Challenges of implementation of Access and Benefit Sharing measures in livestock sector: animal breeding, research and genebanking

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Content

• New ABS legal landscape
• Specific characteristics of AnGR
• Gene flow of AnGR
• Impact of ABS measures
  – animal breeding
  – conservation of AnGR & genebanking
  – research
• Conclusions
ABC of the Nagoya Protocol

- **Access**
  - to GR and TK (PIC)
  - (or no access regulations)

- **Benefit Sharing**
  - bilaterally: according to MAT
  - the GMBSM?
  - monetary/non-monetary

- **Compliance**
  - national legislation
  - IRCC / checkpoints
  - checks on users
Monitoring the utilization of genetic resources

Provider Country

PIC
Competent National Authority

MAT
- Terms of Use (e.g. Commercial or non-commercial)
- Benefit-sharing (monetary or non-monetary)

Permit

Notified to ABS Clearing-House

International Certificate of Compliance

User Country

GRs + Certificate

Utilization of GRs

Checkpoint(s):
- one or more
- must be effective
- should be relevant to the utilization of genetic resources or to the collection of relevant information at, inter alia, any stage of research, development, innovation, pre-commercialization or commercialization

Provide information on PIC, MAT, source of GRs, use of GRs

Benefit-sharing
Nagoya Protocol: implementation

• Adopted 12 October 2010
• Came into force 12 October 2014
• As for 7rd October 2019
  – Parties: **119 + 3**
  – CNA: **110**
  – National legislation: **244** acts by **73 countries**
  – IRCC: **1109** certificates issued by **18 countries**
  – Checkpoints: **52** by **25 countries**

[https://absch.cbd.int/](https://absch.cbd.int/)
The Access and Benefit-Sharing Clearing-House (ABSCH) is a platform for exchanging information on ABSCH and a key tool for facilitating the implementation of the Nagoya Protocol.
Specific characteristics of AnGR

Diverse breeding systems:
• pastoralists – sometimes collective ownership with customary law
• small-scale subsistence farmers and smallholders - individual ownership of livestock
• centralized breeding systems with breeding organizations - private companies or cooperatives

Open market:
• domestic and international exchange by private-private transaction
• contracts from very simple to very sophisticated
• price according to the phenotypic/genetic value of animals

Information standards on transfer germplasm set by:
• WTO: Sanitary and Phytosanitary measures (SPS)
• EU zootechnical legislation (pedigree, genetic value)
Breeders

- Private companies
- Cooperative breeding enterprises
- Individual operators
- State-run breeding farms

End users

- Small-scale farmers
- Livestock keepers

Commercial producers

(FAO, 2009)
## Agro-biodiversity: sectoral differences

<table>
<thead>
<tr>
<th>Ownership</th>
<th>PGR public genebanks</th>
<th>AnGR private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of individual</td>
<td>low</td>
<td>high to very high</td>
</tr>
<tr>
<td>Exchange</td>
<td>S→N</td>
<td>N→N and N→S</td>
</tr>
<tr>
<td>Trading</td>
<td>farmers’/breeders’ rights</td>
<td>bilateral agreements</td>
</tr>
<tr>
<td>Genetic progress</td>
<td>new varieties</td>
<td>continuous, selection in purebred populations</td>
</tr>
<tr>
<td>Inbreeding</td>
<td>used extensively</td>
<td>not desirable</td>
</tr>
<tr>
<td>Breeding/testing costs</td>
<td>inexpensive</td>
<td>expensive</td>
</tr>
<tr>
<td>GM</td>
<td>possible/efficient</td>
<td>difficult/not accepted</td>
</tr>
<tr>
<td>Patentability</td>
<td>varieties</td>
<td>breeds not patentable</td>
</tr>
<tr>
<td>Centres of origin</td>
<td>well defined</td>
<td>multiple domestication</td>
</tr>
</tbody>
</table>

Adapted from Hiemstra et al. 2006
Specific characteristics of AnGR

- Private ownership
- Small part of AnGR in public domain
  - breeding/research stations
  - genebanks
Gene flow of AnGR

- Major gene flow: \( N \rightarrow N \) and \( N \rightarrow S \) supporting enhancement of livestock production in developing countries „the Livestock revolution”

- Very limited \( S \rightarrow N \)

