PROFILE
NBAGR

KUTCHI CAMEL

KILAKARSEL SHEEP

SWAMP BUFFALO

MOTU CATTLE

राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो

(भा.कृ.अ.प.) करनाल–132 001 (हरियाणा) भारत

NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES
(Indian Council of Agricultural Research)

P.O.Box No. 129, G.T. Road By-Pass, Near Basant Vihar, KARNAL - 132 001 (Haryana)
Tel: 0184-2267918 Fax: 0184-2267654 E-mail: directornbagr@gmail.com
Website: www.nbagr.res.in

OVERVIEW OF FARM ANIMAL GENETIC RESOURCES

Conservation of farm animal biodiversity has assumed special significance in the recent times as 1/3rd of the world's livestock and poultry breeds are at risk of becoming extinct and the rate of extinction is on the rise. As one of the world's mega biodiversity centres, India harbours more than 130 well documented indigenous breeds of various species viz, cattle (34), buffalo (12), sheep (39), goat (21), horse (6), camel (8) and poultry (15), besides pigs, yak, mithun, ducks, quails and geese. These valuable genetic resources are the culmination of adaptive evolution in specific ecosystems over thousands of years resulting in unique, sustainable germplasm that have been contributing in many ways to human survival and well being. The maintenance of this vast diversity is a major challenge as most of these breeds being low producers are at a risk of genetic dilution or complete erosion due to increasing pace of urbanization, intensive agriculture, mechanization and through the use of exotic germplasm, technological advances in agriculture and change in the preferences of producers/consumers.

HISTORY

In realization of the urgent need for conservation and sustainable utilization of vastly distributed indigenous farm animal breeds of the country, the National Bureau of Animal Genetic Resources (NBAGR) and National Institute of Animal Genetics (NIAG) were established on 21st September, 1984 at NDRI, SRS, Bangalore. These twin institutions were shifted to NDRI, Karnal in July, 1985 and were later amalgamated into one in April, 1995 and named "National Bureau of Animal Genetic Resources". The Bureau now has its own campus at Makrampur, G.T.Road By Pass, Karnal.

VISION

Striving for excellence in innovative research to identify genetic potential of indigenous livestock for improvement and conservation.

MISSION

To protect and conserve Indigenous Farm Animal Genetic Resources for sustainable utilization and livelihood security.
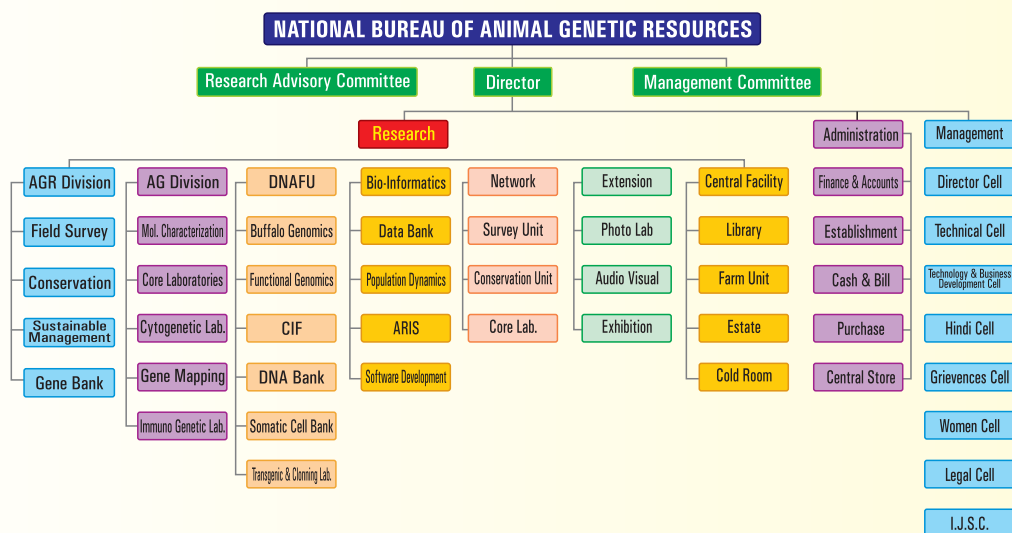
MANDATE

Identification, Evaluation, Characterization, Conservation and Utilization of Livestock and Poultry Genetic Resources.

OBJECTIVES

1. To conduct systematic surveys to characterize, evaluate and catalogue farm livestock and poultry genetic resources and to establish their National Data Base.

2. To design methodologies for *ex-situ* conservation and *in-situ* management and optimal utilization of farm animal genetic resources.

3. To undertake studies on genetic characterization using modern techniques of molecular biology.

4. To conduct training programmes related to evaluation, characterization, conservation and utilization of animal genetic resources.

