# The Second Report

**On the**

## State of the World's Animal Genetic Resources for Food and Agriculture

**Including sector-specific data contributing**

**To**

**The State of the World's Biodiversity for Food and Agriculture**

**2014**


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**(Indian Council of Agricultural Research)**
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## I. EXECUTIVE SUMMARY

Livestock sector is an integral part of India and this sector contributes significantly to the national economy and to socio-economic development of the country. India has a repository of large number of domesticated mammalian and avian breeds developed over a long time in varying agro-climatic conditions and production systems. They provide milk, meat, egg, fibre, wool, leather, work power and organic fertilizers to agriculture and employment to rural masses as well as many stakeholders engaged in management and improvement of these resources. Livestock products are the major source to ensure food and nutritional security to millions of people. The value of output from livestock sector at current prices during 2011-12 has been estimated as Rs. 4590.50 billion, which includes Rs. 3054.8 billion from milk group, Rs. 836.4 billion from meat group, Rs. 178.03 billion from egg, Rs. 4.52 billion from wool and Rs. 318.5 billion from dung.

India is the largest producer of milk in the world and this production has reached to 132.4 mmt during 2012-13 with per capita per day availability of 290 g. Share of milk from exotic / crossbred cattle, indigenous cattle, buffalo and goat is 24.3, 20.9, 51.1 and 3.8 percent, respectively. During the eleventh five year plan (2007-08 to 2011-12), overall annual growth rate in milk production was observed as 4.51%. The egg production in India has reached to 69.4 billion eggs with per capita per annum availability of 55 eggs. Egg production from 1999-2000 onwards has achieved overall annual growth rate 6.69%. The meat production in India has reached to 5.5 mmt during 2012-13. Meat is mainly contributed by cattle, buffalo, sheep, Goat, pig and chicken. During the eleventh five year plan (2007-08 to 2011-12), overall annual growth rate in meat production was observed as 8.44%. The wool production of the country has been recorded as 46.1 million kg.

India is a country which possesses breeds of almost all the mammalian and avian species domesticated in Asia and it harbours a good number of indigenous breeds of livestock and poultry. These valuable animal genetic resources, developed over a period of thousands of years through natural selection and human intervention, are well adapted to their respective habitat. Till 2012, National Bureau of Animal Genetic Resources, Karnal has registered 37 breeds of cattle, 13 breeds of buffalo, 23 breeds of goat, 39 breeds of sheep, 6 breeds of horses and ponies, 8 breeds of camel, 15 chicken breeds, 2 pig breeds and one donkey breed in the country. For the genetic improvement of these livestock resources, attempts were made to import exotic germplasm which resulted into dilution of Indian local breeds. The adaptation of temperate exotic breeds needed more scientific management under tropical climate of India. There has been a change in the utility pattern of these genetic resources, which has created a stiffer competition to the local breeds for their survival.

Therefore, genetic erosion is a problem of national and international concern and a number of local breeds are at the risk of extinction.

Maintenance and management of this valuable vast diversity has become a major challenge as most of these breeds are low producers, facing genetic dilution due to many factors like increasing mechanization of agriculture, over emphasis on some high producing breeds, market forces and many unforeseen factors in different parts of the country. Therefore, there is a need for every country to develop their plans for conservation and sustainable utilization of vastly distributed farms animal breeds by utilizing available technologies for their management. Further, shrinkage in grazing land and unavailability of breeding males of known genetic merit are resulting into dilution and depletion of animal genetic resources.

At present, priority is being given to characterization and evaluation of animal genetic recourses. Surveys are being conducted in the breeding tracts through a network approach by involving various agencies. Conservation of various breeds both *in-situ* and *ex-situ* has also been taken up. Programmes for the genetic improvement of breeds are undertaken. Livestock Development Boards are being set up in each state to boost these activities. Priority areas for further understanding of AnGR include breed-wise livestock census with appropriate basic population data to monitor status of breeds, formation of Breed Societies, adequate training facilities for proper manpower development, awareness creation among stake holders as well as masses, breeding policies for vertical genetic improvement and conservation. Critical Gaps for management of animal genetic resources include lack of legislation for registration and management of AnGR and protection of animal keepers' rights, Lack of National/ Regional Focal point, lack of adequate breeding males of high genetic merit, under utilization of most of the native AnGR due to limited knowledge of their attributes, lack of national and regional gene banks with adequate facilities of germplasm storage, lack of recording system at grass root level, lack of basic and advance population statistics for developing the early warning and response system for AnGR, lack of breeding programmes separately for livestock reared under different production systems, shrinkage in grazing land, lack of effective and efficient marketing channel especially for small holders.

Indian Council of Agricultural Research has constituted a National Advisory Board to develop the guidelines for Management of Genetic Resources which also includes a chapter on guidelines for management of Animal Genetic Resources. Likewise, India is in process to develop National Plan of Action for animal genetic resources which may be useful for the state animal husbandry agencies for developing strategies and programmes for management of animal genetic resources in their respective states.

## II. DATA FOR UPDATING THE PARTS AND SECTIONS OF THE STATE OF THE WORLD'S ANIMAL GENETIC RESOURCES FOR FOOD AND AGRICULTURE

FLOWS OF ANIMAL GENETIC RESOURCES

1. Studies of gene flow in animal genetic resources have generally concluded that most gene flow occurs either between developed countries or from developed countries to developing countries. Does this correspond to the pattern of gene flow into and out of your country? (yes/no/yes but with some significant exceptions)

Yes

1.1. If you answer "no" or "yes but with some significant exceptions", please provide further details. Please include information on: which species are exceptions and which regions of the world are the sources and/or destinations of the respective genetic material. (Text)

There are no exceptions as such, however, the country has laid down certain guidelines for import and export of germplasm including the veterinary health certification which need to be met with while importing or exporting.

2. Have there been any significant changes in patterns of gene flow in and out of your country in the last ten years? (Yes/no)

NO

2.1. If yes, please indicate whether this view is based on quantified data (e.g. import and export statistics collected by the government) (yes/no)

NA

2.2. If yes, please provide references (preferably including web links) (if relevant, indicate which types of animal genetic resources are covered). (Text)

NA

2.3. Please also describe the changes, indicating the species involved, the direction of the changes, and the regions of the world to and from which the patterns of imports and exports have changed. (text)

NA

3. Please describe how the patterns of gene flow described under Questions 1 and 2 affect animal genetic resources and their management in your country. (Text)

Production has increased due to increase in population of crossbred cattle, sheep, pig, and poultry

**LIVESTOCK SECTOR TRENDS**

4. Please indicate the extent to which the following trends or drivers of change have affected or are predicted to affect animal genetic resources and their management in your country and describe these effects. (Score: none, little, medium, high)

| Drivers of change | Impact on animal genetic resources and their management over last ten years (score) | Future impact on animal genetic resources and their management (predicted for the next ten years) (score) | Describe the effects on animal genetic resources and their management (text) |
|---|---|---|---|
| Changing demand for livestock products (quantity) | Medium<br><br>High in Poultry | Medium<br><br>High in Poultry | Demand in milk, meat and egg has increased due to increase in human population, improved income and awareness about animal products in the country, this has resulted changing utility pattern of AnGR e.g. cattle for milk instead of draft, sheep for meat and milk instead of wool, and increased demand for goat meat & milk. Due to infrastructural development, the utility of pack animals has also been reduced. In yak the population size is marginally increased obviously due to better management. The utility of AnGR for food is likely to be increased in future. The breeds for agriculture and pack purpose will face stiffer competition from the breeds used for food production.<br><br>Gradual replacement of Indigenous poultry with crosses or purely commercial poultry. |
| Changing demand for livestock products (quality) | Little<br><br>Medium in Poultry | Little<br><br>High in Poultry | Due to increase in purchasing power of people the quality of livestock food production is improving and likely to be further improved in future. The draft, transport and pack utility is reducing due to availability of mechanical alternates. However, fast increasing prices of the petroleum products might bring small and marginal stakeholders back to using AnGR for draft purposes.<br>This is likely to promote saving of the draft breeds and the breeds producing quality products e.g. A2 type milk.<br><br>Gradual replacement of Indigenous poultry with crosses or purely commercial poultry. |
| Changes in marketing infrastructure and access | Little<br><br>Medium in Poultry | Little<br><br>High in Poultry | Presently there is increase in infrastructural facilities and better access to milk and food products from livestock. This might lead to use of few highly productive breeds which is likely to adversely affect the low producing but adapted breeds. |
| Changes in retailing | Little<br><br>Medium in Poultry | Little<br><br>High in Poultry | Presently there is increase in infrastructural facilities and better access to milk and food products from livestock. This may lead to use of few highly productive breeds which might adversely affect the low producing breeds. |
| Changes in international trade in animal products (imports) | None | None | - |

| | | | |
|---|---|---|---|
| Changes in international trade in animal products (exports) | None | Little | Increased knowledge of the quality of indigenous cow milk and use of buffalo meat and milk & its products, might provide opportunity for increased export. |
| Climatic changes | None | Little | Overall there will be marginal impact of climate change on indigenous breeds of livestock except in the breeds reared at high altitude (Yak) and deserts (Camel). |
| Degradation or improvement of grazing land | Medium | High | Since majority of Indian AnGR are kept under crop-livestock-production system, therefore, degradation of grazing land might adversely affect AnGR of the country. |
| Loss of, or loss of access to, grazing land and other natural resources | Medium | High | Shrinkage of grazing land or loss of access to the grazing land and change in land use pattern are adversely affecting the survival of AnGR kept under extensive system. This is likely to further intensify in future. |
| Economic, livelihood or lifestyle factors affecting the popularity of livestock keeping | Medium | High | • New generations are losing interest towards livestock keeping because of changes in lifestyle aspirations and alternate opportunities available in the country in the recent past.<br>• Livestock keeping is becoming less profitable.<br>• Average herd / flock size is decreasing. |
| Replacement of livestock functions | Medium | Medium | Due to mechanization in agriculture, transportation, shift in utility has been noticed in all livestock species. |
| Changing cultural roles of livestock | Little | Medium | Old traditions are losing ground. |
| Changes in technology | Little | Medium | Scientific reproduction and health management is being adopted by more number of livestock keepers. |
| Policy factors | Little | Medium | • Implementation of policy becomes difficult in small herd / flock size in country.<br>• Ban on grazing land.<br>• Up-gradation by a superior breed to other breeds/populations within a species.<br>• Due to crossbreeding some of the indigenous breeds are losing ground |
| Disease epidemics | Little | Little | Less number of epidemics are encountered due to improved health services but poultry is much affected by epidemics. |

## OVERVIEW OF ANIMAL GENETIC RESOURCES

5. Please provide the number of locally adapted and exotic breeds kept in your country. (Number of breeds)

| Species | Number of breeds | |
|---|---|---|
| | Locally adapted breeds | Exotic breeds |
| Cattle (specialized dairy) | 5 | 2 |
| Cattle (multipurpose) | 32 | 0 |
| Buffalo | 13 | 0 |
| Sheep | 39 | 3 |
| Goats | 23 | 2 |
| Pigs | 2 | 4 |
| Chickens | 15 | 7 |
| Ducks* | 0 | 2 |
| Horse and Pony | 6 | 1 |
| Donkey | 1 | 2 |
| Camel | 8 | 0 |
| Yak* | 0 | 0 |
| Mithun* | 0 | 0 |
| Rabbit* | 0 | 3 |

* Registered breeds are not available

### CHARACTERIZATION

6. Please provide an overview of the current state of characterization in your country by indicating the extent to which the activities shown in the following table have been carried out. (surveying and monitoring: [first two columns] number of breeds; characterization [columns 3 to 8]: categories (score: none; low [approximately <33%]; medium [approximately 33–67%]; high [approximately >67%]).

| Species | Baseline survey of population size | Regular monitoring of population size | Phenotypic characterization | Molecular genetic diversity studies – within breed | Genetic diversity studies based on pedigree | Molecular genetic diversity studies – between breed | Genetic variance component estimation | Molecular genetic evaluation |
|---|---|---|---|---|---|---|---|---|
| Cattle (specialized dairy) | Medium | Low | High | High | Low | High | Low | None |
| Cattle (multipurpose) | Medium | Low | High | High | Low | High | Low | None |
| Buffalo | Medium | Low | High | High | Low | High | Low | None |
| Sheep | Medium | Low | High | High | Low | Medium | Low | None |
| Goats | Medium | Low | High | High | Low | High | Low | None |
| Pigs | Medium | Low | Medium | Medium | None | Low | None | None |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Chickens | Medium | Low | High | High | Low | Medium | None | Low |
| Ducks | Medium | Low | None | Medium | None | Medium | None | None |
| Horse and Pony | Medium | Low | High | Medium | None | Medium | None | None |
| Donkey | Low | None | Low | Low | Low | None | Low | None |
| Camel | Medium | Low | Medium | Medium | Low | None | Medium | None |
| Yak | Medium | Medium | Low | Low | Low | None | Low | None |
| Mithun | Medium | Medium | Low | Low | Low | None | Low | None |
| Rabbit | Low | Low | Low | None | None | None | Low | None |

**INSTITUTIONS AND STAKEHOLDERS**

7. Please indicate the state of your country's capacities and provisions in the following areas of animal genetic resources management. (Score: none, low, medium, high)

| Institutional assessment | Score |
|---|---|
| Education | Medium |
| Research | Medium |
| Knowledge | Medium |
| Awareness | Low |
| Infrastructure | Low |
| Stakeholder participation | Low |
| Policies | Medium |
| Policy implementation | Low |
| Laws | Low |
| Implementation of laws | Low |

8. Please provide further information regarding your country's capacities in each of the above-mentioned areas of management. If relevant, please indicate what obstacles or constraints your country faces in each of these areas and what needs to be done to address these constraints. You may also provide information on any particular successes achieved in your country in any of these areas and on the reasons for these successes. (Text)

| Capacities | Description |
|---|---|
| Education | Good network of National, provincial, NGO and private education institutes for veterinary and animal sciences |
| Research | Good network of National, provincial, NGO and private research institutes for veterinary and animal sciences |
| Knowledge | Knowledge of the stakeholder is Low due to limited infrastructure facilities and medium education |
| Awareness | Training, Livestock shows, farmers meeting, Health camps, demonstrations are improving the awareness among stakeholders but up to a limited extent. |
| Infrastructure | Inadequate, especially in terms of marketing facilities |

| | |
|---|---|
| Stakeholder participation | Limited stakeholders' participation and animal keeper's organization due to small herd / flock size and large number of animal keeper's |
| Policies | Livestock policies at National and Provincial levels are in place. However, conservation policy and specific breeding policy under different production system are under preparation |
| Policy implementation | In absence of adequate infrastructure, funds and manpower policy implementation is weak and needs to be strengthened |
| Laws | Limited legislation for sustainable management of AnGR and there is need to protect livestock keepers' right on the lines of regulations available for plant genetic resources of the country |
| Implementation of laws | Poor implementation of laws |

9. What steps have been taken in your country to engage or empower the various stakeholders in animal genetic resources management (e.g. establishment of livestock keepers' organizations, development of biocultural community protocols)? (Text)

- Animal husbandry in India is a state (provincial) subject and each state government has established a network of veterinary hospitals, poly-clinics, and dispensaries. These institutions are organizing health camps, fertility camps, animal fairs and livestock keepers' meetings to empower them.
- Krishi Vigyan Kendras established in almost all the districts are also disseminating technical knowledge to the stake-holders.
- Breed societies have been established for a few livestock breeds.
- NGO's are partially funded by the government for different kinds of activities related with management of AnGR like Breed Saviour Awards.