- Rare examples on successful introgression of exotic AnGR to mainstream breeds (e.g. Meishan pig: early maturity, high litter size but slow growth and high fat level)

- Use of wild species almost negligible

http://www.ars.usda.gov/is/graphics/photos/nov02/k10089-2.htm
Gene flow of AnGR

- Growing $S \rightarrow S$ flow

Potentially will be most affected by the Nagoya Protocol and national ABS legislation

3 years of negotiations between authorities of Brazil and Indie

**RECENT EXCHANGE AGREEMENTS**

- After the last ban that forbid the importation of zebu cattle from India in 1962, Brazil and India re-started the discussion about Animal Genetic Resource exchange in 1998.

- Recently, Brazil and India signed two Agreements:
  - Agreement to import embryos from India
  - Agreement to export semen from Brazil
Awassi sheep

Primitive fat tail sheep from Arabian Peninsula
Israel, ARO
Volcani Center

Assaf: 5/8 Awassi 3/8 East Friesian

http://www.freeisraelphotos.com/photo/69

Gootwine, 2008
Gene flow of Awassi and Assaf

Zárate, Musavaya and Schäfer, 2006
Why do we exchange AnGR?

For the livestock sector, there are three integrated contexts in which genetic resources are exchanged and used that may be affected by a new ABS regime:

- Market (breeding, multiplication, production, conservation)
- Research
- Culture

Exchange of AnGR is beneficial and smoothly running
Commercial trade in AnGR
American Breeders Service
China - Genus plc has a new strategic agreement with River Stone Farm (Shandong) Co., Ltd to become the Group’s first commercial multiplier in China.

Riverstone is a joint venture between Black River Capital Partners Food Fund Holdings (Singapore) Pte Ltd (Black River) and Pipestone System, a leading US pig management company.

Under the terms of the multi-year agreement, Genus’s porcine genetics division, Genus PIC, will exclusively stock and sustain Riverstone’s new pig production project at its new site in China.
PIC China makes milestone shipment to Shennong

Yunnan Shennong Agricultural Industry Group (Shennong) has recently imported more than 1,000 elite, high-health great grandparent (GGP) from The PIG Improvement Company (PIC).

The shipment of elite pigs is a major milestone in PIC China’s partnership with Shennong, an integrated pork producer and one of the most progressive pig farming companies in China. It involved transporting 1,000 GGP gilts from PIC’s genetic nucleus facilities in North America and delivering them to Shennong’s facility. The animals recently completed a 45-day period of quarantine and are now being integrated into Shennong’s nucleus herds.
Genus plc partners with BCA to progress PRRSv resistant pigs in China

The initial phase of the collaboration is expected to take several years and focuses on the research, development and regulatory approval in China of PRRSv resistant pigs.

May 16, 2019
Every year, about 250,000 chicks make a 7,000-mile journey from central Iowa to China.

Feeding China: Iowa firm helps hatch egg industry expansion

West Des Moines-based Hy-Line International hopes to play big role as China moves toward U.S.-style mega-operations.

Lynn Hicks, lhicks@dmreg.com

Every year, about 250,000 chicks make a 7,000-mile journey from central Iowa to China.
Sells all over the world

Latin America
- Argentina
- Belize
- Bolivia
- Brazil
- Chile
- Colombia
- Costa Rica
- Dominican Republic
- Ecuador
- El Salvador
- Guatemala
- Guyana
- Haiti
- Honduras
- Mexico
- Panama
- Paraguay
- Peru
- Suriname
- Uruguay
# US trade value of AnGR in 2018 (USD)

<table>
<thead>
<tr>
<th>AnGR</th>
<th>IMPORT</th>
<th>EXPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purebred breeding cattle: live</td>
<td>3,556,520</td>
<td>76,960,782</td>
</tr>
<tr>
<td>Cattle semen</td>
<td>37,025,000</td>
<td>190,306,369</td>
</tr>
<tr>
<td>Purebred breeding pigs: live</td>
<td>666,770</td>
<td>13,876,109</td>
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<tr>
<td>Chicken below 185g</td>
<td>8,746,680</td>
<td>203,491,176</td>
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<tr>
<td>Turkeys below 185g</td>
<td>24,739,975</td>
<td>12,607,230</td>
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<tr>
<td>Fertilised eggs for incubation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chicken</td>
<td>19,790,373</td>
<td>315,184,649</td>
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<tr>
<td>Fertilised eggs for incubation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other poultry species</td>
<td>26,420,068</td>
<td>9,649,282</td>
</tr>
<tr>
<td><strong>TOTAL USD</strong></td>
<td><strong>120,975,386</strong></td>
<td><strong>819,075,598</strong></td>
</tr>
</tbody>
</table>

