

NEWSLETTER

OCTOBER 2019 – Issue 6



editorial

By Michèle Tixier-Boichard, INRA

Innovative Management of Animal Genetic Resources (IMAGE) was on the spot at **EAAP Conference** in Ghent, Belgium between August 26-29, 2019.

The conference was preceded by the European Regional Focal Point for Animal Genetic Resources (ERFP) meeting and the **4th Dialogue Forum** of IMAGE which took place at the annual meeting of SAVE Foundation. It addressed the issues of the Nagoya protocol in general and farm animals in particular. Exhaustive presentations were given by Elzbieta Martyniuk and Alicja Kozłowska, who is specifically in charge of the implementation of the EU regulation for Access and Benefit Sharing. Presentations can be downloaded from the [IMAGE portal](#).

On August 26, challenges and prospects for farm animal genetic resources were discussed in two sessions organized by the EAAP Genetics Commission on “What to Conserve” (Session 1) and “Raising Awareness about Animal Genetic

Resources” (Session 11, organized by FAO, a partner of IMAGE). In both sessions, partners of IMAGE gave presentations, i.e. Richard Crooijmans (WUR), Linn Fenna Groeneveld (NordGen) and Maria Wurzinger (BOKU), with case studies or methodological developments.

On August 28, IMAGE had twin sessions (no: 33 and 43) on “Burning Issues on Biodiversity” at **EAAP 2019**. Session 33 (“What are the benefits from gene banks?”) gave the opportunity to present some major achievements by IMAGE through oral presentations and posters, such as the stakeholders’ involvement in the dialogue forum and the ethical survey about cryoconservation of breeds (Waltraud Kugler), the current state of gene bank collections in Europe and the economic optimisation of collections (Sipke-Joost Hiemstra, Rafael De Oliveira Silva), the improvement of semen freezing protocols (Elisabeth Blesbois, Henri Woelders), the molecular characterization of genetic



freezing protocols (Elisabeth Blesbois, Henri Woelders), the molecular characterization of genetic diversity across breeds (Richard Crooijmans, Coralie Danchin, Anouk Van Breukelen) and the search for selection signature (Simon Boitard), the different options to use gene bank collections for breeding or introgression of rare traits such as blue-egg shell in White Leghorn layers (Torsten Pook, Claudia Dierks, Jack Windig).

Session 43 ("Fitter livestock farms from better gene banks") was organized with 4 other EU-supported projects: SmartCow, Feed-A-Gene, GenTORE, GPlusE, which are the members of the Common Dissemination Booster "**Fitter Livestock Farming**". The aim was to demonstrate the complementarities between them to characterize genetic collections and to share data about them. Phenotyping methods, as in [SmartCow](#), can contribute to orient the choice of individuals for gene banks, or add value to samples already kept in

gene banks, with a particular example for milk samples ([GPlusE](#)). The joint analysis of climatic and genetic data is an approach used in IMAGE for landscape genomics. On the other hand, the example given by [GenTORE](#) focused on the characterization of farm type which also carries a lot of importance and would be useful to combine with climatic data. Characterizing experimental genotypes, as in [Feed-A-Gene](#), opens the way to identify relevant traits and molecular markers to further characterize animal breeds. As a whole, the session was very well attended. The discussion showed that efforts still have to be done to facilitate data sharing between projects, the IMAGE proposal relying on BioSamples database of EBI to connect data with samples.

Do not miss the next appointment with IMAGE, which is an open international seminar on **05 February 2020** in **Madrid**. For the updates, please check our [website](#).



1-Michèle Tixier-Boichard, 2- Henri Woelders, 3- Anouk van Breukelen
and 4- Richard Crooijmans at IMAGE session at EAAP 2019 in Ghent, Belgium



SAVE THE DATE

6 NOVEMBER 2019

AFTERNOON WORKSHOP, BRUSSELS (Belgium)

WHAT R&I CAN DELIVER TO SUPPORT CLIMATE MITIGATION AND ADAPTATION IN LIVESTOCK FARMING

atf animal task force
A European Public-Private Platform

Fitter LiveStock Farming



On the [9th Animal Task Force \(ATF\) Seminar](#) about Climate Smart Livestock Farming, ATF will dedicate its afternoon session to the “Fitter Livestock Farming” Common Dissemination Booster (CDB). The CDB “Fitter Livestock Farming” session will be about “What R&I can deliver to support climate mitigation and adaptation in livestock farming” and it will take place on **06 November 2019**, between **14:00-16:15** at the **University Foundation in Brussels**.

