Application of Information Technology (IT) in Field Survey and Dairy Buffalo Recording System

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NBAGR Mandate

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

Coordination and capacity building in animal genetic resources management and policy issues.

IT Applications in Animal Production

- Data Processing Systems on Field Survey for characterization of breeds.
- Information System on Animal Genetic Resources (AnGR).
- IT in Animal Recording System.
- Herd Management Systems.
- Decision Support Systems on nutrition, breeding, diseases, etc.
- Genomic Resources Databases : Quantitative Trait Loci (QTL), Single Nucleotide Polymorphism (SNPs).

Inventory of Animal Genetic Resources (AnGR)

- Collection of the survey data on breeds for characterization.
- Computerization and Analysis of the survey data for creation of **breed descriptors**.
- Development of databases on animal genetic resources.
- To provide access to databases to potential users such as farmers, students, researchers.
- Decision making on AnGR - Assignment, Management and Conservation.

Breed Survey Questionnaires (Cattle / Buffalo)

- GENERAL INFORMATION: About the farmers, geography, origin and development of the breed and management practices.
- QUALITATIVE VARIABLES: Body color, Horn color, Hoof color, Ear shape, Hump size.
- QUANTITATIVE VARIABLES: Body weight, chest girth, body length, height at withers, muzzle circumference.
- HERD-LEVEL DATA: Basic temperament, heat tolerance, herd size and composition.
- DAIRY AND REPRODUCTIVE PERFORMANCE: Lactation length, daily milk yield, age at first calf, slaughter weight, dressing percentage.

Source: FAO. 2012. Phenotypic characterization of animal genetic resources. FAO Animal Production and Health Guidelines No. 11. Rome.

Data Processing System for Field Survey on Breeds

The data collected through systematic survey in the breeding tract of the breed is fed to a data processing system for its management and analysis.

The Data Processing System should be flexible:

- To accept all the type of data – numeric (averages), text (color), options (frequencies of trait values, for example Body color: black-80%, Brown:20%).
- Additional data unseen at the time of preparation of questionnaires.

The survey data is analyzed to obtain **Breed Descriptors**, that become input to reports and databases on AnGR.