ORGANIZATIONAL STRUCTURE OF NBAGR

NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

| Research Advisory Committee | Director | Management Committee |

Research

AGR Division	AG Division	DNAFU	Bio-Informatics	Network	Extension	Central Facility		Administration	Management
Field Survey	Mol. Characterization	Buffalo Genomics	Data Bank	Survey Unit	Photo Lab	Library		Finance & Accounts	Director Cell
Conservation	Core Laboratories	Functional Genomics	Population Dynamics	Conservation Unit	Audio Visual	Farm Unit		Establishment	Technical Cell
Sustainable Management	Cytogenetic Lab.	CIF	ARIS	Core Lab.	Exhibition	Estate		Cash & Bill	Technology & Business Development Cell
Gene Bank	Gene Mapping	DNA Bank	Software Development			Cold Room		Purchase	Hindi Cell
	Immuno Genetic Lab.	Somatic Cell Bank						Central Store	Grievences Cell
		Transgenic & Cloning Lab.							Women Cell
									Legal Cell
									I.J.S.C.

RESEARCH PROGRAMMES

Identification, Evaluation, Characterization and Documentation of Animal Genetic Resources

- Characterization of all the breeds/populations of livestock and poultry
- Development of methodologies for economic evaluation of Animal Genetic Resources
- Functional characterization of genes of economic and environmental importance
- Association studies using SNP markers with economic traits
- Prioritization of breeds for conservation based on molecular genetic data
- Documentation and development of database of AnGR

Conservation and Utilization of Indigenous Livestock and Poultry Germplasm

- Development of methodologies for *ex-situ* conservation
- Strengthening of AnGR Gene Bank (Semen, Embryo, DNA, Somatic Cell) for short and long term use
- Establishment of *in-situ* conservation units
- Development of models for utilization of *in-situ* conserved germplasm

Breed Registration and IPR Issues

- Registration of breeds
- Development of standardized breed descriptors

Human Resource Development

- Skill development/upgradation programme for different stake holders
- Awareness building on utilization of AnGR

Network Project on Animal Genetic Resources

- Characterization and conservation of farm AnGR
- Diversity analysis of recognized breeds/newly evolved populations of farm AnGR
- Development of molecular markers for economic traits in buffalo

ACHIEVEMENTS

Characterization of AnGR

Majority of the indigenous breeds known for various species have been characterized phenotypically as well as genetically. The current status of breeds characterized by the bureau is given below:

Species	Defined Breeds	Characterization		Documentation
		Phenotypic	Genetic	
Cattle	34	30	30	21
Buffalo	12	10	12	8
Goat	21	21	21	16
Sheep	39	38	38	24
Camel	8	6	6	1
Horse	6	5	6	3
Pig	3	1	3	1
Chicken	15	15	15	13

Breed Registration of AnGR

*   Registration of animal germplasm has been initiated to protect and check the biopiracy of indigenous AnGR. Guidelines, descriptors and application form for registration of new breeds/ populations have been prepared and are available at website of the institute (www.nbagr.res.in/ GUIDELINES.pdf).

*   Accession numbers have been given to 129 extant breeds of various species of livestock and poultry. These have been published as a special feature in The Indian Journal of Animal Sciences, 78(1): 127-130 (2008).

*   Breed descriptors of extant breeds are being prepared in consultation with species specific institutes for publication in Indian Journal of Animal Sciences. So far descriptors of 12 buffalo, 26 cattle, 13 goat, 14 sheep, and 4 horse breeds have been published in different issues of Indian Journal of Animal Sciences.

Registration of new breeds of cattle and buffalo

Applications for the registration of some lesser known populations of cattle and buffaloes were received from Orissa and Gujarat states. Breed Registration Committee in a meeting held on 12.04.2010 in, Krishi Bhawan, New Delhi under the chairmanship of Deputy Director General (Animal Sciences), ICAR approved the registration of four new breeds of cattle and two of buffaloes. Accession Numbers have been allotted to these breeds as given below:

S.No.	Breed	Home Tract	Accession number
CATTLE			
31	Motu	Orissa, Chhatishgarh & Andhra Pradesh	INDIA_CATTLE_1526_MOTU _03031
32	Ghumusari	Orissa	INDIA_CATTLE_1500_GHUMUSARI _03032
33	Binjharpuri	Orissa	INDIA_CATTLE_1500_BINJHARPURI _03033
34	Khariar	Orissa	INDIA_CATTLE_1500_KHARIAR _03034
BUFFALO			
11	Banni	Gujarat	INDIA_BUFFALO_0400_BANNI_01011
12	Chilika	Orissa	INDIA_BUFFALO_1500_CHILIKA_01012

Livestock Information Management

An Information system on Animal Genetic Resources of India **(AGRI-IS)** covering all domestic livestock and poultry species has been developed. This database contains descriptors of various breeds of livestock and poultry. The information on animal farms, semen production, vaccine production, livestock population, animal breeding, animal health infrastructure and animal products like milk, meat, egg, wool, etc is also available in this database. A soft version of AGRI-IS 2.0 has also been developed using MS-Access   in the form of CD which is being supplied on demand.