This workshop will bring together animal scientists with livestock professionals and advisors, as well as researchers, non-profit & societal organisations and industry representatives, to discuss sustainable use of resources, preservation of biodiversity, livestock gene bank collections and improvement of soil quality in the livestock sector.

More information about the event, seminar programme and the registration for the event are available on [ATF's website](#). Additionally, you can watch the video about the event [here](#).

The Fitter Livestock Farming Project Group is a cluster of six research projects (IMAGE, GentTORE, FEED-A-GENE, GplusE, SAPHIR & SmartCow) funded by the European Commission and coordinated under the CDB, aiming to bring Innovation to food safety and sustainable agriculture.

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Fitter LiveStock Farming

IMAGE Session at EAAP 2019

Burning issues in biodiversity 2:

"Fitter livestock farms from better gene banks"



IMAGE project's afternoon session "Fitter livestock farms from better gene banks" at EAAP 2019 on 28th August was organized with other EU projects namely SmartCow, Feed-A-Gene, GenTORE, GPlusE, which are the members of the Common Dissemination Booster "Fitter Livestock Farming". The session was very well attended.

Following the introduction by Michèle Tixier-Boichard, **Paolo Cozzi** made a presentation about "The IMAGE unified data portal to integrate and represent European gene bank data". Cozzi mentioned about the data management, gene banks using Cryoweb and [IMAGE-InjectTool](#). Using InjectTool, data derived from different sources can be standardized and validated against IMAGE metadata standards and finally submitted to EBI [BioSamples](#), which has been chosen as the sample reference archive for all IMAGE data.

Rene Baumont presented "SmartCow: integrating European cattle research infrastructures to improve their phenotyping offer". Baumont mentioned how SmartCow will improve phenotyping capabilities. He said that book of methods in cattle physiology will be published in 2021. He said that the development of the cattle ontology of traits and the ontology of environmental conditions, refining in vivo methods to evaluate feed efficiency and gas emissions, new biomarkers (proxies) that can be easily measured in milk, faeces, urine, or blood through rapid analytical methods and tools to generate new and improved information from animal sensors, would enable a more efficient phenotyping and genetic selection of cattle.

Nicolas Gengler mentioned about "GplusE: Mid-infrared milk analysis based technologies adding value to gene banks". Gengler explained that mid-infrared (MIR) spectra based milk analysis strategies would allow to add value to gene bank collection and clarified how MIR based technologies can add value. Using directly MIR has the advantage of a phenotypic characterization (i.e. milk phenome) close the genome. As for the use of the genome for selection of candidates for gene banks, the use of this milk phenome could be a strategy to assess and to cover the existing variability in a given breed and among breeds to preserve.



Nicolas Gengler

Helene Gilbert presented "Feed-a-Gene: Responses of pigs divergently selected for cortisol level or feed efficiency to a challenge diet". She talked about the study to evaluate (1) if a modified cortisol level in pigs alters their feed efficiency and their production performance; and (2) if alternative dietary resources would affect these responses.



Rene Baumont



Helene Gilbert

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Paolo Ajmone Marsan presented "IMAGE project strategy to investigate local adaptation in European sheep". He explained the landscape genomics (LG) to investigate selective sweeps associated to adaptation to climatic conditions in local sheep populations and genetic collections.



Paolo Ajmone Marsan

Florian Leiber gave a presentation about the "Economic resilience and efficiency indicators of conventional and organic dairy farms across Europe". The effect of compliance with organic production standards on dairy farms were shown, which was assessed in terms of their economic efficiency and profitability across 4 geoclimatic classes in Europe. The results showed that, organic farms have environmental gains and their profitability is better compared to conventional farms. Also, organic farms represent high performance with low robustness but good resilience.