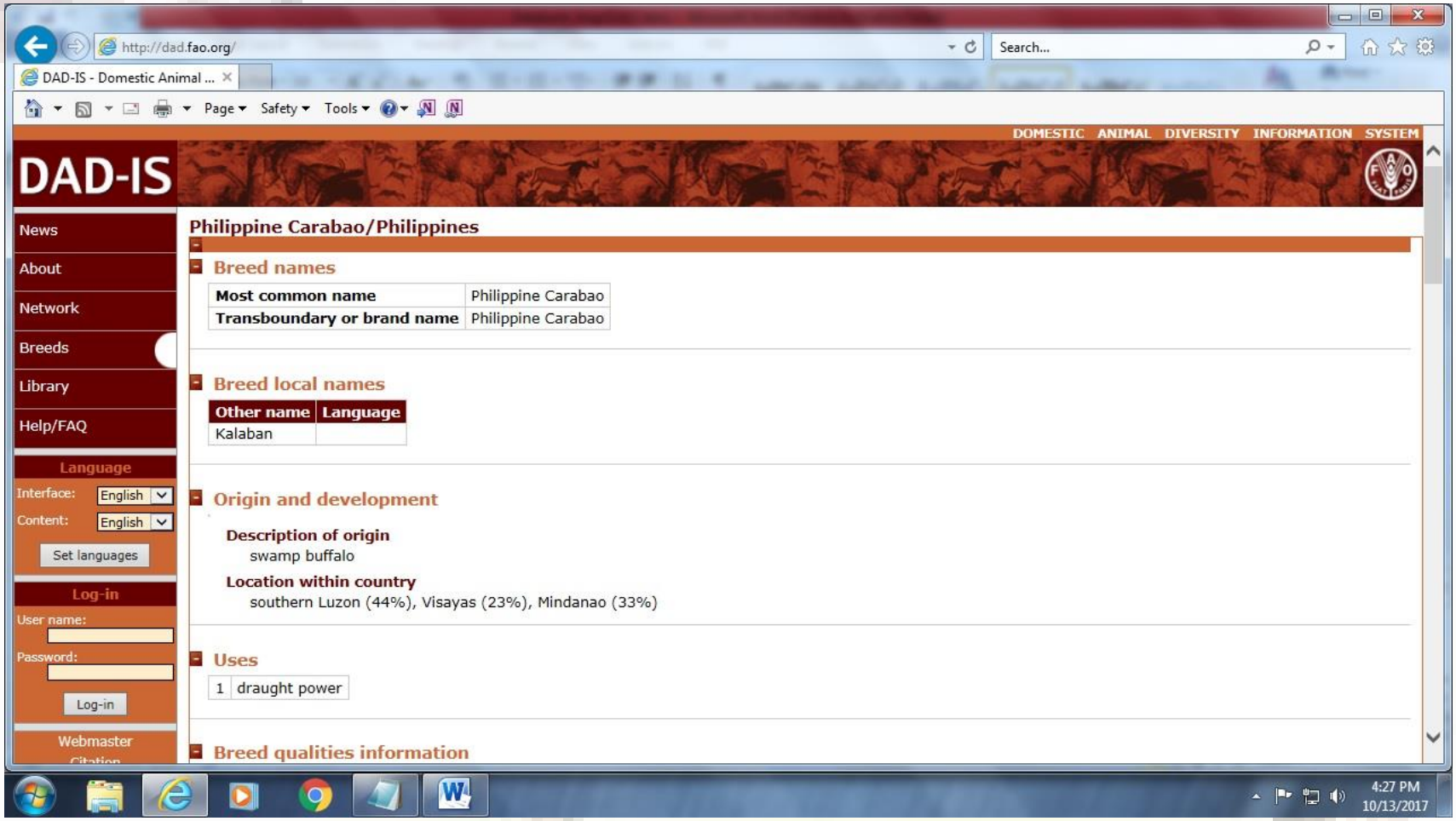
Databases on Animal Genetic Resources

- A database on animal genetic resources is maintained on a regional / country basis.
- Working unit of a database for animal genetic resources is the breed.
- It stores information on breeds descriptors of breeds of various livestock species such as cattle, buffalo, sheep, goat, pig, etc.
- It stores the data about breeding tracts of breeds of various livestock species.
- Breeding farms, Veterinary clinics, AI Centers.
- Database on AnGR are developed by government, public agencies, Co-operative societies, etc.

Domestic Animal Diversity Information System (DAD-IS - http://dad.fao.org/**)**

- Food and Agriculture Organization (FAO) has developed DAD-IS for global management of AnGR .
- DAD-IS is a multi-language information system available in English, Spanish and French.
- It contains information on more than 15000 breeds / populations of 38 domesticated animal and bird species from 180 countries.
- It provides support for teaching, research, policy formulation and early warning on breeds.