Information system for the management of livestock germplasm (ISGerm)

A computerized information system (ISGerm) has been developed for management and use of information on germplasm available in the National Gene Bank at NBAGR. ISGerm has the provision for entering and retrieving the information on semen characteristics, health status of the donors, photographs of donating bulls, and other details of semen collections.

Fig. A page showing characteristics of semen donor

Data Processing System for the survey data on Animal Genetic Resources (DPSAnGR)

A Data Processing System for Animal Genetic Resources (DPS AnGR) has been developed for management and analysis of the data collected through field surveys on animal genetic resources.
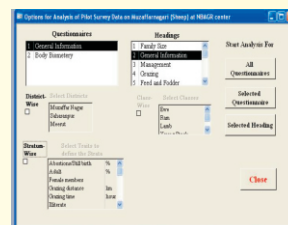

Fig. Option form for Analysis of survey data

Management information system for Gaushalas

A comprehensive digitized inventory on Gaushalas of Haryana State with specific focus on their cattle genetic resources, and material resources was developed to integrate the data on Gaushalas on different aspects at one place. A user friendly graphical user interface has been developed for storage and retrieval of information from the database.

SNP database for AnGR

SNP database for AnGR of India has been developed which is specifically for native livestock and poultry breeds based on secondary data sources. User interface is under development using ASP.NET with VB-Script.

Genome Analysis

- Molecular genotyping for diversity analysis accomplished in various breeds of buffalo, cattle, goat, sheep, camel, chicken
- Development of heterologous marker panel for buffalo and goat genome diversity analysis
- Identification and annotation of mammary gland expressed genes in buffalo.
- A programme on 'Buffalo Genomics' has been initiated in collaboration with Network Project on Buffalo improvement. Genome wide ubiquitously distributed buffalo specific SNP chip will be developed for genomic selection of Murrah buffalo.
- Establishment of Indicine origin of A2 allele of beta casein that is fixed across indigenous milch breeds of cattle and buffalo.
- Genetic diversity analysis of the 12 registered buffalo breeds indicated Banni buffaloes of Kutch, Gujarat as genetically unique population among other buffaloes of western India. Distinct clustering of Toda and Jaffarabadi buffaloes was also observed in the groups.
- Assamese buffaloes, generally considered as swamp type animals have been found to be of riverine/hybrid/swamp type as revealed by cytogenetic analysis.
- Classification of Manipuri buffaloes of north-east India as true swamp type by cytogenetic analysis and mtDNA based phylogenetic studies.
- The phylogenetic consensus tree constructed for 22 Indian goat breeds showed three distinct grouping of these breeds/populations. Most of the breeds of western, eastern coastal, southern peninsular regions clustered together while all the North Indian breeds clustered separately. MDS and PCA analysis clearly separated the breeds of Himalayan region from rest of the breeds.
- Relationship among different poultry populations using both morphological and genetic data has been established. All the breeds having overlapping morphology are classified into two distinctive types: game breeds and ordinary breeds.

Characterization of Major Genes

Candidate gene characterization for Growth, Production, Immune response, Heat regulation genes in cattle, buffaloe, sheep, goat and poultry revealed the polymorphism at nucleotide level. A number of SNPs (500 buffaloe, 134 cattle, 12 sheep, 115 goat and 10 poultry) were identified. Out of 115 SNPs identified in goats 5 of GH, 3 of casein and 2 of lacto globulin genes were found to be trait associated.

Cattle: DGAT1, Myostatin, SPP1 (Osteopontin), Growth Hormone Receptor, Growth Hormone Releasing Hormone Receptor, Interleukins, Insulin like growth factors, HS1, Butyrophilin1,3 (BTN-1,3), beta lactoglobulin (β-LG), Prolactin (PRL), pituitary-specific transcription factor 1 (PIT-1), kappa-casein (K-CN), beta-casein (β-CN), alpha S1 casein (αS1-CN), alpha S2 casein (αS2-CN), Bovine growth hormone (GH), alpha lactalbumin (LALBA), Toll-like receptor 4 (tlr 4), Toll-like receptor 9 (tlr 9), Monocyte chemotactic protein (mcp 1), inducible Nitric Oxide synthase gene (nos2A)

Buffalo: DGAT1, Myostatin, SPP1 (Osteopontin), Growth Hormone Receptor, Growth Hormone Releasing Hormone Receptor, Leptin, ABCG2, Milk Caseins, Lactoglobulins, Interleukins, Insulin like growth factors, Mammary derived growth inhibitor (MDGI), Osteopontin, Lactoferrin, beta lactoglobulin (β-LG)

