Policies, programmes and activities related to biodiversity for food and agriculture

Reports from international instruments and organizations

1. Contact information

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<tr>
<th>Name and position of respondent</th>
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<tr>
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<tr>
<td>Geographical coverage of your organization</td>
<td>GLOBAL</td>
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2. Components of biodiversity for food and agriculture covered by your organization

Note: For a complete definition refer to Annex 1 of: http://www.fao.org/nr/cgrfa/biodiversity/guidelines/en/

Sectoral genetic resources for food and agriculture

- Animal genetic resources [✓]
- Aquatic genetic resources [ ]
- Forest genetic resources [ ]
- Plant genetic resources [✓]

Associated biodiversity of relevance to food and agriculture

- Micro-organisms (including bacteria, viruses, protists and fungi) [✓]
- Invertebrates (including insects, spiders, worms) [✓]
- Vertebrates (including amphibians, reptiles and non-domesticated birds and mammals) [ ]
- Wild and cultivated terrestrial and aquatic plants other than crop wild relatives [ ]
Please provide details on the components of biodiversity for food and agriculture involved (species, breeds, varieties):

The Joint FAO/IAEA Division supports member states on the biodiversity of livestock including cattle, buffalo, sheep, goat, camel and chicken as part of its continuing efforts towards implementation of the "Global plan of action on Animal Genetic Resources". In addition, the Joint FAO/IAEA Division supports enhancing biodiversity in soils, especially through work on legumes and pulses, which support a large and diverse population of soil organisms.

PRIORITY AREA 1: ASSESSMENT AND MONITORING

1. Does your organization implement or support the implementation of projects or programmes that contribute to the assessment of the status of biodiversity for food and agriculture?

   Yes 🆓
   No ☐

If yes, please provide details on the countries and species involved and indicate whether the population trends of these species are monitored:

The Joint FAO/IAEA Division has been implementing coordinated research (CRPs) and technical cooperation (regional and national TCPs) projects to assess the current status of phenotypic and genetic diversity of various livestock species in 34 countries. This includes assessment of genetic diversity of 68 sheep breeds, 40 goat breeds, 19 cattle breeds, three buffalo breeds and 17 chicken populations located across Asia, Africa, Europe and Latin America (Albania, Angola, Argentina, Armenia, Austria, Bangladesh, Bosnia and Herzegovina, Bulgaria, Burkina Faso, China, Croatia, Ethiopia, Greece, Hungary, India, Indonesia, Iran, Iraq, Jordan, Kazakhstan, Macedonia, Madagascar, Montenegro, Romania, Myanmar, Peru, Pakistan, Serbia, Sri Lanka, Syria, Turkey, Viet Nam, Yemen and Zambia).

2. Is your organization involved in surveying and monitoring population sizes of and/or threats to associated biodiversity species that are known to contribute to regulating or supporting ecosystem services in and around agricultural and food production systems?

   Yes ☐
   No 🆓

If yes, please provide details on the countries and species and ecosystem services involved:

3. Is your organization involved in surveying and monitoring population sizes of and/or threats to wild food species?

   Yes ❌
   No 🆓

If yes, please provide details on the countries and species involved:
4. Has your organization identified major obstacles to assessing and monitoring components of biodiversity for food and agriculture that are part of its mandate?

Yes ☐

No ☐

If yes, please list these obstacles, being as specific as possible regarding the species involved:

1. Inadequate number of skilled personnel available to assess phenotypic and genetic diversity of livestock.
2. Unavailability of breed specific census data resulting in lack of information on population status, breed distribution, etc.
3. Information on clearly defined phenotypes of many geographically isolated populations/breeds within a region is limited.
4. Lack of pedigree and performance records to assess breeds in small holder production systems
5. Lack of simple production system specific questionnaire to collect information on breeds
6. Lack of adequate resources in terms of infrastructure, equipment and funding for DNA analysis including genotyping, sequencing, etc.
7. Lack of awareness among National stakeholders on the importance of evaluation of local animal genetic resources

5. What are the priority measures that need to be taken to address these obstacles?

1. Increase awareness among national stakeholders (national livestock breeding departments, breed organizations, government agencies) on livestock biodiversity.
2. Technical support to member states on assessment and monitoring of genetic diversity of livestock breeds need to be improved/strengthened.
3. Breed-wise census of livestock
4. Training of personnel from member states and capacity building

6. Please describe any additional activities relevant to the implementation of Priority area 1: Assessment and monitoring

The Joint FAO/IAEA Division is implementing programs (CRPs and TCPs) aimed at identification, genetic characterization and improvement of sheep in Sudan and cattle in Bangladesh, Burkina Faso, Madagascar and Papua New Guinea.