In 2011, the USA exported **$664 million** worth of breeding stock and genetic material
Import of semen to the USA: **37,025,000 USD**

<table>
<thead>
<tr>
<th>Period</th>
<th>Trade Flow</th>
<th>Reporter</th>
<th>Partner</th>
<th>Commodity Code</th>
<th>Trade Value (US$)</th>
<th>Netweight (kg)</th>
<th>Qty Unit</th>
<th>Qty</th>
<th>Flag</th>
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</thead>
<tbody>
<tr>
<td>2018</td>
<td>Export</td>
<td>Mexico</td>
<td>USA</td>
<td>051110</td>
<td>$7,804</td>
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<td>USA</td>
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<td>$202,098</td>
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<td>2018</td>
<td>Export</td>
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<td>USA</td>
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<td><strong>$32,833,274</strong></td>
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<tr>
<td>2018</td>
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<td>USA</td>
<td>051110</td>
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<td>Export</td>
<td>Denmark</td>
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<td>2018</td>
<td>Export</td>
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<td>$1,444,272</td>
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<td>2018</td>
<td>Export</td>
<td>Germany</td>
<td>USA</td>
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<td>$189,559</td>
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<td>2018</td>
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<td>Hungary</td>
<td>USA</td>
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<td>$31,893</td>
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<td>Israel</td>
<td>USA</td>
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<td>$2,000</td>
<td></td>
<td>0</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>Italy</td>
<td>USA</td>
<td>051110</td>
<td>$55,320</td>
<td></td>
<td>4</td>
<td>3,503</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>Netherlands</td>
<td>USA</td>
<td>051110</td>
<td>$1,365,760</td>
<td></td>
<td>5,567</td>
<td>242,063</td>
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<td>2018</td>
<td>Export</td>
<td>New Zealand</td>
<td>USA</td>
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<td>$163,526</td>
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<tr>
<td>2018</td>
<td>Export</td>
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<td>USA</td>
<td>051110</td>
<td>$211,946</td>
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<td>30</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>Slovakia</td>
<td>USA</td>
<td>051110</td>
<td>$7,083</td>
<td></td>
<td>1</td>
<td>6,000</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>Sweden</td>
<td>USA</td>
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<td>$43,394</td>
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<td>0</td>
<td>7,901</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>Switzerland</td>
<td>USA</td>
<td>051110</td>
<td>$32,033</td>
<td></td>
<td>4</td>
<td>66</td>
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<tr>
<td>2018</td>
<td>Export</td>
<td>United Arab Emirates</td>
<td>USA</td>
<td>051110</td>
<td>$16,089</td>
<td></td>
<td>25</td>
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</tr>
<tr>
<td>2018</td>
<td>Export</td>
<td>United Kingdom</td>
<td>USA</td>
<td>051110</td>
<td>$187,307</td>
<td></td>
<td>217</td>
<td>18,785</td>
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</tr>
<tr>
<td>2018</td>
<td>Export</td>
<td>United Rep. of Tanzania</td>
<td>USA</td>
<td>051110</td>
<td>$10,757</td>
<td></td>
<td>97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Showing 1 to 20 of 20 entries
Commercial trade in AnGR

• When selling animal genetic resources (breeding animals, semen, embryos, fertilised eggs for incubation...)
  – the value of this material as a genetic resource is reflected in its price
  – the buyer usually is free to use it for further breeding and research

• **The price** of animals in fact **includes a benefit-sharing agreement**: the breeder/breeding company gets money in exchange for providing genetic material to user

• In some case parties may agree on restrictions on the further use of breeding material and its transfer to third parties, either through contracts or through “gentlemen’s agreements”.

(FAO, 2009; Schloen et al, 2011)
Impact of the ABS measures
When ABS legislation becomes relevant?

Introduction of AnGR from a country regulating access!