Sheep: Boroola gene, Growth differentiation factors, Growth hormone, TypeI intermediate filament wool keratin (IF), B2C high wool sulphur protein, ovine cysteine and histidine rich protein (CYHR1), and Bone morphogenetic protein 15 (BMP15), beta-lactoglobulin (β-LG)

Goat: Leptin, CAST, CAPN1, Growth Hormone, kappa-casein (K-CN), beta-lactoglobulin (β-LG)

Chicken: Myostatin

Conservation of AnGR

Ex-situ Conservation:

• A total of about 76,769 cryopreserved semen doses representing economically important and endangered breeds of seven species are being maintained in the Animal Gene Bank.

• Animal Genomic Resource Bank is established which has collection of genomic DNA from 130 breeds/populations of livestock and poultry. It also has buffalo mammary gland EST library.

In-situ Conservation:

• *In situ* model of conservation has been developed by providing technical inputs and incentives to the farmers/breeders in the breeding tract of respective breeds and has been adopted under Network Project through the State Agricultural and Veterinary universities/ State Animal Husbandry Departments/ ICAR Institutes and NGOs. A total of 9 *in-situ* conservation units comprising of Krishna Valley and Tharparkar cattle, Toda buffalo; Nilgiri, Magra and Kilakarsal sheep; Beetal and Surti goat and Spiti horse have been established.

• Under *in situ* conservation project Gaushalas located in Haryana, Gujarat, Rajasthan and Uttar Pradesh has been examined to advocate a proper prototype for recording, maintaining, enhancing and conservation of indigenous cattle breeds. A new model 10P was developed to produce young bulls from purebred cows in an open nucleus manner within the Gaushalas.

Screening of Breeding Bulls for chromosomal abnormalities

To identify chromosomal abnormalities in breeding bulls being used in breed improvement programmes of various states, a total of 1456 breeding bulls belonging to HF, Jersey, Sahiwal, Hariana, Tharparkar, Gangatiri, Ponwar, Kherigarh, Red Sindhi, Ongole and crossbred cattle & Murrah, Nili Ravi, Bhadawari and Surti buffalo breeds in the country have been screened for chromosomal abnormalities. Recommendations regarding the use of these bulls for breeding were provided to the concerned agencies.

TECHNOLOGIES/METHODOLOGIES DEVELOPED

• **Survey Methodology for AnGR Characterization** - widely used for breed inventorization

• ***In-situ* Conservation Model** - Used by various research and development agencies engaged in conservation and development of AnGR

• **Somatic Cell Banking** - Alternate approach for conservation of AnGR

• **Digitized Database on AnGR** - Widely used in decision support

- **Test for Fecundity Gene in Sheep and Goats** - Used for identification of prolific animals
- **Standard Karyotypes of Livestock Species** - Used widely to screen chromosomal abnormalities as diagnostic tools for detecting genetic disorders in breeding bulls
- **Molecular Diversity Analysis** - Standardized protocol for establishment of genetic relationship among different breeds of a species
- **Breed Assignment Based on Microsatellite Genotyping** - Assignment of individuals to breeds/populations
- A methodology for assigning animals to a breed on the basis of the calculated score
- A methodology utilizing genetic algorithms for assigning an unknown animal to a known breed using genetic data such as microsatellite markers

FUTURE THRUSTS

- Computational Methodologies for Animal Genetic Resources
- Development of Farm Animal Germplasm Repositories
- Comparative and Functional Genomic Research for Improvement and Conservation of Animal Genetic Resources
- Functional characterization of genes of economic and environmental importance
- Animal Cloning and Transgenics
- Registration of Animal Germplasm to protect and check the biopiracy of indigenous AnGR
- Documentation of AnGR and Preparation of National Watch List
- Human Resource Development Programmes for Characterization, Evaluation, Conservation and Utilization of AnGR
- Evaluation and Value addition for sustainable and viable use of AnGR

WHAT NBAGR CAN OFFER

- Breed registration
- *Ex-situ* conserved germplasm
- DNA sequencing
- Parentage testing and pedigree analysis
- Karyological screening and profiling
- Training in the field of evaluation, characterization and conservation of AnGR
- Consultancy planning and policy making related to characterization and conservation of AnGR.

PUBLICATIONS

Books	7
Training Manuals	4
Accession numbers	>1000 NCBI GenBank accessions
Research Papers	550
Breed Monographs/ Bulletins/ leaflets	62
Breed Calendars	5 [Cattle, Buffalo, Sheep, Goat, Chicken]
Launched Research Journal in Hindi	Pashudhan Prakash (ISSN 0976-4569)

GHUNGROO PIG

SPITI HORSE

G.L.A.M. Media
mob. 989.669.4026