CIAT/PBGL project on cassava: ecotilling of genotype collection for identification of variation in starch synthesis relates genes.

IAEA TC Project on Microbial biotechnology to improve cultivation of cowpea. This project will be assessing microbial characterization to study the competitive ability of rhizobia strains in soils. In previous IAEA projects involving Benin, Brazil, Egypt, Kenya, Mexico, Pakistan, Senegal and Thailand, bacterial strains (Rhizobia leguminosarum, Rhizobium tropici, R.etli etc) and their population trends have been monitored in the soil.

PRIORITY AREA 2: CONSERVATION AND SUSTAINABLE USE

Conservation

1. Does your organization take or support actions to protect components of biodiversity for food and agriculture that are at risk from climate change, invasive alien species and natural or human-induced disasters?

Yes ☐

No ☐
If yes, please provide details on the countries and species involved, the actions taken, the impacts and the lessons learned:

IAEA projects in SSA on conservation agriculture and microbial biotechnology to improve productivity and adaptation of legumes to climate change. In Benin, improving biodiversity through increase in microbial population which enhances soil fertility has resulted in 50% increase in yield of soybean, groundnut and maize. Drought and low nutrient availability can seriously affect microbial population. Similarly, increase rhizobium population can be achieved through the use of bio fertilizers (Inoculum) in soil and increased cultivation of legumes.

2. Does your organization implement or support the implementation of conservation measures for associated biodiversity and/or wild food species?

*In situ*

Yes ●

No ○

*Ex situ*

Yes ●

No ○

If yes, please provide details on the countries, measures and species involved:

IAEA's work in SSA support conservation measures such as provision of organic cover, optimal nutrient additions and the addition of diverse organic amendment.

3. If your organization maintains *ex situ* collections of biodiversity for food and agriculture components could you please provide further information on these collections?

Animal Production and Health Laboratory (APHL) of the Joint FAO/IAEA Division is maintaining a repository of genetic material (DNA) from indigenous livestock breeds. At present, about 7000 DNA samples collected from more than 100 breeds of various livestock species including cattle, sheep, goat, chicken, Alpaca and pig are maintained under cold storage. Information on all these DNA samples have been documented. The repository helps to improve collaborative animal genetic research through sharing of samples under appropriate material transfer agreement among collaborators from different member states.

4. Has your organization identified major obstacles to enhancing the conservation of biodiversity for food and agriculture, and in particular of associated biodiversity and wild foods?

Yes ●

No ○

If yes, please provide details:

- Lack of appropriate guidelines and protocols for establishing and maintaining National Livestock Gene Banks
- Lack of infrastructure for maintenance of National Livestock Gene Banks and storage of germplasm
- Lack of funding for in situ as well as ex situ conservation of endangered animal breeds
- Lack of ability to provide vegetative cover and organic amendment due to poor soil health, and impact of climate change.

5. What are the priority measures that need to be taken to address these obstacles?

Formulation of guidelines and standard operating procedures (SOPs) for establishment and maintenance of livestock gene banks
Adequate funding to establish infrastructure for livestock gene banks
Increase vegetative cover by soil amendments to enhance soil health.

