



Inventory, characterization and monitoring of animal genetic resources

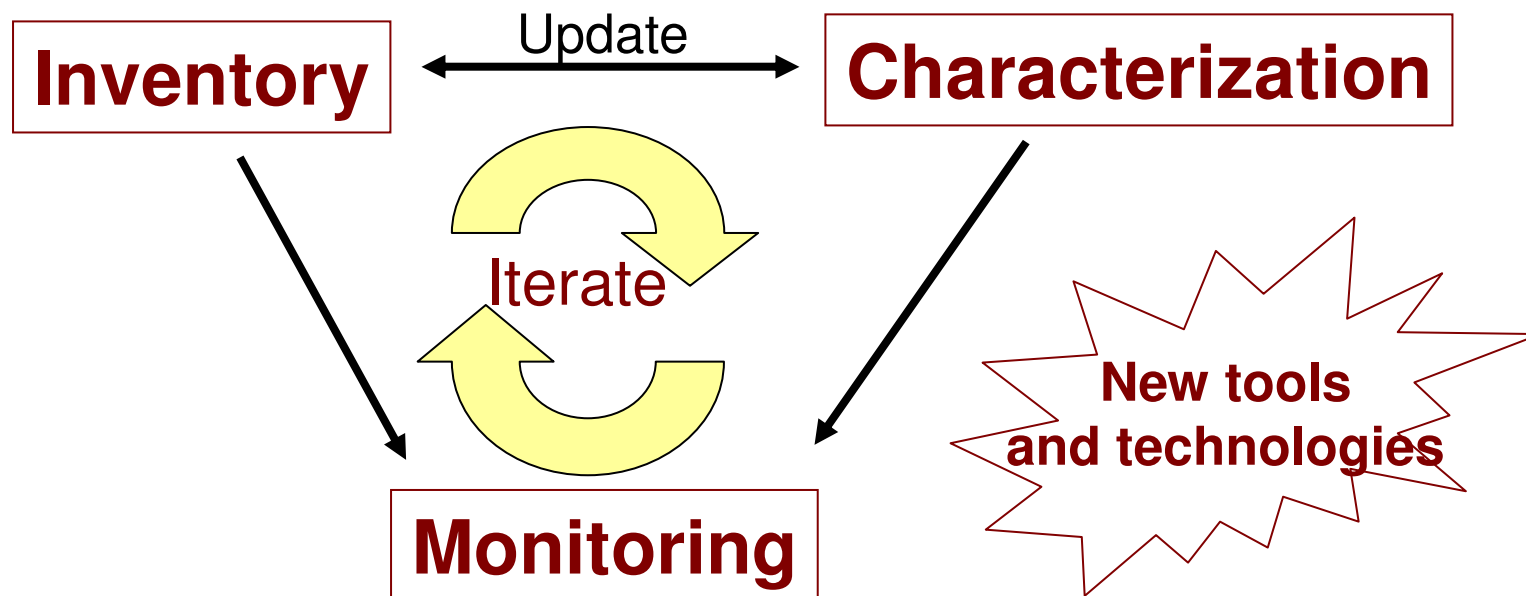
Michèle Tixier-Boichard

Workneh Ayalew

Han Jianlin



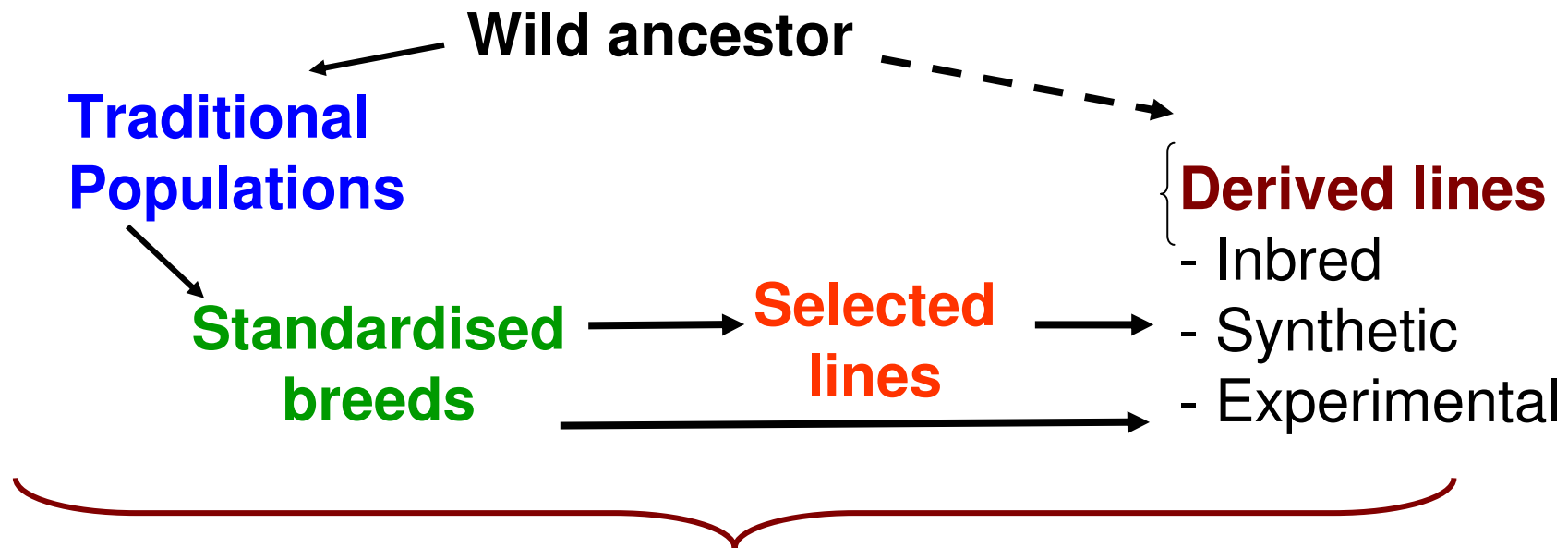
Integrated approach and Iterative Steps



Sustainable use and conservation

Conceptual framework

- Which AnGR to consider :



All populations are relevant for inventories of AnGR



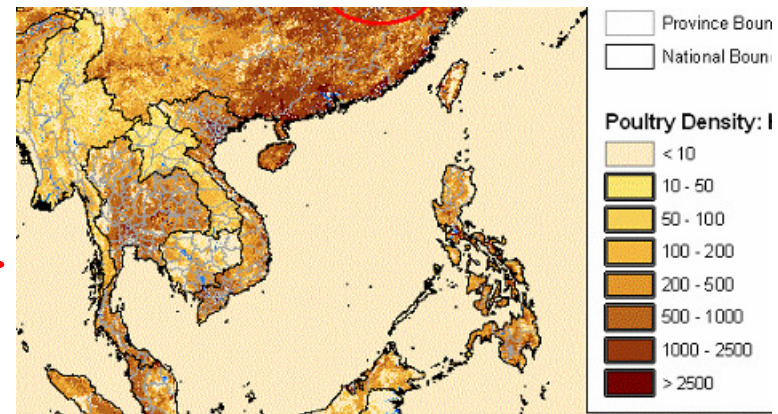
Conceptual framework

- What levels to consider,
 - **diversity between populations**
AND within-population
- Use descriptors of diversity on the 3 dimensions of sustainable development :