Florian Leiber

Luís Telo da Gama made a presentation about "Capacity building to enhance the use of Animal Genetic Resources in a multinational context". In order to build capacity in conservation and management of AnGR using novel technologies, 3 postgraduate training courses were organized and nearly 100 participants from 17 different nationalities (in Europe, Africa and America) attended the courses, which covered topics such as the role of AnGR in sustainable development, assessment of genetic diversity using different tools, management of small populations, development and management of conservation programs, and reproductive technologies. Da Gama also provided information about the upcoming training sessions.



Luís Telo da Gama

For closing the session and final discussion, **Michèle Tixier-Boichard** took the floor and mentioned that IMAGE project is developing a web portal to connect all data pertaining to gene bank collections. She told that cooperation between Common Dissemination Booster (CDB) projects (GenTORE, FEED-A-Gene, SAPHIR, GplusE, SmartCow and IMAGE), should increase the knowledge of phenotype-genotype relationships. Refined characterization of gene bank samples would improve the prediction of animal performance and enhance the complementarity between gene banking strategies and management of on-farm populations. This approach could then be disseminated in training programs of IMAGE.

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IMAGE highlights presented at Wageningen Symposium on Cryopreservation and Reproductive Technologies

By Sipke-Joost Hiemstra, WUR

How can the latest innovations in animal reproduction and cryopreservation technologies be used in animal breeding and conservation programs? What are the benefits of the use of such technologies and how is the balance when also considering animal welfare, ethical considerations, and societal acceptability? And finally, where should we focus our research priorities?

These questions were addressed the 5th of September at an inspiring Symposium “**New opportunities of animal reproductive and cryopreservation technologies for breeding and conservation**”, organised by the Animal Breeding and Genomics group and the Centre for Genetic Resources, the Netherlands (CGN) of Wageningen University & Research. The Symposium was well attended by a variety of experts and stakeholders, representing different domains and farm animal species.

Leading scientists from the Faculty of Veterinary Medicine of Ghent University, the Faculty of Veterinary Medicine of Utrecht University, and Wageningen University & Research presented the state of the art and progress made in animal reproduction and cryopreservation research.



Ann Van Soom, Sipke-Joost Hiemstra, Tom Stout, Henri Woelders, Bernard Roelen



Henri Woelders

Dr. Henri Woelders, of Wageningen Livestock Research (WLR) and the Centre for Genetic Resources, the Netherlands (CGN) presented on the potential of cryopreservation and use of various types of germplasm in pigs and chicken, focussing on embryos, gonads, primordial germ cells and semen, including highlights from the EU Horizon 2020 IMAGE project. He showed that cryopreservation of poultry semen is applicable for long term conservation of rare breeds, and may also be used for maintaining breeding lines.

Cryopreservation and transfer of gonads was shown to be an effective means in bird and mammalian species, while primordial germ cells offer possibilities and potential advantages in bird and fish species. Also, recent advances in pig embryo cryopreservation were shown and it was demonstrated how mathematic modelling of cellular events during embryo cryopreservation are extremely helpful.

More details about the Symposium and the presentations of the speakers can be found [here](#).

IMAGE's Upcoming Courses and Training

By Luís Telo da Gama

Characterization, Management and Exploitation of Genomic Diversity in Animals



Wageningen University & Research organizes a 5-day interactive course **from 09 to 13 December 2019**, in **Wageningen Campus**, Wageningen, The Netherlands, within the framework of the EU Horizon 2020 project IMAGE.

The aim of the course is to learn about novel methods to characterise, manage and exploit genomic diversity (animal genetic resources) and directly apply such methods to participant's own dataset. Target audience of the course are PhD students, post-docs and researchers interested in genomic diversity. The content of the course is briefly as follows:

- Measures of genomic diversity
- Diversity across breeds
- Adaptive introgression
- Functional genomics
- Management of small populations
- Optimal contributions

For more information about the course, please [click here](#) or contact Aniek Bouwman (aniek.bouwman@wur.nl).

Using Gene Bank Material for Livestock Populations: Case Studies and Optimization Using the MoBPS Software



The training session about using gene bank material for livestock populations will take place **from 20 to 22 November 2019** in **AgroParisTech**, Paris, France. It is jointly organized by the IMAGE Consortium and AgroParisTech. The target audience is population managers and gene bank users.

The training session has two parts :

- 1) Presentation of real situations where cryopreserved material from a gene bank was used in live populations: why, how, what results, what questions?
- 2) Introduction to and use of the MoBPS software, develop to simulate and compare different breeding scenarios including the use of cryopreserved material. This part will mainly consist of practicals.