**BREEDING PROGRAMMES**

10. Who operates breeding programmes in your country? (Yes, No)

| Species | Government | Livestock keepers organized at community level | Breeders' associations or cooperatives | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|
| Cattle (specialized dairy) | Yes | Yes | Yes | No | No | Yes | Gaushalas* |
| Cattle (multipurpose) | Yes | Yes | Yes | No | No | Yes | Gaushalas |
| Buffalo | Yes | Yes | Yes | No | No | Yes | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sheep | Yes | Yes | No | No | No | Yes | - |
| Goats | Yes | Yes | No | No | No | Yes | - |
| Pigs | Yes | No | No | No | No | Yes | |
| Chickens | Yes | Yes | No | Yes | No | Yes | - |
| Ducks | Yes | Yes | No | Yes | No | Yes | - |
| Horse and Pony | Yes | Yes | Yes | No | No | Yes | - |
| Donkey | Yes | Yes | No | No | No | No | |
| Camel | Yes | Yes | No | No | No | Yes | - |
| Yak | Yes | Yes | No | No | No | No | - |
| Mithun | Yes | Yes | No | No | No | Yes | - |
| Rabbit | Yes | No | No | No | No | No | |

**Gaushalas are cattle herds in the country*

10.1. If you choose the option "others", please indicate what kind of operator(s) this refers to. (Text)

- In livestock species other than cattle and buffalo, individual farmers keep breeding males in their herd / flock. However in cattle several of about 4000 Gaushalas are also operating breeding programmes in the country

11. For how many breeds in your country are the following activities undertaken? (Number of breeds)

| Tools | Cattle | | | Buffalo | | Sheep | | |
|---|---|---|---|---|---|---|---|---|
| | Locally adapted breeds | Cross bred | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Cross bred | Exotic breeds |
| Animal identification | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Breeding goal defined | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Performance recording | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Pedigree recording | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Genetic evaluation (classic approach) | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Genetic evaluation including genomic information | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |
| Management of genetic variation (by maximizing effective population size or minimizing rate of inbreeding) | 5 | 1 | Nil | 8 | Nil | 11 | 3 | Nil |
| Artificial insemination | 20 | 1 | 2 | 7 | Nil | Nil | Nil | Nil |

| Tools | Pig | | | Goat | | Poultry | | |
|---|---|---|---|---|---|---|---|---|
| | Locally adapted breeds | Cross bred | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Cross bred | Exotic breeds |
| Animal identification | Nil | Nil | Nil | 13 | 01 | 5 | Nil | 7 |
| Breeding goal defined | Nil | Nil | Nil | 13 | 01 | 5 | Yes | 7 |
| Performance recording | Nil | Nil | Nil | 13 | 01 | 5 | 3 | 7 |
| Pedigree recording | Nil | Nil | Nil | 13 | 01 | 3 | Nil | 7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Genetic evaluation (classic approach) | Nil | Nil | Nil | 13 | 01 | 3 | Nil | 7 |
| Genetic evaluation including genomic information | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |
| Management of genetic variation (by maximizing effective population size or minimizing rate of inbreeding) | Nil | Nil | Nil | 13 | Nil | Nil | Nil | Nil |
| Artificial insemination | Nil | Nil | Nil | 3 | 1 | 3 | 3 | 7 |

| **Tools** | **Yak*** | | **Mithun*** | | **Camel** | | **Horse and Pony** | |
|---|---|---|---|---|---|---|---|---|
| | **Locally adapted breeds** | **Exotic breeds** | **Locally adapted breeds** | **Exotic breeds** | **Locally adapted breeds** | **Exotic breeds** | **Locally adapted breeds** | **Exotic breeds** |
| Animal identification | Nil | Nil | Nil | Nil | 4 | Nil | 2 | 1 |
| Breeding goal defined | Nil | Nil | Nil | Nil | 4 | Nil | Nil | Nil |
| Performance recording | Nil | Nil | Nil | Nil | 4 | Nil | Nil | Nil |
| Pedigree recording | Nil | Nil | Nil | Nil | 4 | Nil | Nil | Nil |
| Genetic evaluation (classic approach) | Nil | Nil | Nil | Nil | 4 | Nil | Nil | Nil |
| Genetic evaluation including genomic information | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |
| Management of genetic variation (by maximizing effective population size or minimizing rate of inbreeding) | Nil | Nil | Nil | Nil | 4 | Nil | Nil | Nil |
| Artificial insemination | Nil | Nil | Nil | Nil | Nil | Nil | 1 | Nil |

*Registered breeds are not available

| **Tools** | **Donkey** | | **Rabbit** | |
|---|---|---|---|---|
| | **Locally adapted breeds** | **Exotic breeds** | **Locally adapted breeds** | **Exotic breeds** |
| Animal identification | Nil | Nil | Nil | Nil |
| Breeding goal defined | Nil | Nil | Nil | Nil |
| Performance recording | Nil | Nil | Nil | Nil |
| Pedigree recording | Nil | Nil | Nil | Nil |
| Genetic evaluation (classic approach) | Nil | Nil | Nil | Nil |
| Genetic evaluation including genomic information | Nil | Nil | Nil | Nil |
| Management of genetic variation (by maximizing effective population size or minimizing rate of inbreeding) | Nil | Nil | Nil | Nil |
| Artificial insemination | Nil | Nil | Nil | Nil |

12. Please indicate how many of the breeds in your country are subject to breeding programmes applying the following breeding methods. (Number of breeds)

| Breeding Methods | Cattle | | | Buffalo | | Sheep | | |
|---|---|---|---|---|---|---|---|---|
| | Locally adapted breeds | Cross bred | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Cross bred | Exotic breeds |
| Straight/pure-breeding only | 37 | 5 | 2 | 13 | Nil | 39 | 3 | 3 |
| Straight/pure-breeding and cross-breeding | Nil | Nil | Nil | Nil | Nil | Nil | 1 | Nil |

| Breeding Methods | Pig | | | Goat | | Poultry | | |
|---|---|---|---|---|---|---|---|---|
| | Locally adapted breeds | Cross bred | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Cross bred | Exotic breeds |
| Straight/pure-breeding only | 5 | Nil | 6 | 23 | Nil | 15 | Nil | Nil |
| Straight/pure-breeding and cross-breeding | Nil | 6 | Nil | Nil | 1 | Nil | 3 | 5 |

| Breeding Methods | Yak | | Mithun | | Camel | | Horse & Pony | |
|---|---|---|---|---|---|---|---|---|
| | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Exotic breeds |
| Straight/pure-breeding only | Nil | Nil | Nil | Nil | 4 | Nil | 6 | 1 |
| Straight/pure-breeding and cross-breeding | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

| Breeding Methods | Donkey | | Rabbit | |
|---|---|---|---|---|
| | Locally adapted breeds | Exotic breeds | Locally adapted breeds | Exotic breeds |
| Straight/pure-breeding only | 1 | 1 | Nil | Nil |
| Straight/pure-breeding and cross-breeding | Nil | Nil | Nil | Nil |

13. Please indicate the state of research and training in the field of animal breeding in your country. (Score: none, low, medium, high)

| Species | Training | Research |
|---|---|---|
| Cattle (specialized dairy) | Medium | Medium |
| Cattle (multipurpose) | Medium | Medium |
| Cattle (crossbred) | Medium | Medium |
| Buffalo | Medium | Medium |
| Sheep | Medium | Medium |
| Goats | Medium | Medium |
| Pigs | Medium | Medium |
| Chickens | Medium | Medium |
| Ducks | Medium | Medium |
| Horse and Pony | Medium | Medium |
| Donkey | Low | Low |
| Camel | Medium | Medium |
| Yak | Medium | Medium |
| Mithun | Medium | Medium |
| Rabbit | Medium | Medium |

14. Please indicate the extent to which livestock keepers in your country are organized for the purposes of animal breeding. (Score: none, low, medium, high)

| Species | Organization of livestock keepers |
|---|---|
| Cattle (specialized dairy) | Low |
| Cattle (multipurpose) | Low |
| Cattle (crossbred) | Low |
| Buffalo | Low |
| Sheep | Low |
| Goats | Low |
| Pigs | Low |
| Chickens | Low |
| Ducks | Low |
| Horse and Pony | Low |
| Donkey | Low |
| Camel | Low |
| Yak | Low |
| Mithun | Low |
| Rabbit | Low |

15. Please indicate the level of stakeholder involvement in the various elements of breeding programmes in your country (Score: none, low, medium, high).

| Cattle | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | High | High | Low | Low | None | None | Low | |
| Animal identification | Medium | Medium | Low | Low | None | None | Low | |
| Recording | Medium | Medium | Low | Low | None | None | Low | |
| Provision of artificial insemination services | Medium | Medium | Low | Low | None | None | Medium | |
| Genetic evaluation | Medium | High | Low | Low | None | None | Medium | |
| Buffalo | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
| Setting breeding goals | Medium | High | None | Low | None | None | Low | |
| Animal identification | Medium | Medium | Low | Low | None | None | Low | |
| Recording | Medium | Medium | Low | Low | None | None | Low | |
| Provision of artificial insemination services | Medium | Medium | Low | Low | None | None | Medium | |
| Genetic evaluation | Low | High | Low | Low | None | None | Low | |
| Sheep | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
| Setting breeding goals | Medium | High | Low | Low | None | None | Low | |
| Animal identification | Medium | Medium | Low | Low | None | None | Low | |
| Recording | Medium | Medium | Low | Low | None | None | Low | |
| Provision of artificial insemination services | None | Low | None | None | None | None | None | |
| Genetic evaluation | Medium | Medium | Low | None | None | None | None | |

| Goat | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Medium | High | Low | Low | None | None | Low | |
| Animal identification | Low | Medium | Low | Low | None | None | Low | |
| Recording | Low | Medium | Low | None | None | None | Low | |
| Provision of artificial insemination services | Low | Low | Low | None | None | None | Low | |
| Genetic evaluation | Low | Medium | Low | None | None | None | Low | |

| Poultry | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Medium | High | Medium | Low | High | High | Low | |
| Animal identification | Low | High | Medium | Low | High | High | Low | |
| Recording | Medium | High | Medium | Medium | High | High | Low | |
| Provision of artificial insemination services | Low | High | Medium | Low | High | High | Low | |
| Genetic evaluation | Low | High | Medium | Low | High | High | Low | |

| Camel | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Medium | High | Low | Low | None | None | Low | |
| Animal identification | Medium | Medium | Low | Low | None | None | Low | |
| Recording | Medium | Medium | Low | Low | None | None | Low | |
| Provision of artificial insemination services | None | Low | None | Low | None | None | None | |
| Genetic evaluation | Medium | Medium | low | Low | None | None | Low | |

| Horses & Pony | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Low | High | Low | Low | None | None | None | NA |
| Animal identification | Low | Medium | Low | Low | Low | None | None | NA |
| Recording | Low | Medium | Low | None | Low | None | None | NA |
| Provision of artificial insemination services | Low | Medium | None | None | Low | None | None | NA |
| Genetic evaluation | None | Medium | None | None | Low | None | None | NA |

| Donkey | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | None | High | Low | Low | None | None | None | NA |
| Animal identification | None | Medium | Low | Low | Low | None | None | NA |
| Recording | None | Medium | Low | None | Low | None | None | NA |
| Provision of artificial insemination services | None | Medium | None | None | Low | None | None | NA |
| Genetic evaluation | None | Medium | None | None | Low | None | None | NA |

| Pig | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Medium | High | Low | Medium | None | None | None | |
| Animal identification | Medium | Medium | Low | Low | None | None | None | |
| Recording | Medium | Medium | Low | Low | None | None | None | |
| Provision of artificial insemination services | None | Low | None | None | None | None | None | |
| Genetic evaluation | Medium | Medium | low | Low | None | None | None | |

| Yak | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Low | High | None | Low | None | None | None | |
| Animal identification | Low | Low | None | Low | None | None | None | |
| Recording | Low | Low | None | None | None | None | None | |
| Provision of artificial insemination services | Low | Low | None | None | None | None | None | |
| Genetic evaluation | Low | Medium | None | None | None | None | None | |

| Mithun | Government | Research organizations | Breeders' associations or cooperatives | Individual breeders/livestock keepers | National commercial companies | External commercial companies | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Low | High | None | Low | None | None | Low | |
| Animal identification | Low | Medium | None | Low | None | None | None | |
| Recording | Low | Medium | None | None | None | None | None | |
| Provision of artificial insemination services | Low | Medium | None | None | None | None | None | |
| Genetic evaluation | Low | Medium | None | None | None | None | None | |

| Rabbit | Government | Research organizations | Breeders' associations or cooperatives[62] | Individual breeders/livestock keepers | National commercial companies[63] | External commercial companies[64] | Non-governmental organizations | Others |
|---|---|---|---|---|---|---|---|---|
| Setting breeding goals | Low | High | None | Low | None | None | None | |
| Animal identification | Low | High | None | None | None | None | None | |
| Recording | Low | High | None | None | None | None | None | |
| Provision of artificial insemination services | None | None | None | None | None | None | None | |
| Genetic evaluation | None | Medium | None | None | None | None | None | |

