, indicators characterized by missing data will be simply discarded. Imputation of missing data will be performed only if a country does not provide any information in response to all the indicators of a priority activity. *Missing data* are considered as missing completely at random in the proposed HCIs because it is assumed that the reason for lack of data is unknown. The proposed model would impute missing data by means of regional unconditional median for continuous indicators or regional mode for categorical ones.

Normalization

13. In order to render comparable and aggregable the variables measured by the different indicators and to provide the contextualization needed for the development of HCIs, it is proposed that HCIs are expressed through an ordered categorical scale defined on the basis of the expert judgment regarding country performance and progress on each indicator. The expert judgements will assure the comparability of the HCIs across time periods, countries and regions.

14. The expert judgment would be expressed for each indicator on the basis of an ordered categorical scale from 1 to 9, where 1 represents the “least degree of implementation or achievement” and 9 a “full degree of implementation or achievement”. The use of a nine-categories scale is driven by the desire to simplify the use and interpretation of the indicators and HCIs. A similar scale is already applied to measure progress in the implementation of the Global Plan of Action for Animal Genetic Resources for Food and Agriculture. An average of the normalized indicators of each priority activity of the Second GPA is calculated to produce a score for the priority activity.

Weighting

15. Weighting is considered as a judgment process and it determines the contribution of each priority activity of the Second GPA to the overall HCI score. Thus, the choice of weighting schemes has a significant effect on the overall HCI. The proposed approach leaves the choice of assigning weights to the different priority activities to the Commission, even if the decision could result in setting all priorities equally important. In this context, it is noteworthy that the Commission in adopting the Second GPA refrained from prioritizing priority activities.

Aggregation

16. The weighted linear aggregation of scores of the priority activities of the Second GPA produces the HCI of the PGRFA target.

Use of the higher-order composite indices

17. The primary use of the three HCIs is to provide a simplified and concise assessment, at country, regional and global levels, of the progress towards the three PGRFA targets, as well as on the implementation of the Second GPA and its priority activities.

18. HCI scores are aggregated across FAO's Regional Groups. The simple average of the scores across countries, or alternatively, weighted averages using scale weights, such as country's total area or population, may be applied.

19. HCIs can be illustrated using simple tables of values, including for each country, individual scores computed for the 18 priority activities of the Second GPA. This will allow the monitoring of the national progress on implementation of the Second GPA for each priority activity (Figure 2). Alternatively, scores can be visualized using eight colours – three shades of red (indicating low levels of implementation), two shades of yellow (indicating medium levels of implementation) and three of green (indicating the highest levels of implementation) (Figures 3 and 4). This type of presentation can be also used to benchmark country performance over time and to conduct cross-countries or cross-regional analyses.

Further revision options

20. The main limitation of the proposed model is also its main advantage: its relative generality and simplicity. As no data for the adopted indicators are available at the moment of its conceptualization, the model has to be general enough to handle different data availability scenarios. The overall quality of the HCIs in terms of accuracy and credibility depends greatly on the quality of data reported. An analysis of the quality of data will be necessary in the future to ensure the reliability of the HCIs as well as their fitness for the intended purpose. Data quality analysis will be a permanent task. It should also be mentioned that while the proposed model is general and simple, it can be further refined and optimized in the future once the data for individual indicators have become available.

21. Data-driven techniques (e.g. factor analysis), based on the statistical properties of the collected indicators, may be further implemented to investigate HCIs robustness through a sensitivity analysis.

	PA_1	PA_2	PA_3	PA_4	PA_5	PA_6	PA_7	**HCI_1**	PA_8	PA_9	PA_{10}	PA_{11}	PA_{12}	**HCI_2**	PA_{13}	PA_{14}	PA_{15}	PA_{16}	PA_{17}	PA_{18}	**HCI_3**
CountryA	2	5	2	7	2	8	5	**4.4**	1	9	1	8	3	**4.4**	3	8	2	5	1	1	**3.3**
CountryB	6	7	5	4	1	2	7	**4.6**	2	7	7	2	2	**4.0**	3	6	1	6	5	3	**4.0**
CountryC	5	3	3	4	5	3	1	**3.4**	3	2	4	3	4	**3.2**	7	2	6	4	6	4	**4.8**
CountryD	5	1	8	8	3	2	7	**4.9**	6	6	5	2	5	**4.8**	9	6	5	2	7	8	**6.2**
CountryE	6	4	3	1	7	7	3	**4.4**	8	6	3	5	2	**4.8**	7	3	7	5	5	3	**5.0**
Country F	1	9	1	6	1	3	4	**3.6**	4	5	3	1	7	**4.0**	6	7	1	9	3	5	**5.2**
CountryG	5	5	4	6	5	4	2	**4.4**	2	1	4	5	6	**3.6**	4	5	4	7	2	6	**4.7**
Country H	1	7	6	6	1	8	2	**4.4**	8	4	2	6	3	**4.6**	1	6	7	6	5	5	**5.0**