For more information and registration to the course, please [click here](#).

Other upcoming courses:

- **Conservation and Management of Animal Genetic Resources**: Agrosavia organizes a post-graduate course from **02 to 06 December 2019**, in **Bogotá, Colômbia**.
- **Post-graduate IMAGE Training course**: Institut National de la Recherche Agronomique organizes a course from **21 to 24 January 2020**, in **Beni Mellal, Morocco**.
- **Gene Bank implementation, Management, and Sustainability**: Animal Production Research Institute organizes a course from **03 to 07 November 2019**, in **Cairo, Egypt**.

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4th IMAGE Dialogue Forum

Access and Benefit Sharing (ABS) Rules

What does ABS mean for conservation research and use of Animal Genetic Resources (AnGR)?

By Waltraud Kugler, SAVE Foundation

The 4th IMAGE Dialogue Forum took place at the occasion of the “Levend Erfgoed Expo 2019” of rare Belgian breeds at the Provinciaal Domein Puyenbroeck in Wachtebeke, Belgium on **25 August 2019**.

The challenges arising from Access and Benefit Sharing (ABS) for exchange of genetic material are subject of IMAGE project’s WP1—Task 1.4 (Implementation of access and benefit sharing regulation). Information on ABS rules and their relevance to breeding, conservation and science are rarely known. Therefore, this Dialogue Forum was laid out as an information platform on ABS.

A comprehensive introduction to ABS in animal breeding, conservation and research was provided by Elzbieta Martyniuk, Faculty of Animal Sciences, Department of Genetics and Animal Breeding at the Warsaw University of Life Science (SGGW), which is an IMAGE partner.

The Policy Officer of the European Commission and EU ABS National Focal Point at the Department: Global Sustainability, Trade & Multilateral Agreements, DG Environment Alicja Kozłowska explained obligations and rules within the EU and the rules for the exchange with other countries, the key provisions of the EU ABS regulation, user obligations like Due Diligence obligations and Due Diligence declarations and an explanation of the tools to use on internet.

It became clear that, the ABS rules do not play a role in most of the cases of the exchange of material for breeding. But on the other hand, science is heavily

affected by the ABS rules. The provider countries may draw up their own regulations. Therefore, sometimes it seems to be impossible to get material for scientific issues. In general, ABS in animal breeding is less relevant than other sectors due to phyto-sanitary measures in the EU, the limited import of animal material to the EU and mostly no legislation on animal breeding and ABS in the member states. But, the attention should be paid to the fact that new products are in the scope of the EU regulation.

Among the conservation NGOs, it is known that there is an ABS regulation and which countries signed the Nagoya Protocol. The National competent authority is hardly known among NGOs. In the recognition of best practice examples, the national or regional acting conservation NGOs are mostly not involved.

Detailed information including the most important weblinks to ABS are available on the [IMAGE website](#).



BioSamples for IMAGE

By Jun Fan, EMBL-EBI

What is BioSamples

[BioSamples](#) is a data archive provided by EMBL-EBI to store and supply metadata about biological samples used in research. The benefits of depositing data in BioSamples includes clear data organization with each record assigned a unique globally recognized identifier, ensuring sample description consistency for data records in different sequencing archives, improved reproducibility, conformation to FAIR data standards, widely recognized repository for openly archiving data for journal publications and synchronization with sister BioSample databases in National Center for Biotechnology Information (NCBI) and DNA Data Bank of Japan (DDBJ).

BioSamples is widely used as the sample reference for other molecular archives, for example the European Nucleotide Archive (ENA), which covers raw sequencing data, sequence assembly information and functional annotation, European Variation Archive (EVA), which stores all types of genetic variation data and ArrayExpress which stores data from high-throughput functional genomics experiments.