15.1. If you choose the option “others”, please indicate what kind of operator(s) this refers to. (Text)

15.2. Please provide further information on the roles that the stakeholders identified in the table play in the implementation of the various activities. If relevant, please also provide further information on the organizational roles played by the stakeholders identified in Question 10. (Text)

- The Government, research and Non-Governmental organisations provide AI and health services, formulate breeding and conservation programmes and also provide consultancy services through a country wide network of agencies associated with animal husbandry practices

16. Does your country implement any policies or programmes aimed at supporting breeding programmes or influencing their objectives? (Yes, no)

| Species | Policies or Programmes |
|---|---|
| Cattle (specialized dairy) | Yes |
| Cattle (multipurpose) | Yes |
| Cattle (crossbred) | Yes |
| Buffalo | Yes |
| Sheep | Yes |
| Goats | Yes |
| Pigs | Yes |
| Chickens | Yes |
| Ducks | Yes |
| Horse and Pony | Yes |
| Donkey | Yes |
| Camel | Yes |
| Yak | Yes |
| Mithun | Yes |
| Rabbit | Yes |

16.1. Please describe these policies or programmes, indicating whether or not they include any measures specifically aimed at supporting breeding programmes for locally adapted breeds or any measures specifically aimed at supporting breeding programmes for exotic breeds (including breed-replacement programmes). Please indicate whether different types of programme are promoted in different production systems (and describe the differences). (Text)

| Species | Description of Policies or Programmes |
|---|---|
| Cattle (specialized dairy) | • National programme for cattle & buffalo breeding<br>• Herd registration<br>• National Dairy Plan<br>• Central Herd Registration Scheme<br>• All India Coordinated Research Project (AICRP) on Cattle<br>• Network Project on Animal Genetic Resources<br>• Genetic Improvement Programmes by State Livestock Development Boards |

| | |
|---|---|
| Cattle (multipurpose) | • National programme for cattle & buffalo breeding<br>• Herd registration<br>• National Dairy Plan<br>• Central Herd Registration Scheme<br>• All India Coordinated Research Project (AICRP) on Cattle<br>• Network Project on Animal Genetic Resources<br>• Genetic Improvement Programmes by State Livestock Development Boards |
| Cattle (crossbred) | • National programme for cattle & buffalo breeding<br>• National Dairy Plan<br>• All India Coordinated Research Project (AICRP) on Cattle<br>• Genetic Improvement Programmes by State Livestock Development Boards |
| Buffalo | • National programme for cattle & buffalo breeding<br>• Herd registration<br>• National Dairy Plan<br>• Central Herd Registration Scheme<br>• Network Project on Animal Genetic Resources<br>• Genetic Improvement Programmes by State Livestock Development Boards<br>• Network Project on buffalo improvement |
| Sheep | • Network Project on Sheep Improvement<br>• Mega Seed Sheep Project<br>• Network Project on Animal Genetic Resources<br>• Genetic Improvement Programmes by State Livestock Development Boards |
| Goats | • AICRP on Goat Improvement<br>• Network Project on Animal Genetic Resources<br>• Genetic Improvement Programmes by State Livestock Development Boards |
| Pigs | • Network Project on Pig improvement<br>• Mega Seed Pig Project |
| Chickens | • Network Project on Animal Genetic Resources<br>• AICRP on Poultry breeding<br>• Poultry Seed Project<br>• Programme on Rural and Backyard Poultry |
| Ducks | • Programme on Rural and Backyard Duck rearing |
| Horse and Pony | • Network Project on Animal Genetic Resources |
| Donkey | • Network Project on Animal Genetic Resources |
| Camel | • Network Project on Animal Genetic Resources |
| Yak | • Genetic improvement programmes by ICAR and State governments |
| Mithun | • Genetic improvement programmes by ICAR and State governments |

| | |
|---|---|
| Rabbit | • Genetic improvement programmes by ICAR and State governments for exotic breeds. |

17. Please describe the consequences of your country's breeding policies and programmes, or lack of breeding policies and programmes, for your country's animal genetic resources and their management. (Text)

| Species | Description of Consequences |
|---|---|
| Cattle (specialized dairy) | • Enhanced productivity<br>• Conservation of locally adapted breeds<br>• Genetic dilution of locally adapted breeds<br>• Number of indigenous animals are declining due to indiscriminate crossbreeding<br>• Improved socio-economic condition of livestock keepers |
| Cattle (multipurpose) | • Enhanced productivity<br>• Conservation of locally adapted breeds<br>• Genetic dilution of locally adapted breeds<br>• Number of indigenous animals are declining due to indiscriminate crossbreeding<br>• Improved socio-economic condition of livestock keepers |
| Cattle (crossbred) | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers |
| Buffalo | • Enhanced productivity<br>• Conservation of locally adapted breeds<br>• Number of some of the indigenous breeds are declining due to up-gradation by a single breed (monoculture)<br>• Improved socio-economic condition of livestock keepers<br>• Genetic dilution of locally adapted breeds<br>• Loss of elite germplasm due to indiscriminate slaughter |
| Sheep | • Enhanced productivity<br>• Grading up of non-descript animals<br>• Improved socio-economic condition of livestock keepers<br>• Loss of elite germplasm due to indiscriminate slaughter<br>• Genetic dilution of locally adapted breeds |
| Goats | • Enhanced productivity<br>• Grading up of non-descript animals<br>• Improved socio-economic condition of livestock keepers<br>• Loss of elite germplasm due to indiscriminate slaughter<br>• Genetic dilution of locally adapted breeds |
| Pigs | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers |
| Chicken | • Enhanced productivity<br>• Conservation of locally adapted breeds |

| | |
|---|---|
| | • Number of indigenous birds are declining due to indiscriminate crossbreeding<br>• Improved socio-economic condition of livestock keepers |
| Ducks | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers |
| Horse and Pony | • Decline in population<br>• Genetic dilution of locally adapted breeds |
| Donkey | • Decline in population |
| Camel | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers<br>• Increased demand for camel milk<br>• Decline in population |
| Yak | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers<br>• Sedentarization<br>• Conservation<br>• Use of external germplasm to reduce inbreeding |
| Mithun | • Enhanced productivity<br>• Improved socio-economic condition of livestock keepers<br>• Conservation |
| Rabbit | • Decline in Angora rabbit population<br>• Increased demand for rabbit meat |

18. Please describe the main constraints to the implementation of breeding programmes in your country and what needs to be done to address these constraints. You may also provide information on any particular successes achieved in your country with respect to the establishment and operation of breeding programmes and on the factors that have contributed to these successes. (Text)

**Constraints**

- Inadequate funds
- Small herd size
- Absence of performance and pedigree recording
- Inadequate number of genetically superior / progeny tested breeding males
- Use of unknown genetic merit males for breeding
- Insufficient resources i.e. infrastructure, marketing, fodder etc. with small farmers
- Indiscriminate breeding / cross breeding.
- Inadequate credit and Insurance support
- Inadequate number of breed societies
- Change in land use pattern
- Inadequate post harvest technologies

- Inadequate awareness and education
- Lack of legal support
- Shrinkage of grazing land
- Grazing tax when yaks migrated to lower altitude during winter.
- Most of the breeding programmes are oriented towards supporting the milch species particularly cattle and buffalo. But species like horse, donkey, camel, yak, and mithun, beg less attention in breeding programmes of the country. Only few organized herds are being maintained by the governmental agencies in different parts of the country. Most of the breeding programmes for pig and poultry are aimed towards using exotic breeds, ignoring the purity of locally adapted populations.

**Success**

- Significant increase in animal production and productivity
- Increase in A.I. coverage
- Characterization and Registration of locally adapted livestock and poultry breeds (144)
- Improved conception rate / fertility rate / fecundity
- Improved per capita availability of animal products
- Improvement in quality animal products
- Conserved germplasm and documentation
- Established germplasm centre for important breeds.
- Availability of indigenous breeds semen in state departments
- Establishment of few breed societies
- Breed-wise census of livestock species

**Needs to be done**

- Identification, performance and pedigree recording system at farmer's door step should be strengthened through education and incentives.
- Farmers should be provided superior males / germplasm of high genetic merit in regular manner.
- Farmers should be acquainted with scientific breeding practices.
- Common property resources and grazing land may be improved Proper policies that include health cover, shelter and conflict management during migration of Livestock.
- Provide legal framework of protection and conservation of AnGR
- Creation of national information management system on AnGR
- Capacity building of livestock stakeholders
- Genetic slippage of AnGR to be checked
- Proper marketing infrastructure needs to be developed

19. Please describe future objectives, priorities and plans for the establishment or further development of breeding programmes in your country. (Text)

| Species | Description of future objectives, priorities and plans |
|---|---|
| Cattle (specialized dairy) | • Bringing more number of females under AI and sire evaluation programmes, increasing breed purity<br>• Establish herd book, breed register, and breed societies.<br>• Ex-situ and in situ conservation<br>• Grading up of non descript population |

| | |
|---|---|
| Cattle (multipurpose) | • Bringing more number of females under AI and sire evaluation programmes, increasing breed purity<br>• Establish herd book, breed register, and breed societies<br>• Improvement and use of draft capability<br>• Ex-situ and in situ conservation<br>• Grading up of non descript population |
| Cattle (crossbred) | • Sire evaluation and AI facilities at farmers' door |
| Buffalo | • Bringing more number of females under AI and sire evaluation programmes, increasing breed purity<br>• Establish herd book, breed register, and breed societies<br>• Development of buffalo for meat production<br>• Ex-situ and in situ conservation<br>• Grading up of non descript population |
| Sheep | • Genetic improvement for mutton, wool, prolificacy, and disease resistance through pure breeding and grading-up<br>• Ex-situ and in situ conservation |
| Goats | • Genetic improvement for meat, milk and fibre production<br>• Ex-situ and in situ conservation<br>• Grading up of non descript population<br>• Coverage of at least 10% of breedable population for pedigree and performance recording |
| Pigs | • Genetic improvement for pork production<br>• Ex-situ and in situ conservation of threatened indigenous pig breeds |
| Chickens | • Genetic improvement for meat and egg production<br>• Development of backyard poultry<br>• Development for synthetic strain<br>• Ex-situ and in situ conservation<br>• Development of germplasm according to consumer preferences |
| Ducks | • Genetic improvement for meat and egg production<br>• Development of backyard Duck rearing<br>• Ex-situ and in situ conservation |
| Horse and Pony | • Genetic improvement for draft, transport capacity etc.<br>• Ex-situ and in situ conservation<br>• Establishment of studbooks |
| Donkey | • Genetic improvement for draft, transport capacity etc.<br>• Ex-situ and in situ conservation |
| Camel | • Genetic improvement for milk, pack /draft ability.<br>• Ex-situ and in situ conservation |
| Yak | • Genetic improvement for milk, meat, hair, packability and draft capacity<br>• Ex-situ and in situ conservation |
| Mithun | • Genetic improvement for meat and draft capacity<br>• Ex-situ and in situ conservation |
| Rabbit | • Improvement of rabbit germplasm for meat and fibre production |

## CONSERVATION

20. Please provide an indication of the extent to which your country's breeds are covered by conservation programmes. (Coverage: none, low, medium, high, no programmes implemented because all breeds of this species present in the country are secure)

| Species | In situ conservation | Ex situ in vivo conservation | Ex situ in vitro conservation |
|---|---|---|---|
| Cattle (specialized dairy) | Medium | Medium | Medium |
| Cattle (multipurpose) | Medium | Low | Low |
| Buffalo | Medium | Low | Low |
| Sheep | Medium | Medium | Low |
| Goats | Medium | Medium | Low |
| Pigs | Medium | Low | None |
| Chickens | Low | Low | None |
| Ducks | Low | Low | None |
| Horse and Pony | Medium | Low | Low |
| Donkey | None | None | None |
| Camel | Low | Low | Low |
| Yak | Medium | Low | Low |
| Mithun | Medium | Medium | Low |
| Rabbit | None | None | None |

21. Does your country use formal approaches to prioritize breeds for conservation? (Yes, No)

Yes

21.1. If so, which of the following factors are considered?

| | Yes / No |
|---|---|
| Risk of extinction | Yes |
| Genetic uniqueness | Yes |
| Genetic variation within the breed | No |
| Production traits | Yes |
| Non-production traits | Yes |
| Cultural or historical importance | Yes |
| Probability of success | No |