DAD-IS View

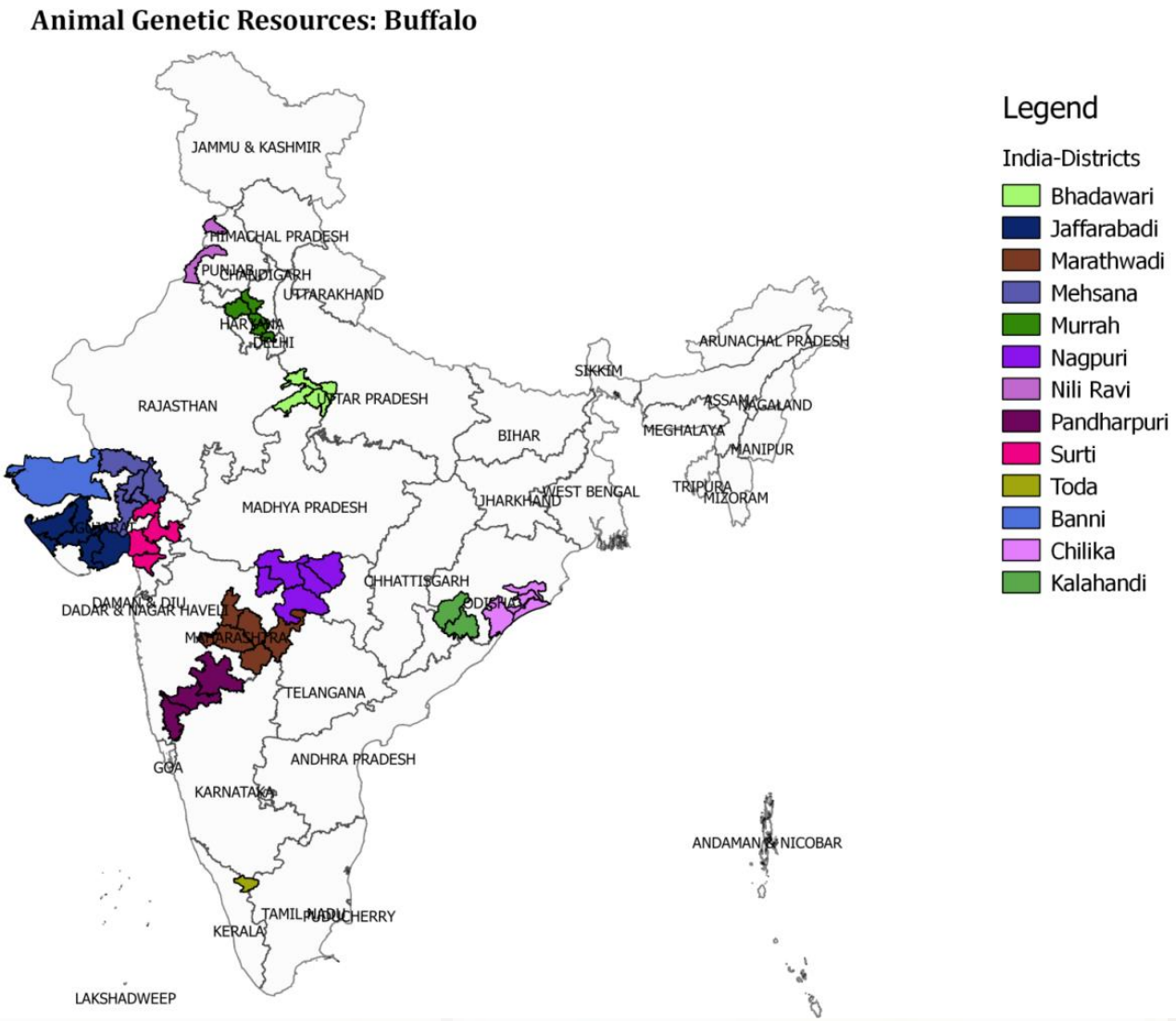


DAD-IS enables National Coordinators of various countries to enter breed-specific data, including data on the size and structure of breed populations, required to calculate risk status.

Geographic Information System (GIS)

- GIS are the tools that provide integration of all the information on a theme, which can be explored and compared according to their geographic coordinates.
- Information on climate, soils, crops can be integrated with native habitats and unique traits of breeds to visualize it in a map form.
- Can help in understanding and decision making on resource allocation and conservation of buffalo genetic resources.
- Examples of GIS software are ARC/INFO, QGIS, etc.

Distribution of Buffalo Breeds in India, using GIS



Databanks for Decision Support on Buffalo Genetic Resources

Animal Classification as belonging to a breed

Using Survey Data: Classification using base data and assignment using test data. Supervised Learning Methods such as Support Vector Machines, Neural Networks.

Using Breed Descriptors: Scoring Function Methodology

Only breed descriptors are available after analysis of field survey data.

Scoring function calculates score for the unknown animal using breed descriptor for each candidate breed. It assigns the animal to a breed with maximum score.

Source: AK Bhatia, A. Jain, DK Sadana, SB Gokhale, RL Bhagat (2010) Phenotypic identification of farm animal genetic resources using computer learning with scoring function. Computers & Electronics in Agriculture 73(1) pages 37-43.

Databanks for Breed Conservation Decisions

Risk Status: Conservation priority on the basis of risk status of the breed – by visualizing trends in effective population sizes.

Unique Traits: on the basis of unique traits of a breed. For example milk fat, horn shape, draft power, adaptability.

Genetic Distinctiveness: Breeds' significance with respect to the total genetic diversity (microsatellite markers) among the breeds under consideration.