Figure 2. Example of presentation of scores per priority activity (PA) and higher order composite indices (HCI).

Scores -Priorities and HCIs)	Indicator colour	Indicator level
1.00 - 1.99		Low-
2.00 - 2.99		Low
3.00 - 3.99		Low+
4.00 - 4.99		Medium-
5.00 - 5.99		Medium+
6.00 - 6.99		High-
7.00 - 7.99		High
8.00 - 9.00		High+

Figure 3. Scores, categories and colours for presenting the level of implementation of the Second GPA.

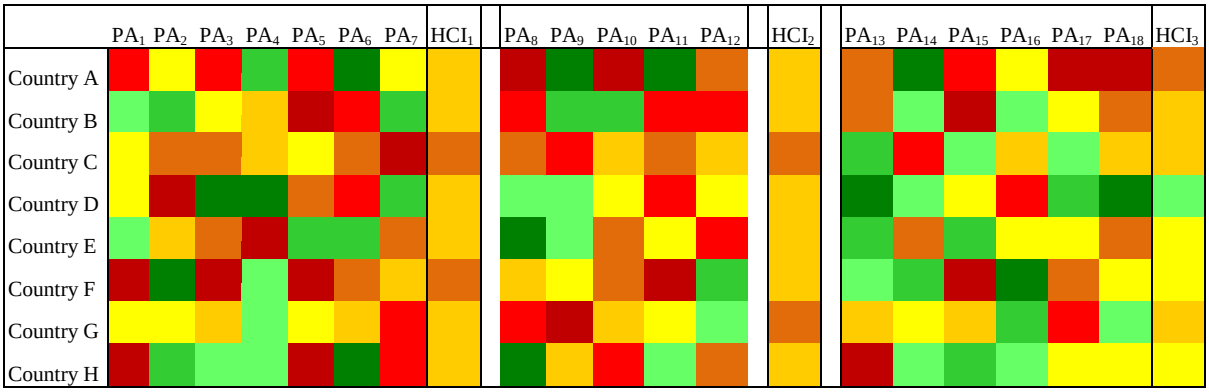

Figure 4. Example of chromatic presentation of scores for priority activities (PA) and higher order composite indices (HCI).

III. REPORTING FORMAT FOR MONITORING THE IMPLEMENTATION OF THE SECOND GLOBAL PLAN OF ACTION

22. Following the Commission's request, the Secretariat finalized the Reporting Format taking into account comments received from Member countries. Changes were made to improve the clarity of the questionnaire, to provide sufficient flexibility for reporting countries and to ensure data consistency. The Reporting Format[11] serves the purpose of guiding National Focal Points in the assessment of progress in the conservation and sustainable use of PGRFA. It reflects the need to limit the workload for countries as well as the need for robust data that allow for an adequate and efficient

[11] CGRFA/WG-PGR-7/14/Inf.4.

assessment of the status of PGRFA and the implementation of the Second GPA.[12] The Reporting Format contains 51 questions that are designed to collect the information needed to calculate the 63 indicators adopted by the Commission. The Reporting Format also asks for expert judgements in relation to the adopted indicators, which are essential for the application of the proposed three higher-order composite indices for PGRFA.