22. Please indicate which of the following methods are used as elements of *in situ* conservation programmes in your country and which operators are managing them. (Yes, No)

| Elements of *in situ* conservation programmes | Operators | | Species targeted | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Public sector | Private sector (NGO) | Cattle (specialized dairy) | Cattle (multipurpose) | Cattle (Crossbred) | Buffalo | Sheep | Goats | Pigs | Chickens |
| Promotion of niche marketing or other market differentiation (including promotion via the association of breed products with geographical indications or other indicators of origin) | Yes | No | No | No | No | No | Yes | Yes | No | No |
| Community-based conservation programmes | Yes | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Incentive or subsidy payment schemes for keeping at-risk breeds | Yes | No | No | No | No | No | No | No | No | No |
| Development of biocultural community protocols | Yes | No | Yes | No | No | Yes | No | Yes | No | No |
| Recognition/award programmes for breeders | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Conservation breeding programmes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Selection programmes for increased production or productivity in at-risk breeds | Yes | No | No | No | No | No | No | Yes | Yes | Yes |
| Promotion of at-risk breeds as tourist attractions | Yes | No | No | No | No | No | No | No | No | No |
| Use of at-risk breeds in the management of wildlife habitats and landscapes | Yes | No | No | No | No | No | No | No | No | No |
| Promotion of breed-related cultural activities | Yes | Yes | No | No | No | No | No | No | No | No |
| Extension programmes to improve the management of at-risk breeds | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Awareness-raising activities providing information on the potential of specific at-risk breeds | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| Elements of *in situ* conservation programmes | Species targeted | | | | | |
|---|---|---|---|---|---|---|
| | Yak | Mithun | Horses | Donkeys | Camel | Rabbit |
| Promotion of niche marketing or other market differentiation (including promotion via the association of breed products with geographical indications or other indicators of origin) | No | No | No | No | Yes | Yes |
| Community-based conservation programmes | Yes | Yes | No | No | Yes | No |
| Incentive or subsidy payment schemes for keeping at-risk breeds | Yes | Yes | No | No | No | No |
| Development of biocultural community protocols | No | No | No | No | No | No |
| Recognition/award programmes for breeders | Yes | Yes | Yes | No | No | No |
| Conservation breeding programmes | Yes | Yes | Yes | Yes | No | No |
| Selection programmes for increased production or productivity in at-risk breeds | Yes | Yes | No | No | No | No |
| Promotion of at-risk breeds as tourist attractions | No | No | No | No | No | No |
| Use of at-risk breeds in the management of wildlife habitats and landscapes | No | No | No | No | No | No |
| Promotion of breed-related cultural activities | Yes | Yes | No | No | No | No |
| Extension programmes to improve the management of at-risk breeds | Yes | Yes | Yes | Yes | Yes | No |
| Awareness-raising activities providing information on the potential of specific at-risk breeds | Yes | Yes | Yes | Yes | Yes | No |

22.1. Please provide further details of the activities recorded in the table and any other *in situ* conservation activities or programmes being implemented in your country. (Text)

- In situ conservation programmes for a few breed of Livestock have been initiated in the respective breeding tracts by providing services and ensuring birth of purebred progeny

- Kilakarsal Sheep: A nucleus Kilakarsal flock was established with a strength of 29 males and 93 females. The tupping and lambing were 95.16 and 91.94 % respectively. Average adult weight of 29.5 and 21.4 kg respectively of male and female was recorded. Thirty Rams were supplied to shepherds for breeding in the field. A total of 1053 (498 male + 555 female) progenies of Kilakarsal were recorded during the scheme. Progenies produced at the farmers' flocks were followed for recording. The tupping and lambing in field was 72.42 and 68.46% respectively. Average weight at birth, 3, 6, 9 and 12 months was 2.61, 8.35, 12.36, 14.16 and 18.07 kg, respectively in farmers' flocks.

- Beetal Goat: The objectives included: maintenance of Beetal goats in its home tract in pure form, checking further decrease in Beetal population, production of quality and elite breeding stock and improvement of production potential for sustainable utilization at the farmers' door. The bucks produced were exchanged across the villages to check inbreeding and were used extensively for breeding. Goat health camps were regularly organized in the breeding tract for vaccinating the animals and creating awareness among the farmers for better health and hygiene management of goats. As a result, a total of 5478 elite Beetal kids were added to the dwindling population of the breed in its breeding tract. A total of 92 pure elite Beetal bucks were made available for breeding of goats at farmers' door. Average flock size increased from 10.65 to 15.40 in flocks of selected 142 farmers. Average kidding rate increased from 1.67 to 1.98 during the project period.

- Tharparkar Cattle: A conservation programmes on Tharparkar breed of cattle is going on in its breeding tract by an NGO [SURE - Society for Upliftment of Rural Economy] in Rajasthan State.

- Surti Goat: A total of 150 Surti goats were registered from 11 villages on the basis of their phenotypic characters and milk production more than 1.5 kg per day. Fifty elite bucks were selected during different phases and used for genetic improvement.

23. Does your country have an operational in vitro gene bank[85] for animal genetic resources? (Yes, No)

YES

23.1. If your country has no in vitro gene bank for animal genetic resources, does it have plans to develop one? (Yes, No)

Not Applicable

23.2. If yes, please describe the plans. (Text)

Frozen semen of 41 breeds from seven species (Cattle, Buffalo, Sheep, Goat, Camel, Yak, Equine) has been collected and stored in Gene Bank. This stored germplasm can be utilized to introduce genetic variability in field animals and support *in situ* conservation efforts. More of animal breeds will be covered under artificial insemination and semen production, so as to strengthen gene bank repository. The epididymal sperms would be utilized for semen conservation, especially in case of small ruminants. Somatic cell banking will also be established.

24. If your country has an *in vitro* gene bank for animal genetic resources, please indicate what kind of material is stored there. (Yes, No)

| Type of material | Stored in National Gene Bank |
|---|---|
| Semen | Yes |
| Embryos | No |
| Oocytes | No |

| | |
|---|---|
| Somatic cells (tissue or cultured cells) | No |
| Isolated DNA | Yes |

25. If your country has an *in vitro* gene bank for animal genetic resources, please complete the following table.

| | Cattle (specialized dairy) | Buffalo | Cattle (multipurpose) | Sheep | Goats | Pigs | Chickens | Camel | Equine | Yak | Rabbit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of breeds for which material is stored | 5 | 9 | 16 | 1 | 4 | Nil | 0 | 1 | 4 | 1 | Nil |
| Number of breeds for which sufficient material is stored to allow them to be reconstituted | 1 | 4 | 2 | 1 | 2 | Nil | Nil | Nil | Horse 3 Donkey 1 | Nil | Nil |
| Does the collection include material from not-at-risk breeds? | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes | No |
| Have any extinct populations been reconstituted using material from the gene bank? | No | No | No | No | No | No | No | No | No | No | No |
| Have the gene bank collections been used to introduce genetic variability into an *in situ* population? | No | Yes | Yes | No | No | No | No | No | No | No | No |
| Have the gene bank collections been used to introduce genetic variability into an *ex situ* population? | No | No | No | No | No | No | No | No | No | No | No |
| Do livestock keepers or breeders' associations participate in the planning of the gene banking activities? | No | No | No | No | No | No | No | No | No | No | No |

* Isolated DNA is available for all the registered breeds of indigenous livestock and poultry

25.1. Please provide further details of the activities recorded in the table (including any examples of the use of gene bank material to reconstitute populations or introduce genetic variability) and any other *in vitro* conservation activities or programmes being implemented in your country. (Text)

- Krishna Valley Cattle semen has been utilized in 150 villages of three districts in Maharashtra. The conception rate had been around 48% and significant population has been added.

- Jaffarabadi buffalo semen is being utilized in its native tract to introduce genetic variability and produce approximately 400 males and females progeny per sire, thus creating pedigreed population of Jaffarabadi buffaloes which can be utilized further for semen production and performance recording.

- Frozen semen of Tharparkar, Sahiwal and Hariana cattle is supplied to *Gaushalas* to improve and increase population of purebred cattle.

26. Does your country have plans to enter into collaboration with other countries to set up a regional or sub-regional *in vitro* gene bank for animal genetic resources? (Yes, no)

Not yet

26.1. If yes, please describe the plans, including a list of the countries involved. (Text)

Not applicable

27. If there have been any cases in your country in which breeds that were formerly classified as at risk of extinction have recovered to a position in which they are no longer at risk, please list the breeds and describe how the recovery was achieved. (Text)

Programmes are being undertaken for Krishna Valley and Vechur cattle, Bhadawari buffalo, Kilakarsal Sheep and Beetal, Surti and Jamunapari Goat

*To provide further details of your country's activities in the field of conservation, please go to Strategic Priority Area 3 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources 2007–2013" (below).*

## REPRODUCTIVE AND MOLECULAR BIOTECHNOLOGIES

28. Please indicate the level of availability of reproductive and molecular biotechnologies for use in livestock production in your country. (Score: none, low [at experimental level only], medium [available to livestock keepers in some locations or production systems], high [widely available to livestock keepers])

| Biotechnologies | Cattle (Dairy) | Cattle (Multipurpose) | Cattle (Crossbred) | Buffalo |
|---|---|---|---|---|
| Artificial insemination | Medium | Medium | Medium | Medium |
| Embryo transfer | Low | None | Low | Low |
| Multiple ovulation and embryo transfer | Low | None | Low | Low |
| Semen sexing | Low | None | Low | Low |
| *In vitro* fertilization | None | None | None | Low |
| Cloning | None | None | None | Low |
| Genetic modification | None | None | None | None |
| Molecular genetic or genomic information | Low | Low | Low | Low |
| Transplantation of gonadal tissue | None | None | None | None |

| Biotechnologies | Sheep | Goat | Pig | Horse, Pony and Donkey |
|---|---|---|---|---|
| Artificial insemination | Medium | Low | Low | Low |
| Embryo transfer | Low | Low | None | None |
| Multiple ovulation and embryo transfer | Low | Low | None | None |
| Semen sexing | None | None | None | None |
| *In vitro* fertilization | Low | Low | None | None |
| Cloning | Low | Low | None | None |
| Genetic modification | None | Low | None | None |
| Molecular genetic or genomic information | Low | Low | Low | Low |
| Transplantation of gonadal tissue | None | None | None | None |

| Biotechnologies | Camel | Chicken | Yak | Mithun | Rabbit |
|---|---|---|---|---|---|
| Artificial insemination | Low | Medium | Low | Low | None |
| Embryo transfer | Low | None | Low | Low | None |
| Multiple ovulation and embryo transfer | Low | None | Low | Low | None |
| Semen sexing | None | None | None | None | None |
| *In vitro* fertilization | Low | None | Low | None | None |
| Cloning | None | None | None | None | None |
| Genetic modification | None | None | None | None | None |
| Molecular genetic or genomic information | Low | Low | Low | Low | None |
| Transplantation of gonadal tissue | None | None | None | None | None |

28.1. Please provide additional information on the use of these biotechnologies in your country. (Text)

- Heterologous sets of microsatellite markers have been identified and used in all livestock and poultry species for the diversity analysis. Molecular genetics/Genomic data has been generated in case of buffalo using these microsatellite markers and diversity analysis work accomplished in different livestock and poultry breeds in India. Besides microsatellite markers, mitochondrial D-loop region also sequenced and based on haplotype sharing, phylogenetic and network analyses carried out to determine the evolutionary relationships among different livestock breeds. Candidate gene sequence characterization and polymorphism analysis work has been also been undertaken at various laboratories for allelic diversity analysis as well as for association with various production and other traits.

- Control of animal diseases assumes prime importance in the crucial time of shifting of animal agriculture from extensive to intensive and commercial system of management. Development of new generation diagnostics and vaccines along with appropriate adjuvant and improved delivery system for the endemic, emerging and exotic diseases of goats will be the major thrust area in the coming decades. Use of stem cells as an alternative medicine would be needed for the therapeutic management of diseases, injuries to vital organs and especially expediting the recovery in certain chronic diseases. Nano-biotechnological approach needs to be developed for efficient drug delivery system, diagnostics and vaccines for better health care of animals.

- In buffalo genomics more than 100 GB DNA sequence data has been generated from one female Murrah buffalo providing nearly 30 fold coverage. The first version of assembly was constructed with Illumina paired end and mate pair short read sequencing using the cattle genome (Btau 4.0 assembly) as a reference. The assembly has read depth of 17-19X. The buffalo assembly represents ~ 91%-95% coverage in comparison to the cattle assembly Btau 4.0. The assembly has 185,150 contigs. The mitochondrial genome is fully covered by a single contig. Whole genome comparison between this assembly and of cattle revealed 52 million mismatches/indels. The present analysis also unveils about 300 structural variants in the buffalo genome. The buffalo assembly has been integrated into a publicly available genome browser (http://210.212.93.84/) with tracks for read pair insert distances, read depth, nucleotide variations, coverage, and the availability of custom tracks for scientific community.
  In buffalo utilizing the microsatellite, mitochondrial D-loop supported by cytogenetic characterization, first time in India, pure swamp buffaloes have been documented in the North-eastern parts of the country.

- There is problem of availability of adequate number elite males to be put for genetic improvement of sheep and goats by natural service under field conditions. Artificial insemination technique for breeding and genetic improvement of sheep and goat using of frozen semen of elite males need to be thoroughly perfected. It is necessary to establish a reference semen grid of goats with all types of facilities and certification.

- Artificial insemination is routine in large ruminants but A.I. in small ruminants is in experimental stages only. In chicken commercial strains to be developed are using A.I. whereas not so in practise in backyard poultry. Conservation of genetic material through cryo-preservation of semen and embryos has not got momentum in sheep, goat and Chicken.

29. If the reproductive and/or molecular technologies are available for use by livestock keepers in your country, please indicate which stakeholders are involved in providing the respective services to the livestock keepers. (Yes, No)

| Stakeholders | Artificial insemination | Embryo transfer |
|---|---|---|
| Public sector | Yes | No |
| Breeders' associations or cooperatives | Yes | No<br>(except dairy cattle to a limited extent) |
| National non-governmental organizations | Yes | No |

| | | |
|---|---|---|
| Donors and development agencies | Yes | No |
| National commercial companies | Yes | No |
| External commercial companies | No (except Chicken) | No |

29.1. Please provide additional information on the roles that the providers identified in the table play in the provision of biotechnology services in your country. (Text)

- Artificial Insemination (A.I.) is the reproductive technology available in cattle and buffalo. However, embryo transfer is in experimental stage only. Artificial Insemination is provided to farmers by various national organisations, State Animal Husbandry Departments, Livestock Development Boards, Non-governmental organisations and co-operative federations. In chicken commercial broilers and layer strains are developed by national commercial companies by using A.I.

- Embryo and genomic technologies are not employed in the field. The breeding bulls are tested for sexually transmissible diseases as well as genetic diseases and chromosomal abnormalities as mandated under the National Programme for cattle and buffalo breeding.

- Attempts have also been made for *Fec B* genotyping to improve the fecundity of local sheep by NGO's and Pvt. Sector research organizations.

