



Globaldiv

GLOBALDIV NEWSLETTER

ISSUE N. 7 - 30TH JANUARY 2009

Editorial - Animal genetic resources in the dialogue between Biodiversity and Agricultures

A conference dedicated to Biodiversity and Agricultures took place in Montpellier, Nov 4-5 2008, under the aegis of the French presidency of the European Union. It gathered about 300 participants with speakers from Europe, USA and China, and representatives from EU and from international bodies such as FAO.

It was aimed at identifying challenges and research needs for more sustainable farming and was organised in 4 parts:

- Ecosystem services and agriculture.
- Agriculture, biodiversity and society: the footprint and the drivers; North/South perspectives, this part included a discussion on genetic resources.
- Agriculture and biodiversity in complex landscapes: pointers towards new policies.
- The way forward for science: what we need to know and how to apply knowledge to improve the situation.

Biodiversity is generally seen at three levels: ecosystems, between-species variability, and within-species variability where genetic resources have their place.

Some key messages of general interest were delivered about biodiversity in a broad sense. The purpose of this editorial is to discuss how these messages may be relevant for animal genetic resources.

EDITORIAL - ANIMAL GENETIC RESOURCES IN THE DIALOGUE BETWEEN BIODIVERSITY AND AGRICULTURES	1
ARTICLE OF THE MONTH - CASE STUDIES: A TOOL BRIDGING SCIENCE AND REALITIES	3
THE BREED OF THE MONTH - THE CINTA SENESE PIG	5
EVENTS CALENDAR	7
BIBLIOGRAPHY	7



Globaldiv

A general issue, widely agreed upon, is the need to fulfil the needs for food security of a growing human population, while at the same time preserving biodiversity.

Why preserve biodiversity?

- Because biodiversity is providing many services to agriculture and to human societies, the so-called ecosystems services, such as pollinisation, which are generally not accounted for but represent a high economic value.
- Because biodiversity is a major resource for adaptation of agriculture to global change (i.e. both climatic change and related social changes).

Several speakers pointed out the need to restore diversity within industrial production systems in order to make them more sustainable.

Two main approaches were discussed:

- Diversify production at the species and within-species levels. Genetic uniformity of the cultivated plants, or of the livestock breeds, in a specialised production system, make them more susceptible to pests that become also specialised for their host. A striking example relating yield to crop diversity was presented with rice in China, where the total yield of a given area was improved by growing together several rice varieties including local varieties (i.e. intercropping). Because susceptibility to pathogens and/or abiotic stresses varied between varieties, a mixture of them appeared to be more robust. Transposition of this concept to animal production does not seem to be straightforward, but deserves some consideration, regarding the possibility to mix local breeds and highly selected breeds within intensive production systems.
- Diversify production systems at the landscape level. Several studies pointed out that landscape complexity may compensate for local high-intensity management and help to maintain a high level of biodiversity, even for wildlife species. From an ecological viewpoint, it can be said that resource heterogeneity is correlated with species diversity. Thus, it was proposed to develop wildlife friendly farming practices.

A model approach relating yield to species density was presented, but data are still lacking to refine it. This model did not include the within-species diversity for crops or breeds (i.e. genetic resources). Indeed, ecological models rarely included the within-species diversity levels, although it may be quite high for domesticated plants and animals. The importance of combining long term observation and experimentation with mathematical models was underlined.

A key message from this debate was that a better knowledge of ecological processes was needed to develop agricultural practices combining production levels and biodiversity preservation.



In a way, this concept is not so much different from the optimisation of genetic trend while minimising inbreeding within a selected population, but, it is here extended to the impact of animal breeding on the diversity and robustness of the whole production system.

The importance of genetic resources for crops (and livestock) was recalled several times, and the following challenges were identified:

- New tools and methods become available, mainly from genomics and biotechnology.
- Genetic resources are one of the 3 pillars of a production system with environmental factors and agro-techniques.
- Managing genetic resources needs to combine objectives on yield with sustainability of the production chain.

Thus, research should integrate the biological, ecological and socio-economic dimensions of the concept of genetic resources, and address more particularly the following topics:

- Adaptation to environment
- Interactions between domestic and wild compartments, with more exchanges between the relevant scientific communities
- Sustainable management of diversity.

In conclusion, this conference was exemplary by its ability to gather experts from ecological sciences with experts from agricultural sciences, who are starting to work together. Ecology and agriculture will benefit from working together for a better knowledge and monitoring of biodiversity. Most of the discussions were directed towards crop production systems, although issues for livestock production systems are very similar. There are thus two messages for our community on animal genetic resources: promote our research in a global perspective and develop cooperation with ecological sciences.

Michele Tixier-Boichard

Directrice du Département sectoriel A4
"Biotechnologies - Ressources - Agronomie"
Direction Générale de la Recherche et de l'Innovation
Ministère de l'Enseignement Supérieur et de la Recherche
Paris - France

Article of the month - Case studies: a tool bridging science and realities

Historically, breeds are both a social construction and a genetic object. Breeders have selected the animals corresponding to an ideal type and the output of this selection process is now inscribed in the genetic structure of the breed. This multidimensional nature of the concept of breed is a real challenge for scientists and stakeholders. By definition, scientists are more interested in biological and quantitative aspects: they are able to characterize the genetic and morphological diversity, they publish comparisons of breeds and define priorities of conservation. This scientific and quantitative approach is essential for the understanding of breeds in a prospect of conservation.



But this approach is not sufficient. Most of the farms are private businesses in a given environmental context. Each territory has specific features. One of the strengths of the European agriculture is the diversity of landscapes, practices and products. All breeders are aware of this diversity.

The challenge is to articulate the diversity of real life and the necessity of a common scientific framework. How to fit "The Breed of the Month" of this issue in a scientific paper? How to be sure that the equations of a high level scientific paper make sense for breeders and stakeholders? There is no definite answer to these questions but a pragmatic solution is the use of case studies, short multidisciplinary studies focusing on a breed in a given context.

Case studies have a triple function.

1. They may be the basic element of a wider approach. In projects such as ECONOGENE or EURECA , case studies were the entry points for interesting comparisons between systems. They are the individual pieces of the global jigsaw of animal genetic diversity.
2. They articulate general concepts with a local level. This combination allows the identification of regional variation and may help to adjust the overall model.
3. The third, and probably one of the most important functions of case study, is to provide a "proof of concept" of the conservation programmes by the assessment, in real situations, the feasibility of conservation practices. Case studies are also the opportunity to include different type of actors in the discussion of the conservation programmes: breeders, breeder associations, local and regional authorities and other stakeholders.

In some situations, the case study may trigger the conservation programme itself. In the late seventies, a young French lecturer, Pierre Quemere, proposed a case study on a local breed to his MSc students. They began a survey, met the breeders and rang the alarm bell : the Bretonne Pie Noire, a cattle breed probably related to the Kerry breed, was on the verge of extinction. In 1977, the number of breeders was inferior to 50 and the population size just above 300 animals. Thirty year later, with the help of INRA, breeders, local and central governments, the breed is in expansion with more than 1000 animals and 300 breeders (Colleau et al., 2002) . A small scale case study became a real research programme and had an actual impact of the conservation of a cattle breed.

In the same country, a recent example shows the importance of the interactions between genetic and social sciences. Studying the Rouge Flamande, Anne Lauvie was implied in a social controversy: part of the breeders agreed to crossbreed Rouge Flamande and Red Danish to increase production. Other breeders were reluctant. A long term case study, showed that 90% of the Flemish Red cows had a proportion of Danish Red genes ranging from 1/8 to 1/2.

The output is not always so clear-cut, but case studies always provide an interesting perspective on the realities of breed conservation. The scientific challenge is to define some kinds of minimal standards to ensure possible comparisons between case studies. Basic demographic (size of populations,



sex ratio) and genetic (effective size) data are required. The importance of socio-economic and geographic data (Bertaglia et al., 2007) has to be emphasized.

A last issue is the access to case studies. Most of them are developed in the context of research project and are not published in the mainstream literature. Some specialized journals, such as the FAO Animal Genetic Resources Information Bulletin are very interesting resources.

Bridging the gap between large scale scientific studies and local realities, case studies are an original tool in the hand of conservationists. A better diffusion of these original results is a priority for all actors concerned by animal genetic resources.

Philippe Baret

Université catholique de Louvain
France

References

- J. J. Colleau , P. Quemere, H. Larroque, J. Sergent, C. Wagner (July, 2002) - Gestion génétique de la race bovine Bretonne Pie-Noire: bilan et perspectives. *INRA Prod. Anim.*, 15(3): 221-230.
- A. Lauvie, C. Danchin-Burge, A. Audiot, H. Brives, F. Casabianca, E. Verrier (2008) - A controversy about crossbreeding in a conservation programme: The case study of the Flemish Red cattle breed. *Livestock Science*, 118(1-2): 113-122.
- M. Bertaglia, S. Joost, J. Roosen, Econogene Consortium (2007) - Identifying European marginal areas in the context of local sheep and goat breeds conservation: A geographic information system approach. *Agricultural Systems*, 94(3): 657-670.

The breed of the month - The Cinta Senese pig



Cinta Senese is the only Tuscany native swine that survived extinction. This breed has antique origins as documented in several old paintings such as the xiv^o century fresco called "Effetti del Buongoverno" painted by Ambrogio Lorenzetti in the Palazzo Comunale of Siena (Tuscany).