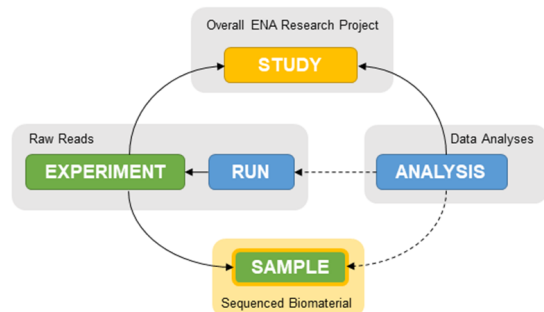


Figure 1: The use of BioSamples in the ENA. The solid lines indicate mandatory requirements and the dotted lines are optional. Samples are only not required for a conceptual analysis. Further information available from the [ENA documentation](#).

It is generally recommended to submit BioSamples as early as possible in a project, provide as much detail as possible, use multiple specific fields of characteristics instead of a long description paragraph and avoid context-specific acronyms.

Project: PRJEB6119

Variation site discovery and genotype calls in the genus Bos (cattle) by the NEXTGEN project (Next generation methods to preserve farm animal diversity by optimizing present and future breeding options).

Organism: Bos taurus (cattle)
Secondary Study Accession: ERP005587
Study Title: NextGen project variation for Bos taurus
Center Name: EBI
Study Name: Bovine EVA update

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Study Accession	Sample Accession	Analysis Accession	Tax Id	Scientific Name	Submitted FTP
PRJEB6119	SAMEA2358280	ERZ019405	9913	Bos taurus	<input type="checkbox"/> ERZ019405.md5 <input type="checkbox"/> IRBT.popu...f.gz.tbi <input type="checkbox"/> IRBT.popu...2.ped.gz <input type="checkbox"/> IRBT.popu...s.txt.gz <input type="checkbox"/> IRBT.popu...p.txt.gz <input type="checkbox"/> IRBT.popu...2.map.gz <input type="checkbox"/> IRBT.popu...2.vcf.gz

Figure 2: Representation of study PRJEB6119 in the ENA browser. The unique BioSamples accession that references the sample is highlighted.

The BioSamples resource for IMAGE

To assist the IMAGE community with submitting sample data to the BioSamples archive, which is used as the core sample archive for the IMAGE unified data portal, an inject tool has been developed. This tool assists gene bank managers with the preparation, standardization and finally submission of their gene bank sample data to the BioSamples archive. The Inject tool is a web tool which curates the data by validating against the IMAGE metadata ruleset to guarantee standardized and high-quality data. The tool further assists users by handling the brokering of data to BioSamples and automating the majority of the submission steps. All IMAGE data archived with BioSamples is then also made available to the community through the IMAGE data portal that will collate all of the IMAGE sample and genomic data into a single interface.

Introgression of Blue Eggshell Color from a Gene Bank Collection into a White Leghorn Breeding Line

By Claudia Dierks and Steffen Weigend (Friedrich-Loeffler-Institut, Neustadt, Germany),
Ngoc-Thuy Ha and Henner Simianer (University of Goettingen, Germany),
Matthias Schmutz and Björn Andersson (Lohmann Tierzucht GmbH, Germany),
David Cavero (H&N International, Germany)
and Rudolf Preisinger (EW GROUP GmbH, Germany)

The aim of TASK 6.3 of the IMAGE project is to demonstrate how ex-situ collections could be efficiently used to transfer a rare characteristic from a chicken gene bank collection into a contemporary in-situ population by marker-assisted introgression. The blue eggshell color has been selected as a trait in this animal model. It is inherited in a monogenic dominant way and the causal mutation is a large retroviral insertion on chromosome 1 at position 65 Mb and upstream of *SLCO1B3* (Wang et al., 2013, Wragg et al., 2013). The insertion induces an overexpression of *SLCO1B3* in the oviduct, which encodes a biliverdin transporter. Subsequently the content of green biliverdin increases in the oviduct and is being stored in the eggshell. For an initial F1 generation, six Araucana cocks were mated with ten White Leghorn (WL) hens of a contemporary breeding line. Two marker-assisted backcross generations (BC1 and 2) will be followed by a final intercross generation to achieve a high performing, WL-like, layer line which is homozygous for blue eggshell color.