30. Please indicate which biotechnologies your country is undertaking research on. (Yes, No)

| **Biotechnologies** | **Public or private research at national level** | **Research undertaken as part of international collaboration** |
|---|---|---|
| Artificial insemination | Yes | No |
| Embryo transfer or MOET | Yes | No |
| Semen sexing | Yes | No |
| *In vitro* fertilization | Yes | No |
| Cloning | Yes | No |
| Genetic modification | Yes | No |
| Use of molecular genetic or genomic information for estimation of genetic diversity | Yes | No |
| Use of molecular genetic or genomic information for prediction of breeding values | No | No |
| Research on adaptedness based on molecular genetic or genomic information | No | No |

30.1. Please briefly describe the research. (Text)

- In the field of artificial insemination, research work is going on to develop new extenders and cryopreservation techniques to increase the sperm viability and semen shelf life and fertility rate, particularly for the species like buffalo and crossbred cattle. Embryo transfer and MOET work is in its infancy in most of the species. To some extent the initiatives have been taken in cattle by state Animal Husbandry Departments. Semen sexing work is also being initiated in

cattle and buffalo due to requirement for female progenies for dairy production, but non-availability of infrastructure, particularly high speed sperm sorter is a major constraint.

- India is pioneer for buffalo cloning work, being the first country in the world having produced the cloned buffalo males and females using hand-guided technique. Sheep clones have also been produced and efforts are being made in other livestock species. Genetic modification research work has also been initiated to produce transgenic goat and buffalo capable of generating proteins of human therapeutic importance.

- Microsatellite markers have been used for the genetic diversity analysis of most of the breeds of indigenous livestock and poultry species and Mitochondrial D-loop region sequencing has also been employed in cattle, buffalo and chicken to characterize them evolutionarily. Cytogenetic and these molecular genetics tools have helped in documentation of newer germplasm like swamp buffaloes in the North-east parts of the country. Work has been undertaken to estimate allelic diversity among various candidate genes using the SNPs identified, in production related, immune response and adaptation traits. Association of these SNPs with phenotypes for their potential as molecular markers is underway, but quality phenotypes being a major constraint. Research on adeptness based on genetic and genomic information has also been initiated taking cattle and buffalo breeds mainly adapted to varied climatic conditions from subzero to highly adverse arid zone of the country. Latest tools like microarrays and SNP chips are being utilized to generate the genome-wide information to understand the genes and genetic variation underlying the adeptness among livestock species. However due to lack of standard phenotypic data and pedigreed records, the molecular tools are difficult to employ for estimation of breeding values of animals.

- Chicken: Chicken SNP chips are available and has been employed to identify genome wide polymorphism

31. Please estimate the extent to which artificial insemination (using semen from exotic and/or locally adapted breeds) and/or natural mating is used in your country's various production systems. (Score: none, low [approximately <33% of matings]; medium [approximately 33–67% of matings], high [approximately >67% of matings], or "production system not present in this country")

| Cattle | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | Low | Low | Medium |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | Low | Low | High |
| Artificial insemination using imported semen from exotic breeds | None | None | Low | Low | Low |
| Natural mating | High | High | High | None | Low |

| Buffalo | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | Low | None | Low | High | Medium |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | None | Medium |

| Sheep | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | None | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | High | High |

| Goat | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | None | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |

| | | | | | |
|---|---|---|---|---|---|
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | High | High |

| Poultry | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | Low | High | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | Low | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | None | None | High | None | High |

| Yak | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | Low | None | Low | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | None | None |

| Mithun | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | Low | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | None | High | None | None |

| Camel | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | None | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | None | High |

| Horses and Pony | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | Low | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | Low | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | None | High |

| Donkey | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | Low | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | Low | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | None | High |

| Pigs | Ranching or similar grassland-based production systems | Pastoralist systems | Mixed farming systems (rural areas) | Industrial systems | Small-scale urban or peri-urban systems |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | None | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | High | High | High | High | High |

| Rabbit | Ranching or similar grassland-based production systems[99] | Pastoralist systems[100] | Mixed farming systems (rural areas)[101] | Industrial systems[102] | Small-scale urban or peri-urban systems[103] |
|---|---|---|---|---|---|
| Artificial insemination using semen from locally adapted breeds | None | None | None | None | None |
| Artificial insemination using nationally produced semen from exotic breeds | None | None | None | None | None |
| Artificial insemination using imported semen from exotic breeds | None | None | None | None | None |
| Natural mating | None | None | High | None | None |

32. Please provide further details on the use of reproductive and molecular biotechnologies in animal genetic resources management in your country. Please note any particular constraints to implementing these activities and any problems associated with their use. Please indicate what needs to be done to address these constraints and/or problems. You may also provide information on any particular successes achieved in your country in the use of biotechnologies in animal genetic resources management and on the factors that have contributed to these successes. (Text)

- Under reproductive biotechnologies only AI is provided at field level. Other technologies- embryo transfer, MOET etc. are non-existent under field conditions.
- Molecular biotechnologies are not used in animal genetic resources of India except for characterization and diversity analysis of breeds

- Use of genomic selection has potential but is not used due to higher cost and inadequate infrastructure.
- Performance records of animals under field conditions are not maintained. Hence the genetic potential (breeding values) of animals is not known. Without identifying genetically superior animals use of embryo transfer and other reproductive technologies has little relevance.
- In developed countries, advanced reproductive technologies and molecular biotechnologies are provided by private commercial companies on payment. Such companies are not available in India.
- The farmers are resource-poor and are not in a position to pay the high cost of application of such technologies.
- Other than the technologies listed above (31), genome resources like microarray and SNP genotyping chips, available commercially for species like cattle, are being utilized at laboratory levels to study trait specific gene expression, identification of gene pathways and the polymorphism associated with adaptation and genetic diversity analysis. Efforts are also underway to develop such resources for species like buffalo having regional importance to India. Bovine microarray chip available commercially has been employed to study the expression profiling of genes associated with lactation in buffalo as an effort to identify biomolecules responsible for truncated lactation. Besides, bovine SNP chip available commercially has been employed to identify genome-wide polymorphism associated with adaptation in cattle.
- Supplementation of microsatellite data along with field studies has helped in identification and registration of 15 new breeds of livestock.
- Cytogenetic and molecular tools- mainly microsatellite and mitochondrial D-loop sequencing has helped in documentation of pure swamp buffaloes in the states of Manipur, Nagaland and Mizoram and riverine and hybrid types in certain parts of Assam state of North-east India.

**Sheep and Goat**

**AI with liquid semen:** The adoption rate of AI by farmers is negligible. However, adoption of AI using semen of superior rams can provide a viable option to resource-poor underprivileged farmers for uplifting their socio-economic status by augmenting production of low producing sheep breeds in their flocks. Non-availability of elite rams and need of heat detection are the major constraints in adoption of AI by the farmers. Other constraints include decrease in fertility after 24 h of liquid semen preservation; involvement of some cost in employment of skilled labour, equipments, drugs, hormones, purchase of semen and lack of awareness about benefits of AI. Different stakeholders are required to motivate the sheep and goat farmers in terms of its success for enhancing the adoption rate of this technology. The use of cost-effective estrus synchronization device in the form of vaginal sponges has given the scope for taking up large-scale fixed time AI programme without detecting estrus. Since grazing land is shrinking, fat lamb production for mutton may be an important criterion to boost the total mutton production. The application of fixed time AI with liquid semen can be useful for augmenting productivity of native sheep by use of elite rams.

Rearing of small ruminants ensures self-employment and acts as a cushion in distress situations like drought and famine. In last few years, goat production in the country gained momentum in the form of a commercially viable enterprise as evidenced by increasing interest of young energetic youth to develop knowledge and skill in this species. In global scenario, India ranks on top in goat population. The demand for meat, milk and fibre is increasing progressively and expected to further rise in future. The goat population in the country is expected to reach 216 million by 2050 with milk and skin production to 9.8 and

0.25 million tonnes, respectively. Urbanization, increased income and strong preference to goat meat will be some of the major contributing factors for growth in goat meat production. To meet out increasing demand of animal products by 2050 it would not be possible just only by increasing their numbers alone, but to a large extent enhancing per animal productivity in a sustainable manner. Since, goat is an important source of meat, milk, fibre, skin and manure especially in the subsistent agriculture in arid and semi-arid zones of Asia and Africa, it can contribute substantially to fulfilling the increasing demand for livestock products in developing and developed countries of the world.

**Pig**

Artificial insemination (AI) has been used to obtain *offspring* from *genetically superior* males for more than 200 years. The technology provides unique opportunity for the genetic improvement of pigs. With all known advantage of AI, it offers the most economically sound method of maintaining genetic variability in a positive direction. Artificial insemination in pigs could be started in India in few north-eastern states like Assam (1981), Meghalaya (1987) and Mizoram (1993).

However, problems with technical transfer and lack of awareness of pig farmers delayed the development of this technology. Nevertheless, technologies could be standardized for training of boars, semen collection, processing and preservation for successful AI and wider field level adoption of the technology could be witnessed in the past few years. To take initiative on this front, AI programmes were actively initiated in the state of Assam under the aegis of NRC on pig (ICAR), Rani through Institute Village Link Project (IVLP) with an aim to distribute good quality germplasm and to validate the developed technology at farmer's field. Currently, artificial insemination technology is being undertaken widely in the neighbouring areas and more than 194 small villages have already been benefitted with AI service. Mizoram is another main state where pig AI is being practiced in the field through state animal husbandry department. Recently, trainings were organized for AI technology right from semen collection and preservation from Punjab, Tripura and Manipur. In Meghalya, ICAR Research Complex for NEH Region has standardized the technology and veterinarians and farmers, unemployed youths were trained on semen collection and processing to perform AI at field conditions. Use of the technology has increased in importance and popularity because of better sow productivity, litter performance, higher profit with changes in farmers' approach. The dispersion of AI practices and related technologies to farmers of the region will improve pig productivity and ultimately livelihood security of the farmers and rural poor.

**Yak**

The use of reproductive and molecular biotechnologies in management of yak genetic resource has already been discussed under para 30.1. The application of reproductive technologies are handicapped by the semi migratory transhumance system of yak rearing, inaccessibility of yak tract, silent oestrus and traditional mindset of yak keepers still prevailing owing to their illiteracy and lack of proper driving force such as marketing infrastructure, co-operative, organized breeders' association, NGOs, donor and development agencies. For application of molecular genetics information a large structured population is required which is not available in India. For a successful endeavour, efforts should be made to access of road and other communication to the desolate yak tracts. Literacy, scientific awareness, basic amenities, marketing, establishment of more number of organized farms at different yak rearing regions and sedentarization are needed to be improved.

**Mithun**

Since, Mithun lives in forest under free range condition, therefore, the biggest challenge in implementing any reproductive biotechnologies is to get hold timely and restrain the animals. Suggestions:

1. It is urgently needed to fence the Mithun dominated areas with wire-fencing or bio-fencing.
2. Implementation of electronic identification through microchip of entire Mithun population is also needed to identify the animal before intervention of any reproductive technology.
3. To develop Mithun catchment areas with all necessary facilities like fodder production, animal crate, first aid treatment etc. where animal can be kept for few days under observation.

**Success achieved**

1. First ever birth of Embryo Transfer Mithun calf in the world – "Bharat" on 27 March 2012 and "Mohan" born of 100-day cryo-preserved embryo on 12 May, 2012.
2. Two AI calves of Mithun by using this protocol born in 2010 in village (field) conditions. However, in the Institute farm, the first AI Mithun calf was born in 2006.

**Poultry**

1. Chicken germplasm have been characterized by microsatellite and SNP markers. Molecular markers for juvenile growth have been identified and validated at the farm.
2. Trait-based gene profiles for egg quality traits have been developed in chicken.
3. Functional genomic profiles by cDNA microarray have been prepared for growth traits in native and broiler chicken.
4. Whole genome of native chicken (Aseel) has been explored for the first time in the country.

## III. DATA CONTRIBUTING TO THE PREPARATION OF *THE STATE OF THE WORLD'S BIODIVERSITY FOR FOOD AND AGRICULTURE*

INTEGRATION OF THE MANAGEMENT OF ANIMAL GENETIC RESOURCES WITH THE MANAGEMENT OF PLANT, FORESTRY AND AQUATIC GENETIC RESOURCES

1. Please indicate the extent to which the management of animal genetic resources in your country is integrated with the management of plant, forestry and aquatic genetic resources. Please describe the collaboration, including, if relevant, a description of the benefits gained by pursuing a collaborative approach.

| Type of collaboration | Extent of collaboration (score: none, limited, extensive) | Description (text) |
|---|---|---|
| Development of joint national strategies or action plans | Limited | Joint national strategies and action plan for plant, animal and fish genetic resources are developed by Ministry of Agriculture and for wild flora and fauna as well as forest development is being taken care by Ministry of Environment and Forest. |
| Collaboration in the characterization, surveying or monitoring of genetic resources, production environments or ecosystems | Limited | Generally, the characterization, surveying or monitoring on plant, animal, fish and forest is taken separately by respective departments and ministries. However, in the last five year plan one project on Harmonizing bio diversity conservation and agricultural intensification through integration of plant, animal and fish genetic resources for livelihood security in fragile eco system was completed by the financial support of the world bank. |
| Collaboration related to genetic improvement | None | The genetic improvement programmes for plant, animal, fish and forest are conducted separately by respective departments/ ministries. |

| | | |
|---|---|---|
| Collaboration related to product development and/or marketing | None | The product development and marketing programmes for plant, animal, fish and forest are conducted separately by respective departments/ ministries. |
| Collaboration in conservation strategies, programmes or projects | Limited | The guidelines for management of genetic resources including plant, animal and fish as well as national plan of action for animal genetic resources is under preparation by ICAR, Ministry of Agriculture. Such strategies/ policies for forest are being developed by Ministry of Environment and Forest. |
| Collaboration in awareness-raising on the roles and values of genetic resources | None | Separately for plant, animal, fish and forest. |
| Training activities and/or educational curricula that address genetic resources in an integrated manner | Limited | SAU's, KVK and other organizations under Government and Non Government organizations are extending Training activities and/or educational curricula that address genetic resources in an integrated manner. |
| Collaboration in the mobilization of resources for the management of genetic resources | None | Separately for plant, animal, fish and forest. |

2. Please describe any other types of collaboration. (text)

Awareness at National Level created about Genetic Resources in holistic approach through exhibitions and Seminars at limited level

3. If relevant, please describe the benefits that could be achieved by strengthening collaboration in the management of genetic resources in the animal, plant, forest and aquatic sectors in your country. If specific plans to increase collaboration are in place, please describe them and the benefits foreseen (text)

Not relevant

4. Please describe any factors that facilitate or constrain collaborative approaches to the management of genetic resources in your country. (text)

- Due to increasing human population and urbanization, agricultural land under fodder production is declining which is adversely affecting nutritional requirement of livestock.
- Ministry of Environment and Forest is taking care of wild flora and fauna and development of forest. While implementing the projects on development of the forest, the ministry imposes ban on grazing of livestock in forest, which is adversely affecting survival of animal genetic resources because majority of livestock in India is reared under crop-livestock production system where major source of animal nutrition is grazing.