**Sustainable use**

6. **Does your organization promote management practices that support the maintenance and use of biodiversity for food and agriculture?**

Note: For examples of such practices, please refer to Annexes 5 and 6 of http://www.fao.org/nr/cgrfa/biodiversity/guidelines/en/

![Yes](X)

*No* [ ]

If yes, please provide details on the countries and practices involved:

The Joint FAO/IAEA-Animal Production and Health Subprogramme (APHS) is supporting national efforts towards genetic improvement and sustainable utilization of indigenous breeds adapted to local production systems through the implementation of (1) Electronic animal identification systems and performance recording under low external input production systems (2) Modern biotechnological tools to improve animal reproduction and dissemination of superior germplasm (3) Application of genomic tools for selective animal breeding. IAEA provides continued support to strengthen and improve national artificial insemination services utilizing the genetically superior bulls available from the indigenous breeds (dissemination of superior germplasm). Some of the examples of IAEA support to indigenous livestock breeds in various countries are:

- Madagascar - Malagasy Zebu cattle
- Myanmar - Pyar Zein, Shwe Ni and Shwe Ni Gyi cattle
- Zambia - Angoni, Barotse and Tonga cattle
- Burkina Faso - Sahelian goat, Azawak cattle, White Fulani cattle
- Sierra Leone - Red Fulani and Kori cattle
- Jordan - Awassi sheep

Further, IAEA supported member state efforts to preserve and respect indigenous livestock production systems and associated traditional knowledge and practices related to animal genetic resources; Some of the examples include (1) IAEA-Technical Cooperation Project supported Tanzania in its efforts to preserve and improve livestock among Masai tribes in Ngorongoro Conservation Area (2) Technical support and training on artificial insemination of Yak maintained under nomadic and semi-nomadic pastoral system in Mongolia (3) Training and support for artificial insemination technology in cattle maintained by Fulani tribes in Sierra Leone

The Joint FAO/IAEA Division works to improve biodiversity in crops using innovative methods, and increasing the availability of staple products especially local plant varieties and resilience to climate change and extreme weather conditions. Since 1950, over 3200 mutant varieties from over 220 plant species have been officially released in over 70 countries (http://mvd.iaea.org/). Their value is measured in billions of dollars and millions of cultivated hectares. The activities of mutation breeding projects supported by the Joint FAO/IAEA Division can be reproduced by any institute that has a functional crop breeding programme.

The application of mutation breeding is commonplace as regards to the crop type and target trait. It is particularly interesting for the improvement of local varieties that are the basis for the farmer's income. In the frequent case of non-availability or non-accessibility of an irradiation facility in a country, the Joint Division assists with its cost-free irradiation service for the initial step of mutation induction. Protocols, guidelines, and manuals published by the Joint Division contribute to smooth transfer of the technology, often supported by expert visits. Mutation breeding is cost-effective and usually does not require large additional investments. This technology accelerates the plant breeding process by producing desired traits, while preserving most of the genetic background of the adapted or existing commercial varieties or preferred local landraces. It is environmentally friendly and increases the diversity of desired traits in important crops. Mutation breeding can be also applied in vegetatively propagated crops, such as banana or cassava, which often are characterized by their narrow genetic bases. Since crops developed by mutation breeding are not subject to regulations such as GMOs, the application of the technology is non-restrictive.

In addition, IAEA provides technical advice and training on the use of legumes species and Rhizobium strains to maintain the population of essential bacteria in soils; and the practice of conservation agriculture.

7. **Does your organization promote the application of ecosystem, landscape and/or seascape approaches?**

![Yes](X)

*No* [ ]
No  

If yes, please provide details on the countries and approaches involved:

IAEA activities related to Soil-Crop-Livestock system with focus on nutrient recycling across soil, plants and animals, Genotype X Environment interaction and optimal breed that is adapted for a particular production system.

8. Does your organization implement or support the implementation of projects or programmes on the use of biodiversity for food and agriculture to cope with climate change, invasive alien species, or natural or human-made disasters?

Yes  

No  

If yes, please provide details:

In 2015 the Joint Division supported national and regional plant breeding programs through 72 IAEA Technical cooperation projects (25 national and regional projects in Asia and the Pacific, 32 national and regional in Africa, 6 national and regional in Europe and Central Asia, 7 national and regional in Latin America and the Caribbean) and 6 Coordinated Research Projects (R&D networks) in 99 Member States. Most of the target traits for improvement are related to abiotic and biotic stresses that are affected by climate change. PGBL and SWMCN develop technologies and protocols to select from populations with induced diversity for tolerance/resistance to such stresses. APHL is also conducting a CRP on “Genome characterization of Local animal breeds to better understand parasite resistance”. Ten countries are participating in the project.

