IMAGE
Innovative Management of Animal Genetic Resources

European Commission
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IMAGE

Innovative Management of Animal Genetic Resources

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Horizon 2020 FRAMEWORK PROGRAMME

TOPIC: MANAGEMENT AND SUSTAINABLE USE OF GENETIC RESOURCES

Topic identifier: SFS-07b-2015

Type of Action: Research and Innovation Action (RIA)

DELIVERABLE D7.11
Deliverable title: Post-graduate course nº3

Abstract:
The assessments performed at European level by IMAGE revealead the occurence of a predominance of entries over exits in gene-bank collections. These results show that the use of animal biobanks is still mostly focused on the protection of endangered breeds. However, other innovative uses are possible. Moreover, these assessments show that training regarding the different applications of genebank resources is needed. Therefore, in order to enhance the use of genetic collections and upgrading animal gene bank management using a multidisciplinary approach, the IMAGE project organised two further post-graduate training courses in Europe. The first course was organized by AgroParisTech from November 20 to 22, 2019. It brought together 15 participants, stakeholders in the conservation of genetic resources or researchers, from 11 countries and almost all continents (Europe, Africa, Asia, South America). This course focused on the different possible scenarios for the usage of genebank resources, challenging participants with focused questions and case studies in different species. The second course was organized at Wageningen University & Research from December 9 to 13, 2019. Again, the importance of the topic attracted participants from different parts of the globe; 27 participants from Europe, Russia, China and South America. The course covered the important topics required to the characterization, management and exploitation of genomic diversity in animals.

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Start date of the project: March 1st, 2016 Duration: 48 months
Organisation name of lead contractor: INRAE (AgroParisTech), WU, WR
Contributors: WR, WU, BOKU, INRAE, FLI, UGOE
Dissemination level: PU
Revision N°: V1

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Executive Summary

Background	T7.5 Training T7.5 Currently, the two assessments regarding the usage of genebank resources performed by the CRB-Anim (France) and the IMAGE projects, conclude that these resources are mostly used for the preservation of endangered breeds, showing that it is crucial to disseminate knowledge regarding other important applications of genebank resources.
Objectives	Organisation of two post-graduate training courses, intended for training of PhD candidates, researchers and dissemination to stakeholders: a) how genebank resources can be used for: reintroduction of diversity into standing populations; the characterization of diversity dynamics (diversity or response to selection); the creation of new breeds resulting from crossbreeding. b) the use of genomic approaches for characterization, management and exploitation of genomic diversity in animals.
Methods	The courses had the participation of IMAGE and invited experts as lecturers who provided lectures and practical sessions. During the first course organized at AgroParisTech, lectures and practicals were conducted on the following specific topics: a) case studies illustrating innovative usage of gene-bank resources; b) molecular indicators of genetic diversity and associated data; c) optimization of cryobank resources to manage the diversity using MoBPS software (developed within IMAGE). During the second course organized at WUR, lectures and practicals were conducted focusing on: a) how to measure genetic diversity; b) detection of introgression; c) linking phenotype with genotype, through GWAS, detection of selection and functional genomics; d) building genebank collections; e) optimization of genetic contributions in inbred populations.
Results & implications	Both courses had a wide international participation from almost all continents (Europe, Africa, Asia, South America). This wide international participation shows that using genebank collections for the management of animal genetic diversity is a subject of concern, reflecting the actions of FAO and other bodies to promote a global action plan for animal genetic resources. Mastering of MoBPS software will be an asset to make the best use of collections. The experience of the 1st course organized in 2018 at WUR showed that IMAGE should continue to reinforce the training to promote in depth knowledge on the conservation of genetic diversity and the use of genomic information becoming available through innovative technologies. IMAGE case studies showed that inbreeding and low fertility may limit the success of collection use, leading to two conclusions: - the genetic diversity of a population must be preserved by biobanking germplasm before the population becomes too inbred and its fertility deteriorates; - methods of collecting, conserving and using reproductive resources must be improved, which is something that IMAGE has contributed to.

1- Using gene bank material for livestock populations: case studies and optimisation using the MoBPS software - France

Aim: Promote the innovative usage of genebank resources and disseminate methods supporting such usage, taking advantage of the estimation of indicators of genetic diversity with associated data, and demonstrating the usefulness of the MoBPS software for the optimization of genebank resources to manage genetic diversity.

Scope of the course:
With the aim of disseminating innovative usage of genebank resources the course comprised three main subjects:
- Presentation of case studies: the French CRB-Anim infrastructure project provided 4 examples illustrating:
- the reconstitution of experimental trout lines (unpublished);
- the reintroduction of diversity into an experimental chicken line (published) or into local pig breeds (unpublished);
- the molecular characterization of the diversity of local breeds of small ruminants and the contribution of cryobank to the management of the diversity of these breeds;
- Estimation of molecular indicators of genetic diversity and associated data;
- Practical usage of MoBPS software, a program developed by researchers of the University of Göttingen as part of IMAGE, for simulation of animal breeding programs, while optimizing the selection of genebank resources to manage the diversity of a population (in conservation or selection) or to redirect its selection objectives.