5. If there are constraints, please indicate what needs to be done to overcome them. (text)

- All kind of biodiversity conservation should be viewed in totality. Collaborations need to be strengthened between different departments in this regard. The forest department must cooperate in providing adequate grazing land to the livestock while developing their programmes for development of forest.
- Sincere efforts are required to increase the area under fodder cultivation

**ANIMAL GENETIC RESOURCES MANAGEMENT AND THE PROVISION OF REGULATING AND SUPPORTING ECOSYSTEM SERVICES**

6. Do your country's policies, plans or strategies for animal genetic resources management include measures specifically addressing the roles of livestock in the provision of regulating ecosystem services and/or supporting ecosystem services? (yes, no)

No

6.1. If yes, please describe these measures and indicate which supporting and/or regulating ecosystem services are targeted, and in which production systems. (text)

Not Applicable

6.2. Please describe what the outcome of these measures has been in terms of:

- the supply of the respective ecosystem services (including an indication of the scale on which these outcomes have been obtained). (text)
- the state of animal genetic resources and their management (including an indication of the scale on which these outcomes have been obtained). (text)

Not Applicable

7. Do your country's policies, plans or strategies for animal genetic resources management include measures specifically addressing environmental problems associated with livestock production? (yes, no)

Yes

7.1. If yes, please describe these measures and indicate the environmental problems that are targeted, and in which production systems. (text)

One mega project on "National Initiative for Climate Resilient Agriculture (NICRA)" has been taken up during last five year plan which addresses environmental problems under different agricultural production system.

7.2. Please describe what the outcome of these measures has been in terms of the reduction of the respective environmental problem (including an indication of the scale on which these outcomes have been obtained). (text)

Key features of NICRA Project are given below:

- Critical assessment of different crops/zones in the country for vulnerability to climatic stresses and extreme events, in particular, intra seasonal variability of rainfall
- Installation of the state-of-the-art equipment like flux towers for measurement of green house gases in large field areas to understand the impact of management practices and contribute data on emissions as national responsibility.
- Rapid and large scale screening of crop germplasm including wild relatives for drought and heat tolerance through phenomics platforms for quick identification of promising lines and early development and release of heat/drought tolerant varieties.
- Comprehensive field evaluation of new and emerging approaches of paddy cultivation like aerobic rice and SRI for their contribution to reduce the GHG emissions and water saving.
- Special attention to livestock and fishery sectors including aquaculture which have not received enough attention in climate change research in the past. In particular, the documentation of adaptive traits in indigenous breeds is the most useful step.
- Thorough understanding of crop-pest/pathogen relationship and emergence of new biotypes due to climate change.
- Simultaneous up-scaling of the outputs both through KVKs and the National Mission on Sustainable Agriculture for wider adoption by the farmers

• Please describe what the outcome of these measures has been in terms of the state of animal genetic resources and their management (including an indication of the scale on which these outcomes have been obtained). (text)

So far the major outcomes of NICRA project are as follows:

- Selection of promising crop genotypes and livestock breeds with greater tolerance to climatic stress.
- Existing best bet practices for climate resilience demonstrated in 100 vulnerable districts.
- Infrastructure at key research institutes for climatic change research strengthened.
- Adequately trained scientific man power to take up climate change research in the country and empowered farmers to cope with climate variability.

8. Please describe any constraints or problems encountered or foreseen in the implementation of measures in your country aimed at promoting the provision of regulating and supporting ecosystem services or reducing environmental problems. (text)

Not available so far

9. Please provide examples of cases in which the role of livestock or specific animal genetic resources is particularly important in the provision of regulating and/or supporting ecosystem services in your country. Please also describe any examples in which diverse animal genetic resources are important in terms of reducing the adverse environmental effects of livestock production. (text)

Data not available

10. Please describe the potential steps that could be taken in your country to further expand or strengthen positive links between animal genetic resources management and the provision of regulating and/or supporting ecosystem services or the reduction of environmental problems. If your country has specific plans to take further action in this field, please describe them. (text)

An holistic approach on Biodiversity Conservation may be taken jointly by Ministry of Environment and Forest & Ministry of Agriculture at Central and State levels.

11. Please provide any further information on the links between animal genetic resources management in your country and the provision of supporting and/or regulating ecosystem services and/or the reduction of environmental problems. (text)

Not available

## IV. PROGRESS REPORT ON THE IMPLEMENTATION OF THE

## GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES – 2007 to 2013

### Strategic Priority Area 1: Characterization, Inventory and Monitoring of Trends and Associated Risks

• The state of inventory and characterization of animal genetic resources
• The state of monitoring programmes and country-based early warning and response systems
• The state of international technical standards and protocols for characterization, inventory, and monitoring

1. Which of the following options best describes your country's progress in building an inventory of its animal genetic resources covering all livestock species of economic importance (SP 1, Action 1)?

*Glossary: An inventory is a complete list of all the different breeds present in a country.*

a. Completed before the adoption of the GPA
b. Completed after the adoption of the GPA
c**. Partially completed (further progress since the adoption of the GPA)** √
d. Partially completed (no further progress since the adoption of the GPA)

Please provide further details:
A big proportion of non-descript population (about 62%) of Indian livestock is in the process of exploration. A system for registration of livestock and poultry breed has been established by the ICAR, New Delhi. So far a total of 129 extant breeds and 15 new populations of different livestock species have been studied and registered as distinct breeds.

2. Which of the following options best describes your country's progress in implementing phenotypic characterization studies covering morphology, performance, location, production environments and specific features in all livestock species of economic importance (SP 1, Actions 1 and 2)?

a. Comprehensive studies were undertaken before the adoption of the GPA
b. Sufficient information has been generated because of progress made since the adoption of the GPA
c**. Some information has been generated (further progress since the adoption of the GPA)** √
d. Some information has been generated (no further progress since the adoption of the GPA)
e. None, but action is planned and funding identified
f. None, but action is planned and funding is sought
g. None

Please provide further details:
Following new breeds of livestock have already been registered after phenotypic characterization in last five years:

1. Banni Buffalo
2. Chilika Buffalo
3. Motu Cattle
4. Ghumsuri Cattle
5. Binjharpuri Cattle
6. Khariar Cattle

7. Kalahandi Buffalo
8. Pulikulam Cattle
9. Kosali Cattle
10. Malnadgidda Cattle
11. Konkankanyal Goat
12. Berari Goat
13. Ghoongroo Pig
14. Niangmegha Pig
15. Spiti Donkey

However, some more livestock populations have been characterized whose registration is in process.

3. Which of the following options best describes your country's progress in molecular characterization of its animal genetic resources covering all livestock species of economic importance (SP 1)?

a. Comprehensive studies were undertaken before the adoption of the GPA
b. **Sufficient information has been generated because of progress made since the adoption of the GPA** √
c. Some information has been generated (further progress since the adoption of the GPA)
d. Some information has been generated (no further progress since the adoption of the GPA)
e. None, but action is planned and funding identified
f. None, but action is planned and funding is sought
g. None

Please provide further details:

More than 90% of the registered breeds of livestock and poultry have been characterized by using FAO recommended microsatellite markers.

4. Has your country conducted a baseline survey of the population status of its animal genetic resources for all livestock species of economic importance (SP 1, Action 1)?

*Glossary: A baseline provides a reference point for monitoring population trends. Population status refers to the total size of a national breed population (ideally, also the proportion that is actively used for breeding and the number of male and female* breeding animals).

a. **Yes, a baseline survey was undertaken before the adoption of the GPA** √
b. Yes, a baseline survey has been undertaken or has commenced after the adoption of the GPA
c. Yes, a baseline survey has been undertaken for some species (coverage increased since the adoption of the GPA)
d. Yes, a baseline survey has been undertaken for some species (coverage not increased since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

The livestock census of India has been taken up species-wise since 1951 and breed-wise since 2007, however the data on breed-wise breeding males and females is not available.

5. Have institutional responsibilities for monitoring the status of animal genetic resources in your country been established (SP 1, Action 3)?

*Glossary: Monitoring is a systematic set of activities undertaken to document changes in the population size and structure of animal genetic resources over time.*

a. **Yes, responsibilities established before the adoption of the GPA** √
b. Yes, responsibilities established after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details:

The livestock census is undertaken by Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.

6. Have protocols (details of schedules, objectives and methods) been established for a programme to monitor the status of animal genetic resources in your country (SP 2)?
a. Yes, protocols established before the adoption of the GPA
b. Yes, protocols established after the adoption of the GPA
c. No, but action is planned and funding identified
d. **No, but action is planned and funding is sought** √
e. No

Please provide further details:

So far only breed-wise populations are estimated through Livestock census.

7. Are the population status and trends of your country's animal genetic resources being monitored regularly for all livestock species of economic importance (SP 1, Action 2)?
a. **Yes, regular monitoring commenced before the adoption of the GPA** √
b. Yes, regular monitoring commenced after the adoption of the GPA
c. Yes, regular monitoring is being undertaken for some species (coverage increased since the adoption of the GPA)
d. Yes, regular monitoring is being undertaken for some species (coverage not increased since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

It is monitored through livestock census since 1951 and pilot studies undertaken by different institutions.

8. Which criteria does your country use for assessing the risk status of its animal genetic resources (SP 1, Action 7)

*Glossary: FAO has developed criteria that it uses to allocate breeds to risk-status categories based on the size and structure of their populations (http://www.fao.org/docrep/010/a1250e/a1250e00.htm).*

**a. FAO criteria** √
b. National criteria that differ from the FAO criteria
c. Other criteria (e.g. defined by international body such as European Union)
d. None

Please provide further details. If applicable, please describe (or provide a link to a web site that describes) your national criteria or those of the respective international body:

Not required

9. Has your country established an operational emergency response system (http://www.fao.org/docrep/meeting/021/K3812e.pdf) that provides for immediate action to safeguard breeds at risk in all important livestock species (SP 1, Action 7)?

a. Yes, a comprehensive system was established before the adoption of the GPA
b. Yes, a comprehensive system has been established since the adoption of the GPA
c. For some species and breeds (coverage expanded since the adoption of the GPA)
d. For some species and breeds (coverage not expanded since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g**. No** √

Please provide further details:

10. Is your country conducting research to develop methods, technical standards or protocols for phenotypic or molecular characterization, or breed evaluation, valuation or comparison? (SP 2, Action 2)

a. **Yes, research commenced before the adoption of the GPA** √
b. Yes, research commenced after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No
Please provide further details:

These have been developed on the basis of guidelines given by FAO. For phenotypic characterization, breed descriptors and survey questionnaires have been developed separately for each of the livestock and poultry species. For molecular characterization, FAO recommended microsatellite markers are used.

11. Has your country identified the major barriers and obstacles to enhancing its inventory, characterization and monitoring programmes?
a. Yes
b. No
c. **No major barriers and obstacles exist. Comprehensive inventory, characterization and monitoring programmes are in place.** √

Please provide further details. If barriers and obstacles have been identified, please list them:

12. If applicable, please list and describe the measures that need to be taken to address these barriers and obstacles and to enhance your country's inventory, characterization and monitoring programmes:

Though major barrier and obstacle exists, however, following issues delays in completing inventory and characterization of animal genetic resources of India:

- Large population size of mammalian and avian species found in India.
- About 62% of mammalian population is non-descript in India.
- Therefore, technical manpower and institutions need to be increased in India.

13. Please provide further comments on your country's activities related to Strategic Priority Area 1: Characterization, inventory and monitoring of trends and associated risks (including regional and international cooperation):

1. We are in process of completing inventories of animal genetic resources.
2. System for registration of livestock and poultry breeds has been introduced in 2008.
3. Breed wise livestock census has been introduced since 2007 to monitor the trend and associated risk.

**Strategic Priority Area 2: Sustainable Use and Development**

• The state of national sustainable use policies for animal genetic resources
• The state of national species and breed development strategies and programmes
• The state of efforts to promote agro-ecosystem approaches

14. Does your country have adequate national policies in place to promote the sustainable use of animal genetic resources (see also questions 46 and 54)?

a. **Yes, since before the adoption of the GPA** √
b. Yes, policies put in place or updated after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details. If available, please provide the text of the policies or a web link to the text:

Livestock is a state subject, each of the 28 States and 8 Union Territories are making policies to promote the sustainable use of animal genetic resources in their states/ UTs.

15. Do these policies address the integration of agro-ecosystem approaches into the management of animal genetic resources in your country (SP5) (see also questions 46 and 54)?

*Glossary: The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (for further information see http://www.cbd.int/ecosystem/description.shtml).*

a. Yes
b. No, but a policy update is planned and funding identified
c. **No, but action is planned and funding is sought** √
d. No

Please provide further details:

A National Advisory Board on Management of Genetic Resources has been established where Guidelines for management of animal genetic resources have been developed.

16. Do breeding programmes exist in your country for all major species and breeds, and are these programmes regularly reviewed, and if necessary revised, with the aim of meeting foreseeable economic and social needs and market demands (SP4, Action 2)?

a. Yes, since before the adoption of the GPA
b. Yes, put in place after the adoption of the GPA
c. **For some species and breeds (coverage has increased since the adoption of the GPA)** √
d. For some species and breeds (coverage has not increased since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

Breeding programmes have been developed by different states and UTs as per the existing scenario of AnGR in their respective states/UTs.