Dairy Buffalo Recording

Integrated Animal Recording System Components

ANIMAL IDENTIFICATION AND REGISTRATION SYSTEM

- Premises census: identification and registration of premises, keepers and owners
- Initial tagging: identification and registration of animals

ANIMAL TRACEABILITY SYSTEM

- Record movements, thefts, losses, deaths or slaughters

ANIMAL HEALTH INFORMATION SYSTEM

- Record health events – disease outbreaks, vaccinations.

ANIMAL PERFORMANCE RECORDING SYSTEM

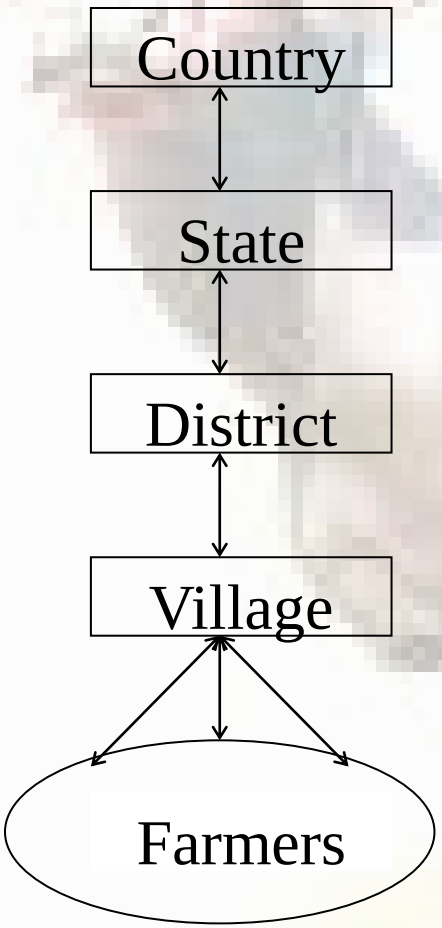
- Milk, meat performance recording events

Source: FAO. 2016. Development of integrated multipurpose animal recording systems. FAO Animal Production and Health Guidelines. No. 19. Rome.

Benefits from Animal Recording System

- Farmers get benefitted through decision support for efficient farm management, genetic improvement of animals, disease management, etc.
- Consumers obtain information about prices, quality and quantity of products available in a region.
- Researchers get raw data for research on animal feed, genetic improvement of stock, conservation of animal genetic resources, etc.
- The nation as a whole gets benefits in the form of sustainable development, environmental stability and enhanced food security.

A framework for the computerized animal recording system in low and medium input system



Country-level Data Warehouse

State-level Data Warehouse

District-level Animal Records

Village-level Animal Records

Input: Data on animals to the village-level animal records.

Output: Decision-support to farmers.