 - economic / social / environmental
- Relevant scales, depending on the breed status
 - from the individual level for endangered breeds to multicountry programmes for transboundary breeds



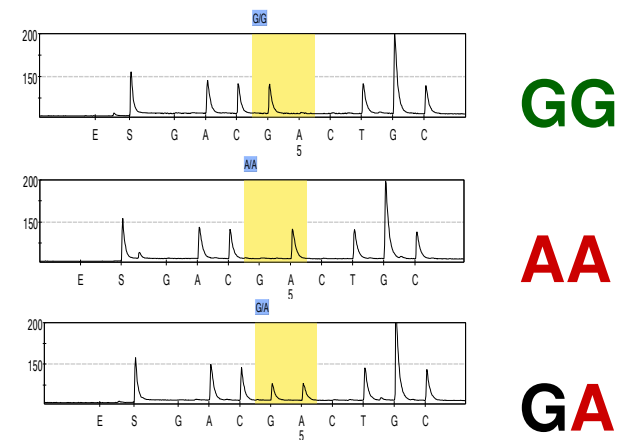
Primary Inventory

- A nationally mandated institution for coordination
- A national mechanism to verify
one breed or population = a distinct unit of AnGR
- Methods for data collection
 - Extension services ,
 - Farmers' organisations
 - Bottom-up from communities
- *** georeferencing
+ on-field counting**
- Set up a database framework
→ DAD-IS