Public: The course was attended by 15 researchers, of which 11 came from different countries and continents (Europe, Africa, Asia, South America, Figure 1). More than 40 applications were received, many of them from Africa, but the lack of funds for traveling and the difficulty to obtain a visa in a few cases, prevented to reach the target of 20 trainees.

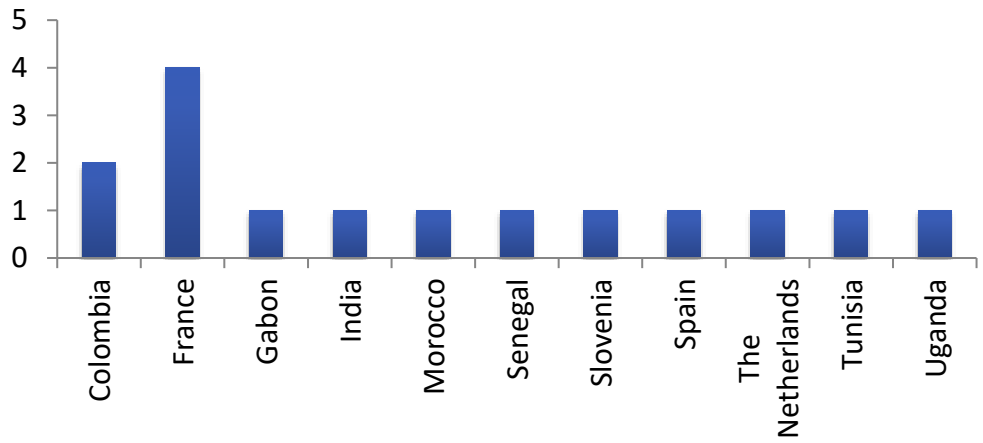

Figure 1- Distribution of partipants per country.

Results: The course was attended by a group of participants coming from Europe, Africa, Asia and South America, showing that researchers and stakeholders, most likely as a result of FAO's action to promote a global action plan for animal genetic resources, are aware of the importance of these resources. Some participants were gene bank managers with a national mandate in their country (India, Tunisia). All participants had the opportunity to analyse and understand how it is important to use genebanks not only as a repository of germplasm for endangered breeds, but as a source of genetic diversity for other breeds as well, while dealing with real examples. Moreover, applicants were exposed to methodology for the estimation of genetic diversity. Understanding how genetic diversity can be optimized while managing genebanks in an efficient manner has been one of the goals of IMAGE. Within this framework, MoBPS software that was developed by IMAGE, will be an asset to make the best use of collections in the near future, for which knowledge tranfer actions are required. During this course, applicants had a special session dedicated to the background and application of MoBPS.

Dates: 20-22 November 2019
Venue: AgroParisTech, 19 av. du Maine, 75015 Paris

Instructors:
Paris Institute of Technology for Life, Food and Environmental Sciences (AgroParisTech), France

- Etienne Verrier

Institut National de la Recherche Agronomique (INRA), France

- Michèle Tixier-Boichard
- Tatiana Zerjal
- Catherine Labbe
- Gwendal Restoux

IFIP-Institut du porc (IFIP), France

- Marie-José Mercat

Institut du L'elevage (Idele), France, (also a partner of IMAGE)

- Coralie Danchin-Burge

Göttingen University, Germany

- Torsten Pook
- Henner Simianer

	Wednesday, Nov 20	
14:00	Welcome	Etienne Verrier
14:10	General Introduction	Michèle Tixier-Boichard
15:00	Coffee break	
15:20	Case study: poultry experimental lines	Tatiana Zerjal
16:00	Case study: rainbow trout experimental lines	Catherine Labbe
16:40	Case study: rare pig breeds	Marie-José Mercat
17:20	Rare sheep and goat breeds	Coralie Danchin-Burge
	Thursday, Nov 21	
09:00	Main indicators of genetic variability from pedigree and/or molecular information	Gwendal Restoux
11:00	Coffee break	
11:30	Data used for the MoBPS software	Torsten Pook
12:30	Lunch	
14:00	Optimization with the MoBPS software (1,2)	Torsten Pook & Henner Simianer
	Friday, Nov 22	
09:00	Optimization with the MoBPS software (2)	Torsten Pook & Henner Simianer
12:30	Lunch	
13:30	Optimization with the MoBPS software	Torsten Pook & Henner Simianer
16:00	End of session	

(1) – up to 18:00

(2) – including a coffee-break

2-Course on characterization, management and exploitation of genomic diversity in animals - The Netherlands

Aim: In order to contribute to the enhancement of the use of genetic collections and upgrading animal gene bank management, this course aimed to provide advanced training regarding the characterization of animal genetic diversity. A team of international lecturers, mostly involved in the IMAGE project, developed a challenging program that included all relevant topics, needed to understand and make best use of genetic diversity.