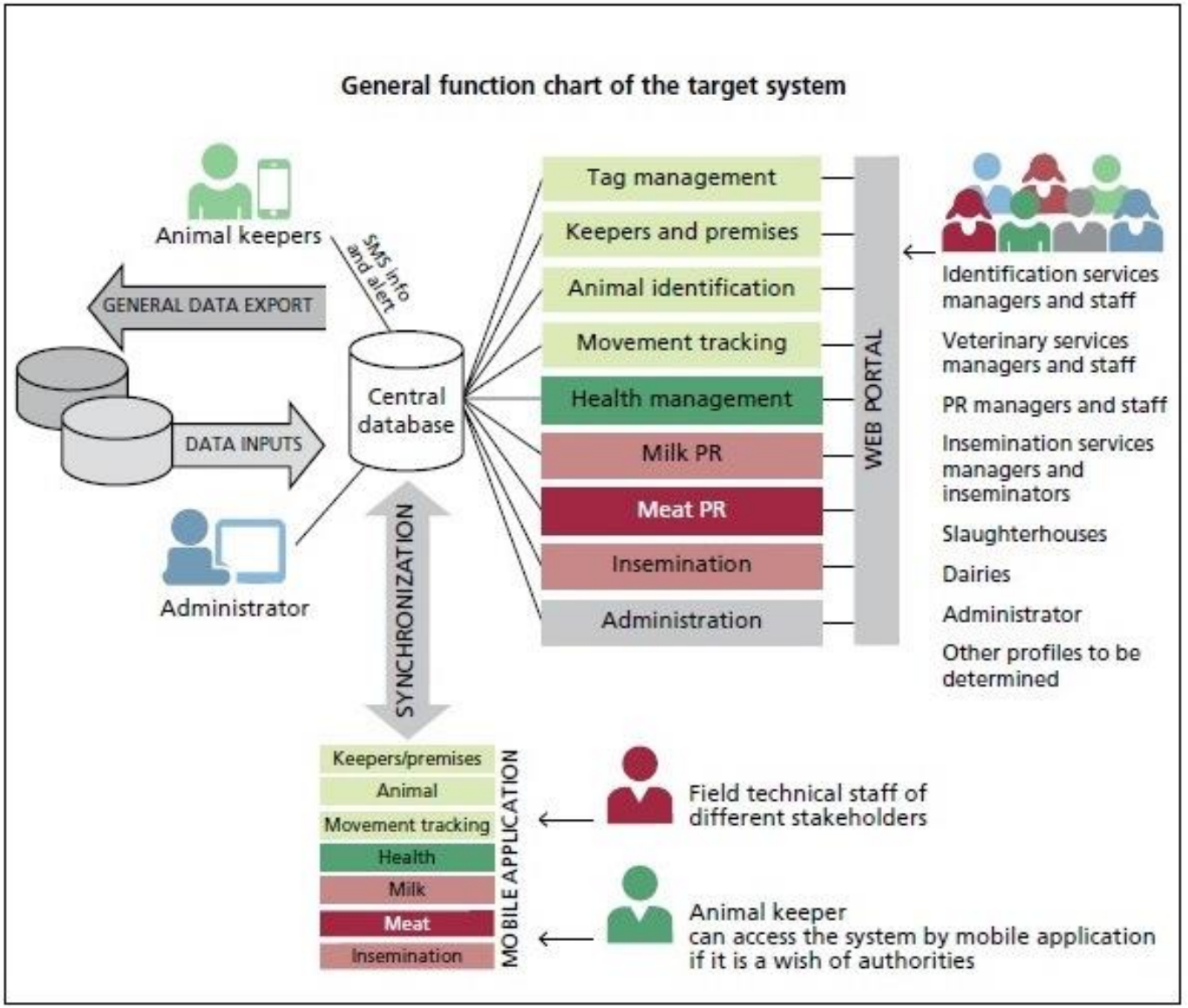
IT System Requirements

- The devices used for data entry and validation, for example handheld devices, notebooks, laptops, etc.
- Communication network(s) used (wired or wireless network).
- The institution hosting and managing the central database.
- The data exchange protocol to be followed among the various databases.
- The software solution: either a readymade software or a newly developed application.
- The software and central database backup protocol.
- Inclusion of GIS and mapping applications in the animal recording system.

Software for Animal Recording

- An integrated animal recording system requires appropriate software.
- Readily available software can be purchased and customized to local needs.
- if sufficient resources and capacity are available, software be developed locally to meet specific needs.
- Aim is to design an integrated system that incorporates all the components (identification, tracing, health management, performance recording) within one central database

Computerized Animal Recording System



Source: FAO. 2016. Development of integrated multipurpose animal recording systems. FAO Animal Production and Health Guidelines. No. 19. Rome.

Case Study: India
National Dairy Development Board (NDDB)
Information Network for Animal Productivity and Health (INAPH)

INAPH has been used for monitoring implementation of

- Progeny Testing
- Pedigree Selection
- AI Delivery
- Ration Balancing

About 5.8 million animals belonging to 3.1 million farmers in 38,340 villages spread across 250 districts in 17 states in India have been registered in the system.

INAPH (http://inaph.nddb.coop)

- It records all activities related to Breeding, Nutrition & Health Identification of superior bull & elite female.
- The NDDB maintains the central database, which receives data from INAPH users across the country.
- Users also receive all necessary information from the system to carry out their daily tasks.
- Used by AI Technicians, Milk Recorders, Local resource persons, Veterinarians through smart-phones / notebooks.

Summary

- Field survey on breeds provide information on habitat, management, phenotypic, performance characteristics of a breed / population of buffalo.
  - provides Breed Descriptors of various indigenous breeds.
  - IT applications include data processing system, databases, information systems, decision support systems for management and conservation of AnGR.

- Animal Recording system emphasizes information on identification, health, nutrition and performance of individual farm and animals.
  - provides traceability, health and performance of animals.
  - IT applications include data warehouses, use interfaces, decision support systems on disease, nutrition, breeding management.


Thank you