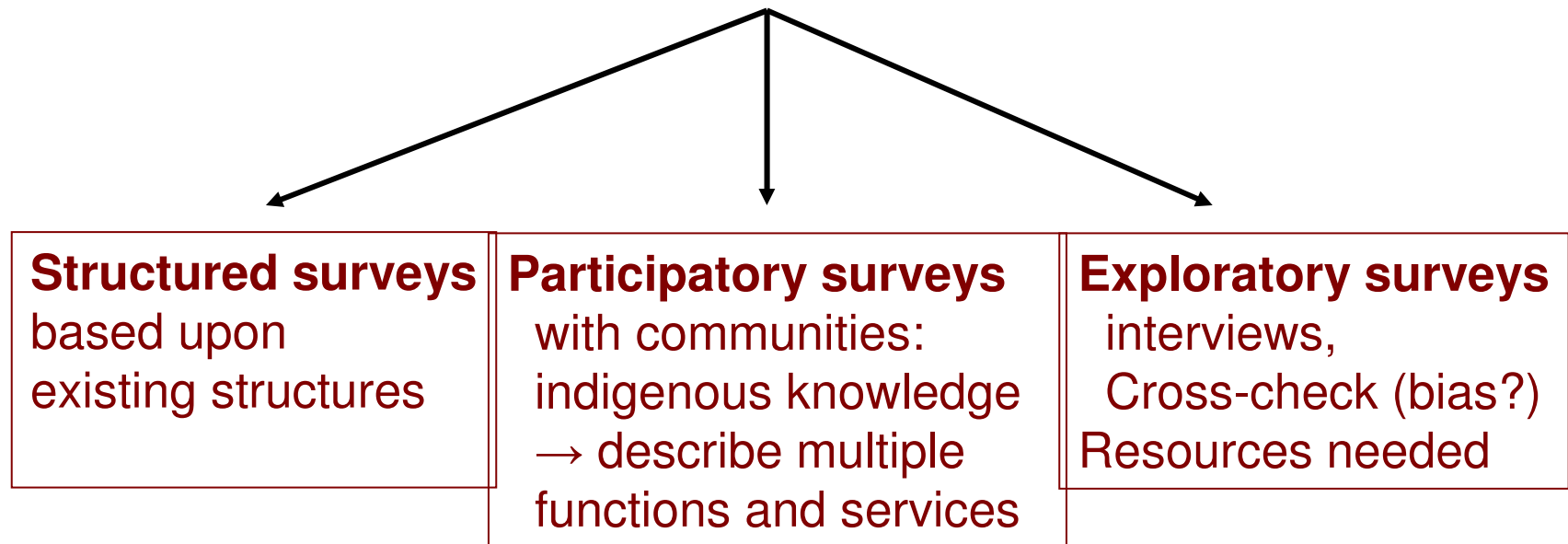
Characterization

- Provides baseline information and criteria for inventory and monitoring
- Documents current uses as well as potential future uses
→ **including environmental impact and describing inputs and outputs**
- **Integrated approach**



Characterization : production systems

- **A breed = a social construct in an agro-ecosystem**
- Data collection: **surveys**
 - Start with simplified FAO formats, adapt questionnaires



Characterization : phenotypes

- **Phenotype in a broad sense**
 - Morphology , Biometrical indices
 - Production levels
 - Specific adaptations → sustainable use
- **Consider not only means but also VARIANCES**
 - Large proportion of the population
 - Data collection :



**Exploit available
data in literature
or service reports**

**Record performance
on-farm/on station**

Characterization: performance testing

- On-farm
 - National breeding schemes
 - Private data ?
(pigs and chickens)
 - On-farm survey
 - **Pictures**
 - **Morphology**
 - **Indigenous knowledge**
 - **Animal ranking**
 - **Breed ranking**
 - * **Georeferencing** :
+ climate + ecosystem
+ disease challenges
- On-station
 - More accurate measures
 - Controlled environment
 - Multiple comparisons and GxE estimation
 - But adaptation of local populations to this environment ?
 - May contribute to set up nucleus flock for conservation

Complementary approaches



Advanced phenotyping : breeds specific features

- **Product quality**
 - precise description of product's typical features
 - Certification systems
 - **Geographical Indication**
 - **Protected designation of origin, including the breed**
 - **specific market chains**
 - in developed as well as developing countries
- **Disease resistance**
 - **Component of adaptation to local environment**
 - Documented for parasitic diseases
 - Current research on defence mechanisms
 - Epidemiology of host x pathogen interaction,
 - importance of **genetic variation**
 - North-South cooperation