17. Is long-term sustainable use planning – including, if appropriate, strategic breeding programmes – in place for all major livestock species and breeds (SP4, Action 1)?

a. Yes, since before the adoption of the GPA
b. Yes, put in place after the adoption of the GPA
**c. For some species and breeds (further progress made since the adoption of the GPA)** √
d. For some species and breeds (no further progress made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

Such planning and programmes have been made by State Governments; however, some national programmes have also been sponsored by Central Government.

18. Have the major barriers and obstacles to enhancing the sustainable use and development of animal genetic resources in your country been identified?

a. Yes
b. **No** √
c. No major barriers and obstacles exist. Comprehensive sustainable use and development measures are in place.

Please provide further details. If barriers and obstacles have been identified, please list them:

19. Have the long-term impacts of the use of exotic breeds on locally adapted breeds (e.g. economic, environmental or genetic impacts) and on food security been assessed in your country (SP4, Action 1)?

*Glossary:*
*Exotic breeds are breeds that are maintained in a different area from the one in which they were developed. Exotic breeds comprise both recently introduced breeds and continually imported breeds.*
*Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.*

a. No exotic breeds are being used for agricultural production
b. **Yes, assessments were introduced before the adoption of the GPA** √
c. Yes, assessments were introduced after the adoption of the GPA
d. No, but action is planned and funding identified
e. No, but action is planned and funding is sought
f. No

Please provide further details:

Exotic breeds in cattle, pig and poultry have increased the milk, meat and egg production in the country. However, use of exotic germplasm has resulted into dilution of locally adapted breeds.

20. Have recording systems and organizational structures for breeding programmes been established or strengthened (SP4, Action 3)?

a. Yes, sufficient recording systems and organizational structures for breeding programmes have existed since before the adoption of the GPA
b. Yes, sufficient recording systems and organizational structures for breeding programmes exist because of progress made since the adoption of the GPA
c. **Yes, recording systems and organizational structures for breeding programmes are partially in place (and were established or strengthened after the adoption of the GPA)** √
d. Yes, recording systems and organizational structures for breeding programmes are partially in place (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

This is available for only organized herds/ flocks under state/central government/ some of NGOs and private companies. However, there is no recording system for the large population of livestock and poultry being maintained by the farmers.

21. Are mechanisms in place in your country to facilitate interactions among stakeholders, scientific disciplines and sectors as part of sustainable use development planning (SP5, Action 3)?

a. Yes, comprehensive mechanisms have existed since before the adoption of the GPA
b. Yes, comprehensive mechanisms exist because of progress made since the adoption of the GPA
c. **Yes, mechanisms are partially in place (and were established or strengthened after the adoption of the GPA)** √
d. Yes, mechanisms are partially in place (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

Many livestock fairs, scientist-farmers interactions, meetings etc are organized by the Government/NGOs and private organizations.

22. Have measures been implemented in your country to provide farmers and livestock keepers with information that facilitates their access to animal genetic resources (SP 4, Action 7)?

a. Yes, comprehensive measures have existed since before the adoption of the GPA
b. Yes, comprehensive measures exist because of progress made since the adoption of the GPA
c. **Yes, measures partially implemented (and were established or strengthened after the adoption of the GPA)** √
d. Yes, measures partially implemented (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

India is having huge diversity in languages, therefore, local institutions are preparing some literature on AnGR in local languages.

23. Has your country developed a national policy or entered specific contractual agreements for access to and the equitable sharing of benefits resulting from the use and development of animal genetic resources and associated traditional knowledge (SP3, Action 2)?

a. Yes, sufficient measures (policy and/or agreements) have been in place since before the adoption of the GPA
b. Yes, sufficient measures (policy and/or agreements) are in place because of progress made since the adoption of the GPA
c. Yes, some measures (policy and/or agreements) are in place (progress has been made since the adoption of the GPA)
d. Yes, some measures (policy and/or agreements) are in place (but no progress has been made since the adoption of the GPA)
e. **No, but a policy and/or agreements are in preparation** √
f. No, but a policy and/or agreements are planned
g. No

Please provide further details:

Some contractual agreements are in process of preparation after commencement of Biological Diversity Act 2002 but no legal instrument is available.

24. Have training and technical support programmes for the breeding activities of livestock-keepers been established or strengthened in your country (SP 4, Action 1)?

a. Yes, sufficient programmes have existed since before the adoption of the GPA
b. Yes, sufficient programmes exist because of progress made since the adoption of the GPA
**c. Yes, some programmes exist (progress has been made since the adoption of the GPA)** √
d. Yes, some programmes exist (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

State Animal Husbandry Departments, ICAR research institutes, State Universities and *Krishi Vigyan Kendras* (Agriculture Science Centres) are regularly organizing training programmes for the benefit of livestock keepers.

25. Have priorities for future technical training and support programmes to enhance the use and development of animal genetic resources in your country been identified (SP 4, paragraph 42)?

a**. Yes, priorities have been identified or updated since the adoption of the GPA** √
b. Yes, priorities were identified before the adaption of the GPA but have not been updated
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details:

Through extension agencies working under Government and non-Government sectors.

26. Have efforts been made in your country to assess and support indigenous or local production systems and associated traditional knowledge and practices related to animal genetic resources (SP 6, Action 1, 2)?

a. Yes, sufficient measures have been in place since before the adoption of the GPA
b. Yes, sufficient measures are in place because of progress made since the adoption of the GPA
c. **Yes, some measures are in place (and were established or strengthened after the adoption of the GPA)** √
d. Yes, some measures are in place (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

While characterising the breed through surveys, such traditional knowledge and practices are documented and later on validated.

27. Have efforts been made in your country to promote products derived from indigenous and local species and locally adapted breeds, and facilitate access to markets (SP 6, Action 2, 4)?

a. Yes, sufficient measures have been in place since before the adoption of the GPA
b. Yes, sufficient measures are in place because of progress made since the adoption of the GPA
c. Yes, some measures are in place (and were established or strengthened after the adoption of the GPA)
d. Yes, some measures are in place (but no progress has been made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
**g. No** √
Please provide further details:

In general, promotion to the products derived from indigenous and locally adapted breeds are not there. However, some milk products from locally adapted breeds of cattle and other dairy species have been promoted.

28. If applicable, please list and describe priority requirements for enhancing the sustainable use and development of animal genetic resources in your country:

- Adequate grazing land
- Breeding males of good genetic merit
- Adequate funding for management of animal genetic resources and research.
- Pedigree and performance recording system.

29. Please provide further comments on your country's activities related to Strategic Priority Area 2: Sustainable Use and Development (including regional and international cooperation):

No

**Strategic Priority Area 3: Conservation**
• The state of national conservation policies
• The state of *in situ* and *ex situ* conservation programmes
• The state of regional and global long-term conservation strategies and agreement on technical standards for conservation

30. Does your country regularly assess factors leading to the erosion of its animal genetic resources (SP 7, Action 2)?

a. Erosion not occurring
b. Yes, regular assessments have been implemented since before the adoption of the GPA
c. Yes, regular assessments have commenced since the adoption of the GPA
d. No, but action is planned and funding identified
e. **No, but action is planned and funding is sought** √
f. No

Please provide further details:

31. What factors or drivers are leading to the erosion of animal genetic resources? Please describe the factors specifying which breeds or species are affected:

- Shrinkage in grazing land due to development of forest.
- Introduction of exotic germplasm especially in cattle, chicken and pig.
- Mechanization of agriculture leading to reduced demand of draft animal power.
- Reduced utility of pack animals due to infrastructure development.
- Undue emphasis to some of high producing breeds.
- Change in utility pattern.
- Inadequate breeding policies under low production system.

32. Does your country have conservation policies and programmes in place to protect locally adapted breeds at risk in all important livestock species (SP 7, SP 8 and SP 9)?

*Glossary: Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.*

a. Country requires no policies and programmes because all locally adapted breeds are secure
b. Yes, comprehensive policies and programmes have been in place since before the adoption of the GPA
c. Yes, comprehensive policies and programmes exist because of progress made since the adoption of the GPA
d. **For some species and breeds (coverage expanded since the adoption of the GPA)** √
e. For some species and breeds (coverage not expanded since the adoption of the GPA)
f. No, but action is planned and funding identified
g. No, but action is planned and funding is sought
h. No

Please provide further details:

- Conservation under Network Project on Animal Genetic Resources.
- Conservation of threatened breeds programme of Department of Agriculture, Dairying and Fisheries, Ministry of Agriculture.
- National programme for Cattle and Buffalo Development (Government of India).
- AICRPs on different livestock and poultry species.
- Conservation programmes of NGOs.

33. If conservation policies and programmes are in place, are they regularly evaluated or reviewed (SP 7, Action 1; SP 8, Action 1; and SP 9, Action 1)?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

National plan for animal genetic resources is under process of preparation by ICAR.

34. Does your country have *in situ* conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

*Glossary: In situ conservation – support for continued use by livestock keepers in the production system in which the livestock evolved or are now normally found and bred.*
*Glossary: Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.*

a. Country requires no *in situ* conservation measures because all locally adapted breeds are secure
b. Yes for all breeds
c. **For some breeds (coverage expanded since the adoption of the GPA)** √
d. For some breeds (coverage not expanded since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

As per point no. 32.

35. Does your country have *ex situ in vivo* conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

*Glossary: Ex situ in vivo conservation - maintenance of live animal populations not kept under their normal management conditions - e.g. in zoological parks or governmental farms - and/or outside the area in which they evolved or are now normally found.*

a. Country requires no *ex situ in vivo* conservation measures because all locally adapted breeds are secure
b. Yes for all breeds
c. **For some breeds (coverage expanded since the adoption of the GPA)** √
d. For some breeds (coverage not expanded since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

At present there are 161 cattle breeding farms, 33 buffalo breeding farms, 5772 poultry breeding farms, 35 duck breeding farms, 82 sheep breeding farms, 79 goat breeding farms, 35 rabbit breeding farms, 127 pig breeding farms, 3 camel breeding farms and 20 horse breeding farms are functioning

under Government and Non-Government sectors. However, these farms are concentrating to few of the important breeds of livestock and poultry.

36. Does your country have *ex situ in vitro* conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

*Glossary: Ex situ in vitro - conservation, under cryogenic conditions including, inter alia, the cryoconservation of embryos, semen, oocytes, somatic cells or tissues having the potential to reconstitute live animals at a later date.*

a. Country requires no *ex situ in vitro* conservation measures because all locally adapted breeds are secure
b. Yes for all breeds
c. **For some breeds (coverage expanded since the adoption of the GPA**) √
d. For some breeds (coverage not expanded since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

The National Gene Bank has been developed at NBAGR, Karnal and semen doses of 28 breeds of 7 livestock species have been preserved at this gene bank. A total of 54 semen production centres, 132 semen banks, 77765 AI centres are also functioning under Government and Non-Government sectors for taking care of cattle and buffalo breeding in the country.

37. Please describe the measures (indicating for each whether they were introduced before or after the adoption of the GPA) or provide a web link to a published document that provides further information:

- DADF: www.dahd.nic.in
- ICAR: www.icar.org.in
- NDDB: www.nddb.org
- NBAGR: www.nbagr.res.in
- NDRI: www.ndri.res.in
- IVRI: www.ivri.nic.in

38. If your country has not established any conservation programmes, is this a future priority?
a. **Yes** √
b. No

39. Has your country identified the major barriers and obstacles to enhancing the conservation of its animal genetic resources?

a. Country requires no conservation programmes because all animal genetic resources are secure
b. **Yes** √
c. No
d. No major barriers and obstacles exist. Comprehensive conservation programmes are in place

Please provide further details. If barriers and obstacles have been identified, please list them:

Inadequate availability of budget. However, Guidelines for management of animal genetic resources have been developed.

40. If your country has existing *ex situ* collections of animal genetic resources, are there major gaps in these collections (SP 9, Action 5)?

a. **Yes** √
b. No

**If yes, have priorities for filling the gaps been established?**
a. **Yes** √
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. No

All the breeds are to be covered provided proper funding is available.

41. Are arrangements in place in your country to protect breeds and populations that are at risk from natural or human-induced disasters (SPA 3)?

a. Yes, arrangements have been in place since before the adoption of the GPA
b. Yes, arrangements put in place after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. **No** √

Please provide further details:

42. Are arrangements in place in your country for extraction and use of conserved genetic material following loss of animal genetic resources (e.g. through disasters), including arrangements to enable restocking (SP 9, Action 3)?

a. Yes, arrangements have been in place since before the adoption of the GPA
b**. Yes, arrangements put in place after the adoption of the GPA** √
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details:

All the breeds of livestock and poultry are not covered so far.

43. Is your country conducting research to adapt existing, or develop new, methods and technologies for *in situ* and *ex situ* conservation of animal genetic resources (SP 11, Action 1)?

a. **Yes, research commenced before the adoption of the GPA** √
b. Yes, research commenced since the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details. If yes, please briefly describe the research:

An institution "National Bureau of Animal Genetic Resources" has been established in 1984.

44. Does your country implement programmes to promote documentation and dissemination of knowledge, technologies and best practices for conservation (SP 11, Action 2)?

a. **Yes, programmes commenced before the adoption of the GPA** √
b. Yes, programmes commenced since the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details:

At smaller scale only by various extension agencies working under Central and State Governments as well as NGOs

45. What are your country's priority requirements for enhancing conservation measures for animal genetic resources? Please list and describe them:

- Classification of livestock and poultry breeds based on their risk status.
- Prioritization of livestock and poultry breeds which are declining.
- Adequate funding and trained manpower for conservation of AnGR by creating awareness among the stake holders.

46. Please provide further comments describing your country's activities related to Strategic Priority Area 3: Conservation (including regional and international cooperation):

- Formulation of breed specific breeding policy.
- Preparation of National watch list.
- All the livestock farms of State and Central Government may be declared as *in-situ* conservation centres

**Strategic Priority Area 4: Policies, Institutions and Capacity-building**
• The state of national institutions for planning and implementing animal genetic resources measures
• The state of information sharing
• The state of educational and research facilities capacity for characterization, inventory, and monitoring, sustainable use, development, and conservation
• The state of awareness of the roles and values of animal genetic resources
• The state of policies and legal frameworks for animal genetic resources

47. Does your country have sufficient institutional capacity to support holistic planning of the livestock sector (SP 12, Action1)?

a. **Yes, sufficient capacity has been in place since before the adoption of the GPA** √
b. Yes, sufficient capacity is in place because of progress made after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details:

Strong network of state and central animal husbandry departments, universities, research institution and NGOs working on different aspects of livestock sector.