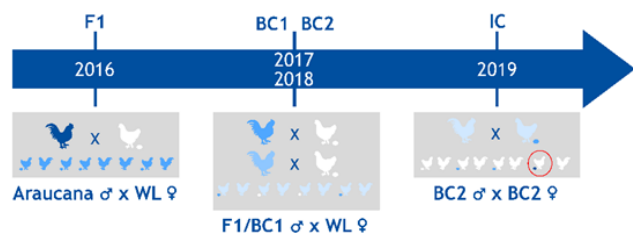


Figure 1: Breeding Scheme

Based on genotyping data of the founder animals, we identified 24 highly informative SNPs on chromosome 1 including the insertion site. Additionally 13 SNPs from a customized 52K SNP array were suitable to distinguish between Araucana and WL genome in this region. These markers were used to detect recombinant animals of the BC1 that carried the blue

eggshell mutation on the one hand and had highest content of WL genome on the other hand with regard to the inserted region on chromosome 1. Out of these recombinants, animals with the highest proportion of the recipient genome and the highest degree of diversity were selected for mating of the BC2 using the r-package MoBPS, Modular Breeding Program Simulator (Pook et al., 2019).

In BC2 animals, we would expect, on average, a WL content of 87.5%. Using marker-assisted introgression, we were able to increase the mean WL content in these animals by 4.42% up to 91.92%.

Analysis of performance data of the BC2 is still under progress. The first results are promising as the mean laying rate increases with a higher WL content in our population. BC2 hens carrying the insertion in heterozygous state (BC2_Bw) showed a clearly improved laying performance compared to their BC1 counterpart, and were close, although still lower than that of WL (WL1/2_ww).

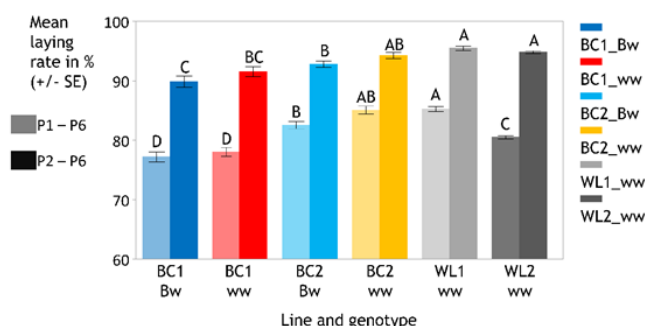


Figure 2: Laying rate



The mean egg weight of the backcross generations is similar to WL (~ 62 g), but the mean eggshell strength of the backcross generations is significant lower than in WL (~ -5-10 N) although the mean eggshell strength of the BC2 increased compared to the BC1 (~ +4 N).

Blue to green eggs were observed in the heterozygous backcrossed hens and eggs of hens without the blue eggshell insertion were white to slightly creamy. It seems that other loci influence the color of the eggshell in our populations.

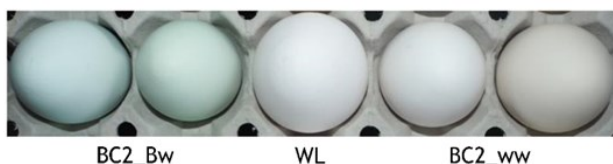


Figure 3: Eggs

The final IC is planned for November 2019. Animals with recombinations close to both sides of retroviral insertion are preferred in setting up mating groups for intercrossing, and selection is also dependent on the results of MoBPS.

The first results of this work were presented as a talk at the EAAP 2019 in Ghent. The IMAGE morning session "Burning issues in biodiversity 1: What are the benefits from animal gene banks?" on 28 August 2019 was well attended.



profiles



Dominic Moran, University of Edinburgh

WP2—Task 2.4 Economic analysis of gene bank development and use

Dominic.Moran@ed.ac.uk

Dominic Moran is Professor of Agricultural and Resource Economics at the Global Academy of The Royal (Dick) School of Veterinary Studies and The Roslin Institute - University of Edinburgh. He was previously Professor at SRUC in Edinburgh. He has a broad interest in the economics of global environmental change, including the challenge of safeguarding biological resources using economic approaches. In IMAGE he collaborates in WP2 Gene bank functioning, and specifically deliverables related to the costs and benefits of gene banks and the conceptualisation of how we might rationalize collections. Our work initially planned to focus on a detailed approach to cost-benefit analysis of genetic collections. However, while the costs of collections are relatively easy to compile, it was more complicated to define scenarios for the benefits likely to arise from different collection configurations, and the likely uses of stored material. Accordingly, we have refocussed onto the issue of cost-effectiveness, developing a mathematical optimisation approach to the challenge of how we might optimise collections at minimum cost across different countries. The analysis allows us to incorporate biological, economic and social objectives into our analysis, and offers wider lessons for other global plant and animal collection initiatives.