IV. UPGRADING OF THE COMPUTER APPLICATION FOR MONITORING THE IMPLEMENTATION OF THE SECOND GLOBAL PLAN OF ACTION

23. The Commission, at its last session, requested FAO to upgrade the existing computer application for monitoring the implementation of the Second GPA in order to enable the use of the relevant indicators, and to assist countries in the use of the computer application when requested.[13] In addition, it requested FAO, subject to the availability of funds, to make the upgraded computer application available in the languages in which the current version is available.[14]

24. The new computer application allows countries to report to the Commission in line with the adopted indicators and the corresponding Reporting Format. The new system is being developed under the umbrella of the World Information and Early Warning System on PGRFA (WIEWS) and will be accessible through the Internet for both data entry and retrieval. The databases of WIEWS and NISMs have been merged into an integrated database. This will produce gains for users in terms of data accessibility and availability, together with efficiencies in terms of system administration, maintenance and data management. Original functionalities of both systems, such as WIEWS institution coding for germplasm exchange and NISMs' multi-language feature have been preserved. Other features including data input, data search, dataset import and dataset export have been improved with latest available web technology and a more user-friendly and portable interface. The beta version of the computer application is presently being tested. Its public release, which will work in Arabic, Chinese, English, French, Russian and Spanish, is planned for early September 2014. Extra-budgetary resources for making it accessible in any additional language are sought.

V. PROCESS FOR MONITORING THE SECOND GLOBAL PLAN OF ACTION

25. The Commission decided that a first assessment of the implementation of the Second GPA, based on the adopted indicators, should be presented to its Sixteenth Regular Session, rather than its next session.[15] On the other hand, the Strategic Plan, as adopted by the Commission, foresees a review of the implementation of the Second GPA for the Commission's next session.[16]

26. Given this inconsistency, FAO decided to proceed as follows:

- During a two-months pilot phase the Reporting Format and the computer application will be tested. The pilot phase will commence on 15 September 2014. Participation by countries in the pilot phase is voluntary. The data generated during the pilot phase will subsequently be used to test the feasibility of higher-order composite indices for PGRFA. This may facilitate the refinement of the indices.
- The official reporting process on the implementation of the Second GPA will be initiated on 30 November 2014 and countries will be asked to report to FAO, using the Reporting Format, by 1 July 2015, on the implementation of the Second GPA. The implementation assessment which will be based on the monitoring reports submitted by countries will be made available to the Eighth Session of the Working Group and, subsequently, to the Commission's Sixteenth

[12] To the possible extent it acknowledges other existing data sources applying international standards and makes provision for them to be incorporated without additional workload.

[13] CGRFA-14/13/Report, paragraph 26.

[14] CGRFA-14/13/Report, paragraph 26.

[15] CGRFA-14/13/Report, paragraph 101.

[16] CGRFA-14/13/Report, *Appendix I*, Table 1.

Regular Session, as foreseen in *Table 1* which the Commission endorsed at its Fourteenth Regular Session.

- For the forthcoming Fifteenth Session, a document on the implementation of the Second GPA will be prepared which will report on FAO activities in support of the implementation of the Second GPA, including on the development of composite indices.

Table 1: Monitoring the implementation of the Second GPA and preparing *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture*

Reports to the Working Group and the Commission	**Information sources**	**Timeline**		
		ITWG-8 2016 **CGRFA-16 2017**	**ITWG-9 2018** **CGRFA-17 2019**	**ITWG-10 2020** **CGRFA-18 2021**
Second GPA implementation assessment	Data provided through NISM or other sources on the basis of agreed indicators			
Report on feasibility of composite indices for PGRFA				
Third Report	Data provided through NISM or other sources on the basis of agreed indicators, country reports and thematic studies and other relevant sources			

27. A Circulate State Letter inviting countries to confirm/appoint national focal points for reporting on the implementation of the Second GPA and the preparation of country reports contributing to the Third Report has been sent to all members of the Commission in August 2013. As per April 2014, 70 countries have designated a national focal point.[17]

VI. GUIDANCE SOUGHT

28. The Working Group is invited to:

- Review, and revise as necessary, the proposed model for building the HCIs and to recommend their endorsement by the Commission;
- Recommend that the Commission calls for extra-budgetary funds to support countries in establishing/strengthening their NISMs for monitoring the implementation of the Second GPA and to make the upgraded computer application available in all the languages in which the version for the first GPA is available; and
- Recommend that the Commission invite all countries that have not yet done so to nominate a National Focal Point for reporting on the implementation of the Second GPA and contributing to the preparation of the Third Report.

[17] CGRFA/WG-PGR-7/14/4 Preparation of *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture*