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**Overview of current and completed projects covering biodiversity and the type of tools and products emerging for the end user**

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**I - HISTORICAL OVERVIEW**

- 1970 Société d'Ethnozootecnie  
Rare Breeds Survival Trust
- 1980 The European Association for Animal Production (EAAP) established a working group on AGR  
FAO held its 1<sup>st</sup> expert consultation
- 1988 Creation at the Hanover Veterinary University of the first databank on AGR (EAAP - AGDB)  
1988-1991 : Global (53 countries)  
1991 - ..... : European
- 1993 2 important books:  
Genetic diversity of European livestock breeds (EAAP: Simon and Buchenauer)  
World Watch List for Domestic Animal Diversity (FAO/UNEP: Loftus and Scherf)
- 1996 The data were made available on the Internet both by FAO (DAD – IS) and by the EAAP – AGDB at Hanover
- 1997 Support at the European Union to a "permanent inventory of the European AGR" (RESGEN 083)

The European breeds inventories are summarized in Table 1. See also Ollivier (1998) for more details on this historical overview.

Table 1 here

**II – EU-funded projects on farm animal biodiversity**

Projects on farm animal biodiversity have been funded since 1994 by EU in the framework of its Biotechnology programme (DG XII) and of its Regulation 1467/94 on genetic resources in agriculture (RESGEN programme of DG VI). They are summarized in Tables 2 and 3. It can be seen that those 8 projects cover not only biodiversity per se but also more general aspects of genetic resources management through inventories and conservation techniques.

Tables 2 and 3 here

### III - Type of tools and products emerging

The molecular tools for biodiversity are essentially SSR (Simple Sequence Repeat or microsatellite) or AFLP (Amplification of subsets of Fragment Length Polymorphism)

Implementation requires (1) collecting blood samples, (2) extracting DNA and (3) analyzing either individual DNA or DNA pooled in each breed. Allelic frequencies per breed are thus obtained.

Within-breed diversity (only when individual genotyping is performed) can be evaluated through Heterozygosity and the test of Hardy-Weinberg equilibrium at each locus.

Between-breed diversity (based on allelic frequencies) can be evaluated using several methodologies.

- Breed differentiation: see the fixation indices (F) of Wright (1943) and Nei (1977).
- Genetic distances: various measures are available and a global protocol has been proposed by an FAO Working Group (see Barker, 1994).
- Phylogenetic tree construction: various algorithms are available, but phylogenetic interpretations are unsure.
- Measurement of diversity: e.g. see the Weitzman (1993) approach and its application to farm animal breeds suggested by Thaon d'Arnoldi et al. (1998).

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### IV - Benefits of biodiversity evaluations to the industry

- Overall view of European domestic animal diversity
- Basic information for establishing conservation strategies, at country level (Convention on Biological Diversity)
- Commercial opportunities for breeding companies and breeding associations, e.g. choice of lines in an improvement programme
- Unambiguous identification (traceability) of breeds, lines, etc...

### References

- Barker J.S.F., 1994. A global protocol for determining genetic distances among domestic livestock breeds. Proc. 5<sup>th</sup> World Cong. Genet. Appl. Livestock Prod. 21: 501-508.
- FAO 1996. CD-ROM DAD-IS: A call to action. Rome.
- Loftus R., Scherf B., 1993. World Watch List for Domestic Animal Diversity. FAO, Rome, 376 pp.
- Maijala K., 1987. Surveying animal breed resources in Europe. In: Research in Cattle production, Danish Status and perspectives. Landhusholdningsselskabets Forlag, Compenhagen, 208-218.
- Maijala K., Cherekaev E.V., Devillard J.M., Reklewski Z., Rognoni G., Simon D.L., Steane D.E., 1984. Conservation of animal genetic resources in Europe. Final report of an E.A.A.P. working group. Livestock prod. Sci. 11: 3-22.
- Nei M., 1977. F-statistics and analysis of gene diversity in subdivided populations. Am. Hum. Genet. 41: 225-233.

Ollivier L., 1998. Animal Genetic Resources in Europe. The 8<sup>th</sup> World Conference on Animal Production. Proceedings Symposium Series 1, 237-244.

Simon D.L., 1997. European approaches. International Speakers Forum. Canadian Farm Animal Genetic Resources at the Crossroads: Crisis or Opportunity ? Ottawa, 27-28 février 1997, 25 pp.

Simon D.L., Buchenauer D., 1993. Genetic diversity of European livestock breeds. EAAP Publication n°66, Wageningen Pers, Wageningen, 581 pp.

Thaon d'Arnoldi C., Foulley J.L., Ollivier L., 1998. An overview of the Weitzman approach to diversity. Genet. Sel. Evol. 30: 149-161.

Weitzman M.L., 1993. What to preserve ? An application of diversity theory to crane conservation. The Quarterly Journal of Economics 108: 157-183.

Wright S., 1943. Isolation by distance. Genetics 28: 114-138.

**Table 1 – European breeds inventories**

Species	EAAP surveys		EAAP-AGDB		FAO
	1982 <sup>1</sup>	1985 <sup>2</sup>	1993 <sup>3</sup>	1997 <sup>4</sup>	Rome 1996 <sup>5</sup>
Cattle	271	148	277	311	332
Goats	65	45	68	101	123
Horse	206	73	123	139	213
Sheep	275	183	283	338	407
Pig	123	64	126	134	156
TOTAL	940	513	877	1023	1231

<sup>1</sup>Maijala et al., 1984; <sup>2</sup>Maijala, 1987; <sup>3</sup>Simon and Buchenauer, 1993; <sup>4</sup>Simon, 1997; <sup>5</sup>FAO, 1996.

**Table 2 – Projects on biodiversity  
Funded by EU DGXII  
(biotechnology programme)**

	Gene bank	Cattle/sheep/ goat diversity	Avian diversity	Pig biodiversity*
Type of project	Research	Research	Research	Demonstration
Call for offers	1995	1995	1997	1997
Coordinator	The Netherlands (Lelystad)	UK (Norwich)	Germany (Celle/Mariensee)	France (INRA)
Nb of partners	6	6	8	6
Nb of subcontractors	-	-	20	6
Nb of EU countries	-	all	8	12
Nb of non-EU countries	FAO	large	9	4+FAO
Nb of breeds	-	165	50	66
Nb of individuals/breeds	-	variable	50	50
Nb of microsatellites	-	25	25 (50 in 10 breeds)	50
DNA typing	-	Individual	- Pooled for microsat. - Individual for microsat. + SNP (on 10 breeds)	Individual and pooled + AFLP
Contact person	K Oldenbrock	G Hewitt	S Weigend	L Ollivier

\* Preceding by a pilot trial in the 1994-1996 PiGMaP project co-ordinated by A. Archibald

**Table 3 – Projects on animal genetic resources  
funded by EU DGVI  
(RESGEN programme)**

web site: <http://europe.eu.int/comm/dg06/res/gen/index.htm>

Type of Project	COMPLETED	CURRENT			
	Inventory (RESGEN 083)	Rabbit (RESGEN 060)	Pig (RESGEN 012)	Cattle (RESGEN 118)	Horse (*)
	CA	SC	SC	SC	SC
Coordination	EAAP	INRA (Toulouse)	INRA (Jouy)	Utrecht University	Trinity College (Dublin)
Nb of partners	-	<del>1</del> 15	<del>5</del> 5	5	-
Nb of EU countries	all	<del>7</del> 7	<del>4</del> 4	14	-
Nb of non-EU countries	-all	<del>6</del> 6	<del>2</del> 2	6	-
Nb of breeds	-	-	23	50	-
Nb of individuals/ breed	-	-	50	50	-
Microsatellites	-	-	50	30	-
AFLP	-	-	x	x	-
Contact person	L Ollivier	G Bolet	L Ollivier	JA Lenstra	D Bradley

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\* Contract under negotiation