9. Does your organization implement or support the implementation of projects or programmes on the maintenance and use of traditional knowledge of associated biodiversity and wild foods?

Yes  

No  

If yes, please provide details:


10. Has your organization identified any major obstacles to improving the sustainable use of biodiversity for food and agriculture, and in particular of associated biodiversity and wild foods?

Yes  

No  

If yes, please list and describe them:

Lack of national breeding policy and inadequate breeding strategies for improved production of local animal breeds in some member states.
Lack of institutional framework to provide efficient animal breeding services
Lack of infrastructure to produce required doses of germplasm and poor artificial insemination coverage in dairy cattle
Lack of systematic identification of superior merit bulls for sustainable genetic improvement of target breeds in livestock.
Lack of animal identification systems and field performance recording in low input, small holder production systems

A major obstacle to improving soil biodiversity has been attributed to low nutrient (phosphorus) availability. Soil management practices to enhance phosphorus availability has helped to improve the sustainable use of biodiversity.
11. What are the priority measures that need to be taken to address these obstacles?

| 1. Advocacy to formulate national and regional animal breeding policy (with focus on agroclimatic and agroecological regions) within country |
| 2. Formulation of effective strategies for breeding local animal breeds with focus on well defined trait(s) |
| 3. Strengthening institutional framework and infrastructure to improve artificial insemination coverage and delivery of animal breeding services |

**Access and benefit-sharing**

12. Does your organization contribute to the development of mechanisms to improve access to and ensure the fair and equitable sharing of benefits arising from the utilization of biodiversity for food and agriculture?

- Yes [ ]
- No [ ]

If yes, please provide details on the countries, mechanisms and species involved:

The Joint Division maintains updates and develops the Joint FAO/IAEA Mutant Variety Database (MVD), currently harbouring information on more than 3200 officially or commercially released mutant varieties from more than 200 plant species worldwide. A modernized version of MVD was published in 2015 (http://mvd.iaea.org/#IHome).

13. Please describe any additional activities relevant to the implementation of Priority area 2: Conservation and sustainable use.

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**PRIORITY AREA 3: POLICIES, INSTITUTIONS AND CAPACITY**

1. Does your organization support countries in developing, reviewing and adjusting their national policies affecting the conservation and sustainable use of biodiversity for food and agriculture, and in particular of associated biodiversity and wild foods?

- Yes [ ]
- No [ ]

If yes, please provide details and specify the countries involved:

The Joint FAO/IAEA Division provided technical assistance to Burkina Faso, Myanmar, Madagascar, Zambia, Angola and Sierra Leone on breeding of cattle for milk, meat and draught. The Joint FAO/IAEA Division supports MSs with expertise to NARS on sustainable use of biodiversity through expert missions, training courses and planning CPFs.
2. Does your organization contribute to the development of regulatory frameworks or legislation for biodiversity for food and agriculture, and in particular for associated biodiversity, wild foods and ecosystem services?

Yes [ ]
No [ ]
If yes, please provide details and specify the countries or regions involved:

3. Does your organization collaborate with other stakeholders involved in the management of biodiversity for food and agriculture (e.g. farmers, fisher folk, forest dwellers, the breeding industry, government agencies, research institutes and civil society organizations)?

Yes [ ]
No [ ]
If yes, please provide details:

The Joint FAO/IAEA Division collaborates with various stakeholders within member states like Animal Husbandry Department, Livestock Breeding Departments, Breed associations and University/Institutional laboratories and facilitates interaction among them, particularly in improving the value chain on delivery of animal breeding services (Animal identification, field performance recording, identification of right bull/breeding male, semen collection, freezing of semen, semen evaluation, cold chain maintenance, delivery of AI service; radio immuno assays to estimate progesterone levels for early detection of non-pregnant animals)
We work with a wide range of stakeholders involved in food and agriculture, including R&D organizations (national and international), farmers, consumers, associations, government agencies, etc. Network with research institutes through Coordinated Research Projects, and international organiztions, such as CIAT, Bioversity International, World Coffee Research, PROMECAFE / IICA, IRRI.

4. Does your organization implement or support the implementation of programmes to increase public awareness on the roles and values of associated biodiversity and ecosystem services in and around food and agriculture production systems?