48. What is the current status of your country's national strategy and action plan for animal genetic resources (SP 20)?

*Glossary: National strategy and action plan for animal genetic resources: a strategy and plan, agreed by stakeholders and preferably government-endorsed, that translates the internationally agreed Global Plan of Action for Animal Genetic Resources into national actions, with the aim of ensuring a strategic and comprehensive approach to the sustainable use, development and conservation of animal genetic resources for food and agriculture.*

a. Previously endorsed national strategy and action plan is being updated (or new version has been endorsed)
b. Completed and government-endorsed
c. Completed and agreed by stakeholders
d. **In preparation** √
e. Preparation is planned and funding identified
f. Future priority activity
g. Not planned

Please provide further details. If available, please provide a copy of your country's national strategy and action plan as a separate document or as a web link:

NBAGR, Karnal is preparing National Plan of Action for Animal Genetic Resources.

49. Are animal genetic resources addressed in your country's National Biodiversity Strategy and Action Plan (http://www.cbd.int/nbsap/)?

a. **Yes** √
b. No, but they will be addressed in forthcoming plan
c. No

Please provide further details:

Country's National Biodiversity Strategy and Action Plan are developed by Ministry of Environment and Forest mainly focusing on wild flora and fauna. However, for animal genetic resources, it is addressed by Ministry of Agriculture at central level and Departments of Animal Husbandry at state level.

50. Are animal genetic resources addressed in your country's national livestock sector strategy, plan or policy (or equivalent instrument)?

a. **Yes** √
b. No, but they will be addressed in a forthcoming strategy, plan or policy
c. No, animal genetic resources are not addressed
d. No, the country does not have a national livestock sector strategy, plan or policy

Please provide further details. If available, please provide the text of the strategy, plan or policy or a web link to the text:

- Suitable institutions are in place at Central Government and State Government to develop strategy, plan or policy for animal genetic resources.
- National Livestock Policy 2013 is in place.

51. Has your country established or strengthened a national database for animal genetic resources (independent from DAD-IS) (SP 15, Action 4)?

a. Yes, a national database has been in place since before the adoption of the GPA
b. Yes, a national database is in place because of progress made since the adoption of the GPA
c. **Yes, a national database is in place but still requires strengthening (progress since adoption of the GPA)** √
d. Yes, a national database is in place but still requires strengthening (no progress since adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

NBAGR, Karnal has developed a database on animal genetic resources.

52. Have your country's national data on animal genetic resources been regularly updated in DAD-IS?

*Note that the Commission on Genetic Resources for Food and Agriculture has requested FAO to produce global status and trends reports every two years.*
**a. Yes, regular updates have been occurring since before the adoption of the GPA** √
b. Yes, regular updates started after the adoption of the GPA
c. No, but it is a future priority
d. No

Please provide further details:

53. Has your country established a National Advisory Committee for Animal Genetic Resources (SP 12, Action 3)?

a. Yes, established before the adoption of the GPA
b**. Yes, established after the adoption of the GPA** √
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. No

Please provide further details. If a National Advisory Committee has been established, please list its main functions:

The constitution of National Advisory Board on Management of Genetic Resources includes Dr. R.S. Paroda, Chairman; Secretary DARE & DG, ICAR, Co-Chairman and 26 members. The members include Chairman, PPV & FR Authority, Chairman, National Biodiversity Authority, Chennai; DDG, Horticulture, ICAR; DDG, Animal Sciences, ICAR; DDG, Crop Sciences, ICAR; Chairman, Research Advisory Committee, NBPGR; Chairman, Research Advisory Committee, NBAGR; Chairman, Research Advisory Committee, NBFGR; Chairman, Research Advisory Committee, NBAII; Chairman, Research Advisory Committee, NBAIM; Executive Director, MSSRF, Chennai; Director, National Botanical Research Institute (CSIR); Sh. Bala Prasad, CEO, National Medicinal Plants Board; Regional Coordinator, South and South East Asia, Biodiversity International; Dr. M. Mahadevappa, Former Chairman ASRB; Dr. S. Kannaiyam, Former Chairman, NBA; Dr. Lalji Singh, VC, BHU, Varanasi; Dr. Suman Sahai, Gene Campaign, New Delhi; Director, NBAGR, Karnal; Director, NBFGR, Lucknow; Director, NBAIM, Mau Nath Bhanjan; Director, NBAII, Bangalore; ADG (Cdn.), ICAR; Dr. Sushama Chaphalkar, Director, School for Biotechnology, Pune. The Director, NBPGR, New Delhi shall be member Secretary of the Board.

54. Is there strong coordination and interaction between the National Focal Point and stakeholders involved with animal genetic resources, such as the breeding industry, livestock keepers, government agencies, research institutes and civil society organizations (SP 12, Action 3)?

a. Yes, strong coordination has been in place since before the adoption of the GPA
b. Yes, strong coordination was established after the adoption of the GPA
c. No, but action is planned and funding identified
d. No, but action is planned and funding is sought
e. **No** √

Please provide further details:

55. Does the National Focal Point (or other institutions) undertake activities to increase public awareness of the roles and values of animal genetic resources (SP 18)?

*Glossary: National Focal Point for the Management of Animal Genetic Resources: the National Coordinator for the Management of Animal Genetic Resources and his or her support staff within the institution responsible for coordinating activities concerning the management of AnGR (http://www.fao.org/docrep/014/ba0054e/ba0054e00.pdf).*

a. Yes, activities commenced before the adoption of the GPA
b. Yes, activities commenced after the adoption of the GPA
c. No, but activities are planned and funding identified
d. No, but activities are planned and funding is sought
e. **No**

Please provide further details:

56. Does your country have national policies and legal frameworks for animal genetic resources management (SP 20)?

a. Yes, comprehensive national policies and legal frameworks were in place before the adoption of the GPA and are kept up to date

b. Yes, comprehensive and up-to-date national policies and legal frameworks in place because of progress made since the adoption of the GPA
c. Yes, some national policies and legislation in place (strengthened since the adoption of the GPA)
d. **Yes, some national policies and legislation in place (not strengthened since the adoption of the GPA)** √
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

- National Livestock Policy 2013
- Livestock Breeding Policy of all State Governments

57. Which of the following options best describes the state of training and technology transfer programmes in your country related to inventory, characterization, monitoring, sustainable use, development and conservation of animal genetic resources (SP14, Action 1)?

a. Comprehensive programmes have been in place since before the adoption of the GPA
b. Comprehensive programmes exist because of progress made since the adoption of the GPA
c. **Some programmes exist (further progress since the adoption of the GPA)** √
d. Some programmes (no further progress since the adoption of the GPA)
e. None, but action is planned and funding identified
f. None, but action is planned and funding is sought
g. None

Please provide further details:

Trainings by State Animal Husbandry Departments, ICAR research institutes, State Universities and *Krishi Vigyan Kendras* (Agriculture Science Centres) are regularly organizing training programmes for benefit of livestock keepers.

58. Have organizations (including where relevant community-based organizations), networks and initiatives for sustainable use, breeding and conservation been established or strengthened (SP 14, Action 3)?

a. **Yes, comprehensive organizations, networks and initiatives have existed since before the adoption of the GPA** √
b. Yes, comprehensive organizations, networks and initiatives exist because of progress made since the adoption of the GPA
c. Yes, some organizations, networks and initiatives exist (established or strengthened since adoption of the GPA)
d. Yes, some organizations, networks and initiatives exist (but no progress made since adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

- NBAGR has been established with the mandate of identification, characterization, evaluation, conservation and sustainable utilization of animal genetic resources.
- Central Department of Animal Husbandry Dairying and Fisheries and State Animal Husbandry Departments and some NGOs are also working in this area.

59. Are there any national NGOs active in your country in the fields of:

Characterization?
a. **Yes** √
b. No

Sustainable use and development?
c. **Yes** √
d. No

Conservation of breeds at risk?
e. **Yes** √
f. No

If yes, please list the national NGOs and provide links to their web sites:

- SEVA: Sustainable- Agriculture Environment and Voluntary Action: http://www.sevango.in
- LPPS: Lokhit Pashu-Palak Sansthan*:* www.lpps.org
- SURE: Society to Uplift rural Economy: www.sure.org.in
- ANTHRA: http://www.anthra.org/ etc.
- NIMBKAR AGRICULTURE RESEARCH INSTITUTE: www.nariphaltan.org
- BAIF: Bhartiya Agro Industries Foundation: www.baif.org.in

60. Has your country established or strengthened research or educational institutions in the field of animal genetic resources management (SP 13, Action 3)?

a. **Yes, adequate research and education institutions have existed since before the adoption of the GPA** √
b. Yes, adequate research and education institutions exist because of progress made since the adoption of the GPA
c. Yes, research and education institutions exist but still require strengthening (progress made since the adoption of the GPA)
d. Yes, research and education institutions exist but still require strengthening (no progress made since the adoption of the GPA)
e. No, but action is planned and funding identified
f. No, but action is planned and funding is sought
g. No

Please provide further details:

Institutions have been established for research and education on animal/ veterinary sciences and AnGR has been opted as one of components of study in many universities and research institutions. Separate institute NBAGR has also been established for research on various aspects of animal genetic resources.

61. Please provide further comments describing your country's activities related to Strategic Priority Area 4: Policies, Institutions and Capacity-building (including regional and international cooperation):

- Livestock policies have been framed by state Animal Husbandry Departments.
- Institution as described in Q-60.

Implementation and financing of the Global Plan of Action for Animal Genetic Resources

- The state of international collaboration for planning and implementing animal genetic resources measures
- The state of financial resources for the conservation, sustainable use and development of animal genetic resources

62. Has your country established or strengthened international collaboration in (SP 16):

Characterization?
a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Sustainable use and development?
e. Yes
f. No, but action is planned and funding identified
g. No, but action is planned and funding is sought
h. **No** √

Conservation of breeds at risk?
i. Yes
j. No, but action is planned and funding identified
k. No, but action is planned and funding is sought
l. **No** √

Please provide further details:

63. Are there any international NGOs active in your country in the fields of:

Characterization?
a. Yes
b. **No** √

Sustainable use and development?
c. Yes
d. **No** √

Conservation of breeds at risk?
e. Yes
f. **No** √

If yes, please list the international NGOs:

Not Applicable

64. Has national funding for animal genetic resources programmes increased since the adoption of the GPA?
a. **Yes** √
b. No

Please provide further details:

Yes, funds for animal husbandry research and education are gradually increasing.

65. Has your country received external funding for implementation of the GPA?
a. Yes
b. **No** √
c. No, because country generally does not receive external funding

Please provide further details:

Not Applicable

66. Has your country supported or participated in international research and education programmes assisting developing countries and countries with economies in transition to better manage animal genetic resources (SP 15 and 16)?

a. Yes, support or participation in place before the adoption of the GPA and strengthened since
b. Yes, support or participation in place before the adoption of the GPA but not strengthened since
c. Yes, support or participation in place since the adoption of the GPA
d. No, but action is planned and funding identified
e. No, but action is planned and funding is sought
f. **No** √

Please provide further details:

Not Applicable

67. Has your country supported or participated in programmes aimed at assisting developing countries and countries with economies in transition to obtain training and technologies and to build their information systems (SP 15 and 16)?

a. Yes, support or participation commenced before the adoption of the GPA and strengthened since
b. Yes, support or participation commenced before the adoption of the GPA but not strengthened since
c. Yes, support or participation commenced since the adoption of the GPA
d. No, but action is planned and funding identified
e. No, but action is planned and funding is sought
f. **No** √

Please provide further details:

Not Applicable

68. Has your country provided funding to other countries for implementation of the Global Plan of Action?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √
e. No, because country is generally not a donor country

Please provide further details. If relevant, specify whether funding was bilateral or multilateral; research cooperation or aid; and to whom and for what it was given:

69. Has your country contributed to international cooperative inventory, characterization and monitoring activities involving countries sharing transboundary breeds and similar production systems (SP 1, Action 5)?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

Not Applicable

70. Has your country contributed to establishing or strengthening global or regional information systems or networks related to inventory, monitoring and characterization of animal genetic resources (SP 1, Action 6)?

**a. Yes** √
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. No

Please provide further details:

71. Has your country contributed to the development of international technical standards and protocols for characterization, inventory and monitoring of animal genetic resources (SP2)?
a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

72. Has your country contributed to the development and implementation of regional *in situ* conservation programmes for breeds that are at risk (SP 8, Action 2; SP 10, Action 1)?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

73. Has your country contributed to the development and implementation of regional *ex situ* conservation programmes for breeds that are at risk (SP 9, Action 2; SP 10, Action 3; SP 10, Action 4)?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

74. Has your country contributed to the establishment of fair and equitable arrangements for the storage, access and use of genetic material stored in supra-national *ex situ* gene banks (SP9, Action 3)?

a. Yes
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. **No** √

Please provide further details:

75. Has your country participated in regional or international campaigns to raise awareness of the status of animal genetic resources (SP19)?

a. **Yes** √
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. No

Please provide further details:

76. Has your country participated in reviewing or developing international policies and regulatory frameworks relevant to animal genetic resources (SP 21)?

**a. Yes** √
b. No, but action is planned and funding identified
c. No, but action is planned and funding is sought
d. No

Please provide further details:

One FAO workshop on in-situ conservation of AnGR has been organized.

77. Emerging issues

In view of the possibility that at some point countries may wish to update the GPA, please list any aspects of animal genetic resources management that are not addressed in the current GPA but will be important to address in the future (approximately the next ten years). Please also describe why these issues are important and indicate what needs to be done to address them.

| Issues to be addressed in future (next ten years) | Reasons | Actions required | Reasons | Actions required |
|---|---|---|---|---|
| | | | | |

# Preparation of the **Country Report - 2**

[SoW - AnGR Process of FAO]

**on 21st December 2013** [Saturday] at NBAGR, Karnal

**[Participants]**

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