Characterization : molecular tools

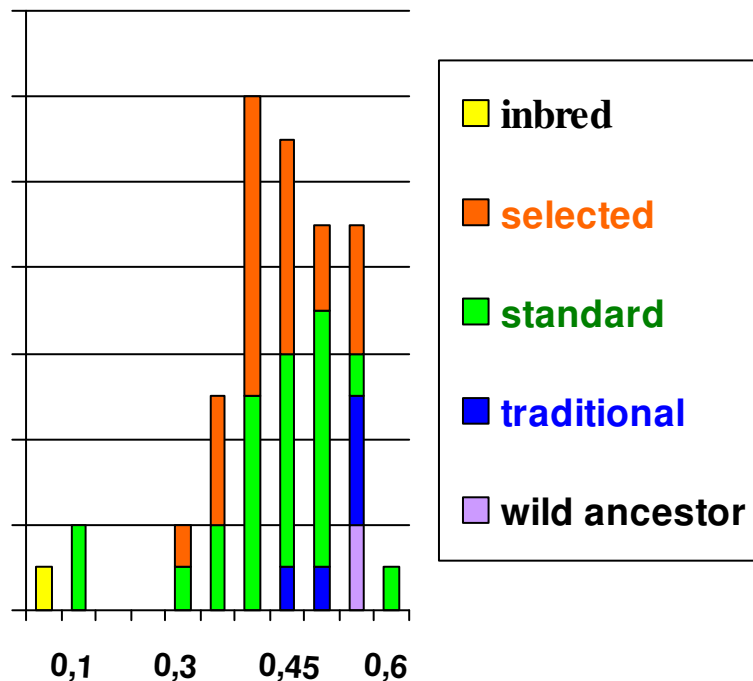
- Sampling procedure (numbers, geographical distribution)
- Choice of molecular tools
 - **Use of DNA markers well reported in the SoW report**
 - for within-breed/population diversity
 - for population history and structure
 - for populations relationships
 - for breed identity

→ **complementary to, but do not replace, phenotypic data,**
refine the understanding of the genetic make-up of a population,
and add value to previous steps of characterization



Molecular markers: within-breed/population diversity

Within-population heterozygosity with microsatellite markers



Ex. in chickens (Hillel et al. 2003)

- Population structure
 - effective population size
 - inbreeding
 - population fragmentation

Livestock
Biodiversity
Hotspots



Molecular markers: between breeds diversity

Molecular tools add value to primary inventory

- **quantify genetic differentiation between breeds**
- **Explain current breed structure arising from domestication**
→ **Reticulate structure rather than a true phylogenetic tree**

- **Match a genetic entity with the breed definition :**
 >90% of animals assigned to their breed with markers
 → **tools for breed traceability**





Emerging molecular tools for characterization

- **Genome sequence and Single Nucleotide Polymorphisms * SNP**
 - Standardized typing technology operates by x 1000 markers
 - fine structure of the genome, selection signatures
 - ! **But HIGH COST**
 - **Whole genome selection + assessment of genetic diversity**
- **Identified genes**
 - Molecular basis for morphological traits (coat colour)
 - **diagnostic tools across breeds**
- **Micro-arrays for gene expression**
 - Useful for unraveling **disease resistance mechanisms**





Advanced inventory and monitoring

- **To support decision-making process**
- **Monitor driving forces**
 - **Criteria already proposed by FAO :**
 - **Climate, terrain, health hazards, resource availability and management**
- **Monitor animal populations**
 - **Population status : size and trends**
 - **Need for a regular update of inventories**
 - **Intervals not longer than one generation for each species**
 - **Use existing census**





Advanced inventory and monitoring

- **Indicators for monitoring AnGR**
 - Breed level and Within breed level
- **Improved monitoring with molecular markers**
 - genetic entity behind the breed → refine the inventory
 - detect fragmented populations → improved management
 - detect loss of diversity, inbreeding → conservation measures
- **Improved monitoring with pedigree analysis**
 - unbalanced use of breeding animals (ancestors >50% gene pool)

→ **update risk status, identify target values, update databases**
→ **revise management of between and within breeds diversity**



Conclusions

- An integrated approach for the inventory of AnGR :
production systems, phenotypes, genome diversity
- Identify breeds specific features
 - support decisions for use, development, conservation
- Conservation needs documentation for future use
- New molecular tools: still costly,
but still evolving
 - Share equipments & protocols
 - agree on standard procedures
MoDAD guidelines