Scope: With the aim of providing advanced training regarding the characterization of animal genetic diversity, the following topics were studied during the course:

a) measures of genetic diversity
b) analysis of across population genetic diversity and introgression
c) linking phenotype, genotype and selection history
d) building gene bank collections
e) optimal contribution selection and management of small populations

Target: The course was attended by an enthusiastic group of 27 participants from 17 countries representing Europe, Russia, China and South America (Figure 2).

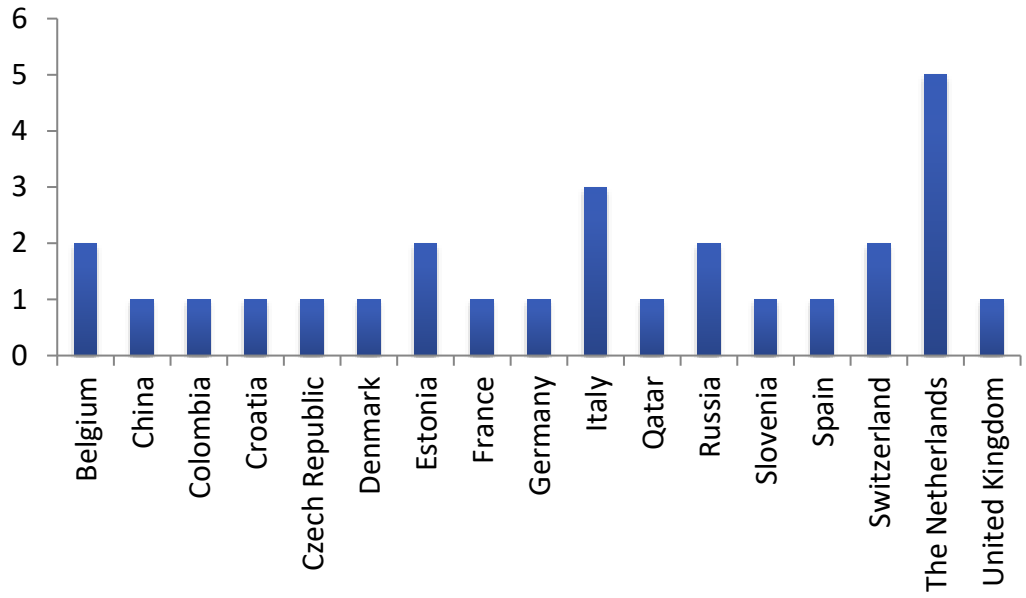

Figure 2- Distribution of partipants per country.

Results: The participants had contact with the most up-to-date concepts related with the use of genomic information for the conservation and management of populations. For that, participants had the opportunity to deal with real data. A speed-dating session was organized in order to assist in the process of group forming. During the week, they worked in groups applying the acquired knowledge to actual population data (that could include phenotype as well as genomic information). A networking dinner was organized (kindly sponsored by Neogen), in which participants and lecturers could interact and discuss genetic diversity topics.

Dates: 9-13 December, 2019
Venue: PC0086, Zodiac (Building 122), Wageningen Campus, De Elst 1, 6708 WD Wageningen, The Netherlands

Teachers:

Wageningen University, The Netherlands
- Martien Groenen
- Mirte Bosse

Wageningen Research, The Netherlands
- Jack Windig
- Aniek Bouwman
- Sipke Joost Hiemstra

University of Natural Resources and Life Sciences, Austria
- Gabor Meszaros

Friedrich Loeffler Institute, Germany
- Steffen Weigend

French National Institute for Agricultural Research, France
- Michèle Tixier-Boichard

Course schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8.30-9.00	Coffee available	Coffee available	Coffee available	Coffee available	Coffee available
9:00-10:30	Intro course Tutorial intro Linux and HPC 9.30 Lecture Intro genomic diversity	Lecture diversity across breeds	Lecture linking phenotype, genotype and selection history	Lecture Optimal contribution	Lecture management small populations
10:30-11:00	Coffee	Coffee	Coffee	Coffee	Coffee
11:00-12:30	Lecture Measures of genomic diversity	Lecture introgression	Lecture functional genomics	Lecture Building gene bank collections	Exercise management small populations
12:30-13:30	Lunch	Lunch	Lunch	Lunch	Lunch
13:30-15:00	Exercise measures of genomic diversity	Exercise admixture	Exercise functional genomics	Exercise prioritization for conservation/setting up gene bank	Group presentations
15:00-15:30	Coffee	Coffee	Coffee	Coffee	Coffee
15:30-17:30	Speed-dating	Group work	Group work	Group work	Group presentations
Evening	17.45-21.00 Pizza night + forming groups			18.30 Course dinner (Restaurant Colors)	