Yes [ ]
No [ ]
If yes, please provide details:

5. Does your organization implement or support the implementation of training or capacity-building programmes for the management of associated biodiversity and ecosystem services in and around food and agriculture production systems?

Yes [ ]
No [ ]
If yes, please provide details and specify countries involved:

The Joint FAO/IAEA Division conducts group training and individual fellowship training courses on genetic characterization of indigenous animal genetic resources and bioinformatics analysis of sequence and genotype data. During the last five years, a total of 109 participants from more than 25 countries were trained through 1-2 weeks of group training courses. 21 participants from more than 15 countries were also provided individual fellowship training for the duration of 2-3 months on specific topics at Animal Production and Health Laboratory (APHL), IAEA, Seibersdorf. Apart from this, more than 100 personnel have been trained on Livestock data collection and analysis, DNA marker tools for genetic characterization and artificial insemination in large and small ruminants through National Training courses in several IAEA member states including but not limited to Burkina Faso, Madagascar, Myanmar, Jordan and Thailand.

6. Has your organization identified priorities for future capacity-building and education on associated biodiversity and ecosystem services in and around food and agriculture production systems?

Yes ☐
No ☐

If yes, please provide details:

1. Genetic Characterization of Livestock Breeds
   (a) Molecular genetic characterization of livestock breeds using genome-wide markers
   (b) Analysis of Next Generation sequence data to identify genome wide markers
   (c) Analysis of high throughput SNP data for evaluating genetic structure of livestock populations

2. Animal Identification using electronic devices and performance recording under field conditions
3. Genomic tools for selective animal breeding
4. Modern biotechnological tools to improve animal reproduction and dissemination of superior germplasm
5. Improvement of artificial insemination services (Tools for early pregnancy diagnosis, infertility management, etc.)

7. Please describe any additional activities relevant to the implementation of Priority area 3: Policies, institutions and capacity.


PRIORITY AREA 4: REGIONAL AND INTERNATIONAL COOPERATION

1. Has your organization contributed to the establishment or strengthening of regional and international research and/or education programmes to assist countries to better manage biodiversity for food and agriculture?

Yes ☐
No ☐

Please provide details:

The Joint FAO/IAEA Division contributes to the establishment and strengthening of regional and international research programmes through its coordinated research projects and regional technical cooperation projects. With respect to livestock biodiversity, two coordinated research projects involving 19 countries have been completed and one coordinated research
project involving ten countries has been initiated recently. One regional technical cooperation project targeting capacity building on animal genetic resources in West Asia has been implemented (2012-2015) and a regional project to improve the host resistance to gastro-intestinal parasites in the indigenous sheep breeds of Latin America is currently ongoing. Apart from this, the Joint FAO/IAEA Division cooperates with CGIAR institutions like International Livestock Research Institute, Nairobi, Kenya and other regional organizations like Inter African Bureau of Animal Resources to strengthen capacities on animal genetic resources in Africa.

JD supports capacity building in the IAEA Member States in the area of food and agriculture through their Technical Cooperation program which involves both human and in country infrastructure capacity building. In 2015 the Joint Division supported national and regional plant breeding programs through 72 IAEA Technical cooperation projects (25 national and regional projects in Asia and the Pacific, 32 national and regional in Africa, 6 national and regional in Europe and Central Asia, 7 national and regional in Latin America and the Caribbean) and 6 Coordinated Research Projects (R&D networks) in 99 Member States. A total of 337 trainees were trained. Plant Breeding and Genetics Laboratory trained 33 fellows, 19 scientific visitors, 16 interns and organized 4 training courses/workshops.

2. Has your organization contributed to the establishment or strengthening of regional and international programmes to assist countries to obtain training and technologies or develop information systems related to biodiversity for food and agriculture and related ecosystem services?

- Yes  
- No  

Please provide details:

The Joint FAO/IAEA Division routinely organizes regional group training and individual fellowship training courses to enhance and build capacities of developing member states in the areas of Evaluation, Characterization, Improvement and Sustainable Utilization of Animal Genetic Resources.

3. Please describe any additional activities relevant to the implementation of Priority area 4: Regional and international cooperation

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