Chiara Bortoluzzi, Wageningen University & Research

WP4 – T4.3 Identification of functional relevance of variation in ex-situ genetic collections, including the prediction and monitoring of major genes and genetic defects

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Chiara Bortoluzzi is a PhD candidate at the Animal Breeding and Genomics Group at Wageningen University & Research, the Netherlands. During her MSc in Wageningen, Chiara investigated the relationship between transcriptomic and methylation data in pig tissues (Wageningen), in addition to perform research on the estimability of the dilution parameter in the context of social genetic effects (Aarhus University, Denmark). The aim of Chiara's PhD is to develop new methods for a more precise and meaningful evaluation of animal genetic resources, with a particular focus on traditional chicken breeds. By means of whole-genome sequencing data, she was able to elucidate the genetic variability harboured by small managed populations and decipher its meaning in terms of functionality, demography, and phenotypic variation. Her research has so far been published in two peer-reviewed papers. Chiara is currently working as guest researcher at INRA under the supervision of the IMAGE Project Coordinator Michèle Tixier-Boichard.

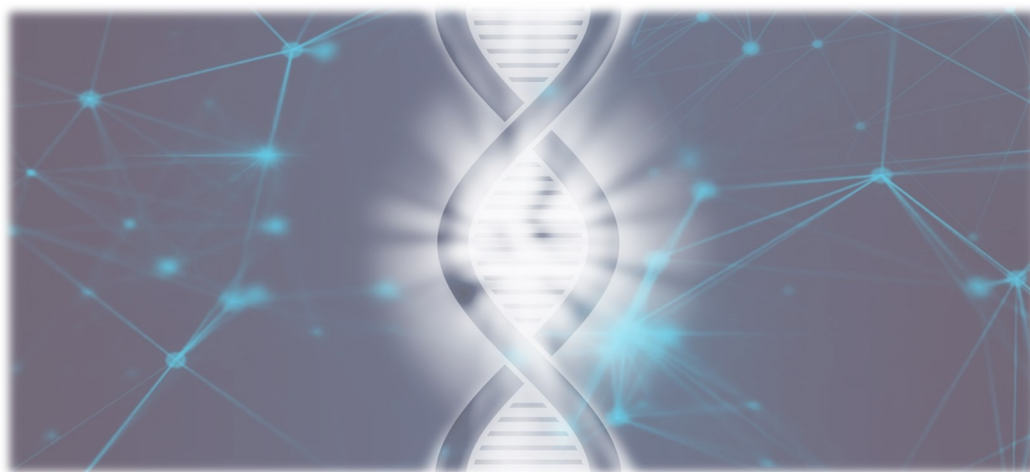
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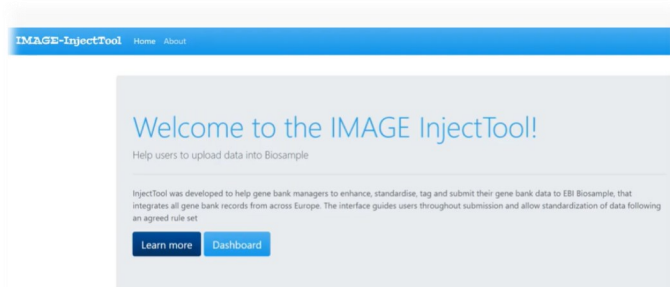


videos

IMAGE published a video about “Fitter Livestock Farming” on its [YouTube channel](#)! Second video is providing information about IMAGE InjectTool, posted by Paolo Cozzi from National Research Council, Institute of Agricultural Biology and Biotechnology, Italy. You may reach the videos below.



Fitter Livestock Farming



“Fitter Livestock Farming” CDB research projects including IMAGE and ATF will have a Stakeholders’ Workshop on **06 November 2019 in Brussels**. Watch the video by clicking the picture above!

Paolo Cozzi presents the IMAGE-InjectTool demonstration video. Watch the video by clicking the picture above!

contact

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IMAGE Newsletter

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