Moreover, Cinta Senese was the first Italian pig breed registered in a national herd-book (1934) and subject to an official selection program, whose objectives included morphological traits, prolificacy, growth rate, body size, fattening and feed consumption. In the 1950s the population counted 160.000 heads, but since 1955 the number of sows started to decline and both herd-book records and selective activities lost importance, because of post-war economical and structural transformation of Italian agriculture. In the 1970s



the breed survived in few herds and in 1986 reached the minimum size of 81 sows and 3 boars recorded. To avoid extinction, since 1980 the Tuscany Region has instituted a new regional herd-book and provided economic incentives to breeders in order to compensate for the lower profitability of the local breed



compared to commercial genotypes. However population size remained critical (less than 100 males and females registered) for about fifteen years. In 1996 a renewed interest in the breed, fostered by the growing commercial success of Cinta Senese high quality products, generated an exponential growth of the population size; but the severe bottleneck experienced, the limited number of founders registered in the herd-book and the lack of an appropriate mating plan caused the rapid increase of Cinta Senese inbreeding by about 1% per year from 1975 to 1995. Assuming a generation interval of 3 years, inbreeding rate in the Cinta Senese was 3 to 6 times higher than suggested as optimal rates. In 1999 a program for inbreeding control was finally launched, including both boar selection and accurate mate planning. Since 2004, every year 5-10 young males of particular importance for inbreeding control will be acquired by the Program and distributed to selected herds. Even if it is too early to evaluate the efficiency of the Program, the preliminary data seem promising. Up to date no selection programmes are implemented in the Cinta Senese hindered by the breed structure, with a low number of small herds scattered throughout the farming area, and by



the lack of both artificial insemination and performance recording. However, if the positive demographic trend will continue and the population will stabilize on a substantial size, the identification of selection objectives and strategies will become compulsory for a sustainable conservation of Cinta Senese, taking into account both breed characteristics and market trends.

Original source: Franci O., Gandini G., Bozzi R. (2007) - Why and how to select a local porcine breed: the case of the Cinta Senese. 5th International Symposium on "Porc Méditerranéen". Tarbes, 16-19 November. Option Méditerranéennes, Serie A: Séminaires Méditerranéennes, Numéro 76: 13-21. Pictures sources:

http://www.agricultura.it/dettagli_azienda.php?ID=35

<http://picasaweb.google.com/angolinofoto/FotoParticolari#5178260893615100834>

Events calendar

- 1st GLOBALDIV WORKSHOP - University of Technology and Life Sciences. Bydgoszcz, Poland. 18-19 March 2009. www.globaldiv.eu
- 37th International Symposium "Actual Tasks on Agricultural Engineering". Grand Hotel "Adriatic", Opatija, Croatia. 10-13 February 2009. <http://atae.agr.hr>
- ANA World Conference "Animal nutrition: preparedness for the challenge". New Delhi, India. 14-17 February 2009. www.anft.org or else www.anaworldcon2009.in
- 16th International conference KRMIVA 2009 in the field of animal nutrition and feed. Opatija, Croatia. 1-3 June 2009. www.krmiva.hr/index-en.htm
- XXXIII CIOSTA-CIGR Section V International Conference "Technology and Management to ensure Sustainable Agriculture, Agrosystems, Forestry and Safety". DISTAFA, Università Mediterranea di Reggio Calabria, Reggio Calabria, Italy. 17-19 June 2009. www.ciosta.unirc.it
- Joint International Agricultural Conference 2009. Wageningen, The Netherland. 6-8 July 2009. www.jiac2009.nl



Bibliography

Naderi S, Rezaei HR, Pompanon F, Blum MG, Negrini R, Naghash HR, Balkiz O, Mashkour M, Gaggiotti OE, Ajmone-Marsan P, Kence A, Vigne JD, Taberlet P. (2008) - The goat domestication process inferred from large-scale mitochondrial DNA analysis of wild and domestic individuals. *Proc Natl Acad Sci USA*, 105(46): 17659-17664.

Cinkulov M, Popovski Z, Porcu K, Tanaskovska B, Hodzic A, Bytyqi H, Mehmeti H, Margeta V, Djedovic R, Hoda A, Trailovic R, Brka M, Markovic B, Vazic B, Vegara M, Olsaker I, Kantanen J. (2008) - Genetic diversity and structure of the West Balkan Pramenka sheep types as revealed by microsatellite and mitochondrial DNA analysis. *J Anim Breed Genet*, 125(6): 417-426.

Cinkulov M, Tapio M, Ozerov M, Kiselyova T, Marzanov N, Pihler I, Olsaker I, Vegara M, Kantanen J. (2008) - Genetic differentiation between the Old and New types of Serbian Tsigai sheep. *Genet Sel Evol*, 40(3): 321-331.

This GLOBALDIV newsletter was compiled by:	Contact information	GLOBALDIV project coordinator
Elena Murelli Università Cattolica del Sacro Cuore	GLOBALDIV www.globaldiv.eu newsletter@globaldiv.eu	Prof. Paolo Ajmone Marsan Università Cattolica del Sacro Cuore, Italy Phone: +390523599204
Project Partners		
Faculty of Veterinary Medicine, Utrecht University (UU FDG) Johannes A. Lenstra	Institute of Farm Animal Genetics, Mariensee (ING) Steffen Weigend	European Association for Animal Production (EAAP); Andrea Rosati
MICROGIS Stephane Joost	International Livestock Research Institute (ILRI) Jianlin Han and Olivier Hanotte	Universidade Estadual Paulista (UNESP) José Fernando Garcia