- New breeds/lines
- Individual breeding animals
- Any type of germinal material

Users have to comply with national legislation of the Provider country and obligations arising from their national law (EU ABS law).
Impact of ABS measures: BREEDING

- **North**: Breeding industry, cooperatives, national breeding programmes: Genetic improvement for mainstream breeds carried out within their selected populations

  At present no need for exotic AnGR from the **South**

  **BUT**

  - Transboundary breeds or imported breeds may require influx or exchange of breeding material
  - Important to facilitate a gene flow from **South** to **South**
  - Future needs? Resistance to diseases /adaptation to climate

  Some European countries introduced access legislation but livestock GR is exempted from access measures (FR & ES)
Impact of ABS measures: CONSERVATION

In case of endangered transboundary breeds

• If there are national ABS measures in one country where the breed is present
  – Access to breeding stock / reproductive material might be more difficult
  – Collection of samples for *ex-situ* conservation might be more difficult
  – Developing joint strategies for conservation might be more difficult

AnGR conservation activities are usually undertaken and implemented at the national level, so potentially only single difficult cases
Impact of ABS measures: GENE BANKS

Svalbard Norway

BioBank Norway
AnGR GENE BANKS

• Animal genebanks: high management requirements
  ✓ Type of genetic material
  ✓ Storage requirements/costs

• Still a limited number of operational national genebanks (in public domain) to conserve AnGR in comparison with PGR

• Animal genebanks are recently growing in number

• Ownership of the genetic material
  – Stays with the owner of the donor animal (AU, FR)
  – Transferred to the genebank (NL, PL)
Impact of ABS measures: GENE BANKS

Need to:

• **Document source of material** that is introduced to the genebank

• Store this information and **make it available for users**

• **Develop protocols and procedures for exchange** of biological material
  – between genebanks
  – transfer from genebank to users

• Adopt and implement voluntary best practices, that include:
  – Standard MAA **Material Acquisition Agreement**
  – Standard MTA **Material Transfer Agreement**

ERFP on AnGR: guidelines for MAA and MTA development
Exchange of AnGR for RESEARCH

- Exchange of AnGR is usually governed by scientific cooperation contracts
- Some research organisations developed own model contracts
- Each party keeps the property of its inputs in the project
- No other use allowed than specified in the project
- Confidentiality required
- The scientific results, publication and potential IPRs are shared
- Remaining genetic material taken care of (give back or destroy options)

Global research community considers the facilitated exchange of research material between countries of a major relevance

(Hiemstra et al, 2010)
Impact of ABS measures: RESEARCH

Research projects often require AnGR from countries regulating access to GR, including AnGR

The User:

• Need to follow requirements on ABS of the Provider country: it often require time and efforts

• Need to respect domestic ABS legislation (compliance measures) and the EU ABS Regulation, if relevant

Countries facilitating access/exempting AnGR from ABS measures will become attractive partners in research projects

The ABS legislation will have a highest impact on the farm animal research sector
### Conclusions: the NP and AnGR

<table>
<thead>
<tr>
<th><strong>Access</strong></th>
<th>AnGR Genebanks</th>
<th>Live animals/germinal products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatively easy to regulate</td>
<td>Difficult to regulate! Ownership and extent of transactions</td>
<td></td>
</tr>
<tr>
<td>Unclear:</td>
<td>At present:</td>
<td></td>
</tr>
<tr>
<td>✓ Bilateral arrangements?</td>
<td>✓ Bilateral private contracts</td>
<td></td>
</tr>
<tr>
<td>✓ Benefits towards the Funding Strategy of the GPA?</td>
<td>✓ Price of AnGR reflects its value</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Compliance</strong></th>
<th>AnGR Genebanks</th>
<th>Live animals/germinal products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject to national legislation, check points and monitoring - feasible</td>
<td>Subject to national legislation, check points and monitoring - difficult</td>
<td></td>
</tr>
</tbody>
</table>
Different rules for different breeds?

Global trade in international, mainstream breeds:
- Contributes to enhancement of livestock production, supports Livestock revolution, especially in developing countries
- Profitable for buyers, enhances profitability
- Breeding companies do not expect additional benefits arising from utilisation of their breeding stock
- The price and ability to sell “products” provides benefits

Exchange of native and locally adapted breeds that may have:
- desirable traits for future breeding needs
- unique cultural /social value

It may restrict research and exchange of these breeds