In situ and *ex situ* integration activities on conservation of AnGR in Serbia - overview

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Definition:

Establishing a coordinated and functionally linked system in which *in situ* (living populations) and *ex situ* (cryopreserved genetic material) measures, are mutually complemented and actively exchanged, through breeding programs, genetic monitoring and cryopreservation, for the purpose of long-term conservation, sustainable use and restoration of the genetic diversity of AnGR (WG questionnaire).

Global level - FAO Global Plan of Action for Animal Genetic Resources (GPA-AnGR);

European level - Animal Genetic Resources (AnGR) Strategy for Europe;

One of the recommendations is to "Develop and implement national strategies and action plans for integrated and complementary in situ and ex situ long term conservation strategies for AnGR, engaging all relevant public and private stakeholders in the process".

National level:

- Strategy for Agriculture and Rural Development 2026-2034 (not yet);
- National Rural Development Program and National Program for AnGR (not yet, actions);
- Law on Animal Husbandry;
  - Breeding organizations;
- Law on Incentives in Agriculture and Rural Development (18 measures RD);
  - -Rule book - incentive for the preservation of AnGR (every year)
  - -Rule book - incentive for the preservation of AnGR in gene bank (2023)
- EUGENA MoU (signed, 2018)

Integration of in situ and ex situ conservation in Serbia

Example from practice: Multi-stakeholder conservation system

Building of institutional network with the integration of all relevant stakeholders and a clear distribution of tasks and responsibilities

- **Ministry of Agriculture, Forestry and Water Management**
- **Breeding organizations**
- **AI centres**
- **Research institutions**
- **Farmers**

Integration link:

- **In situ:** farmers + breeding organizations maintain live populations
- **Ex situ:** AI centers + research institutes store semen and genetic material

- **Link:** data exchange, herdbooks, coordinated breeding programes

Example from practice: Legal + policy framework alignment

- Legal framework (Strategy, Lows) + alignment with FAO Global Plan of Action
- Promotion of "reintegration of AnGR into traditional farming systems"

Integration link:

- Policies explicitly connect:

  - rural development measures (in situ - incentives, ex situ - support for projects)

  - gene banks & research institutions (ex situ backup - biological material repositories)

Example from practice: AI center + live populations

- One artificial insemination (AI) center storing semen (ex situ – in vitro);
- Researche institutions (have possibility for semen storing (ex situ – in vitro);

Integration link:

- Semen from localy adapted breeds
  - collected from in situ populations
  - stored ex situ (cryoconservation)
  - reused on request breeding organization
    * to avoid inbreeding
    * to reintroduce genetic diversity into farms

Example from practice: Herdbook + breeding programs

- Herdbooks maintained by breeding organizations
- Monitoring of population size and genetic structure (implementation of breeding programs)

Integration link:

- In situ: animals raised on farms
- Ex situ: controlled mating plans (not yet)

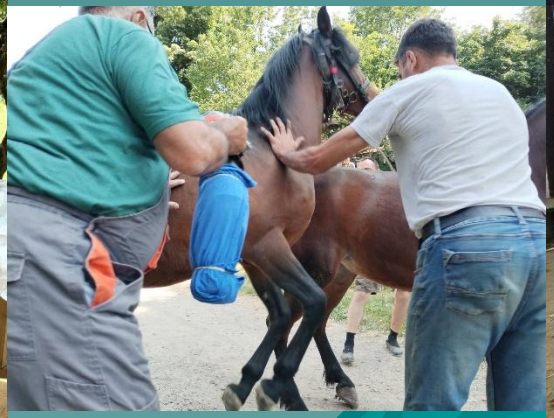
- Benefits: avoidance of genetic erosion and coordinated breeding across various locations

Example from practice: EUGENA MoU (signed, 2018)

- National gene banks network (ex situ)

Integration link:

- Backup of: semen, embryos, DNA etc.
- Benefits: possibility for restoration of endangered breeds maintained in situ



Example from practice: Conservation of locally adapted breeds

- Busha cattle, Domestic Mountain Pony, Zackel sheep types etc.

Integration link:

- Maintained in traditional systems (mountain, extensive grazing)
- Supported by:
  - genetic evaluation (research)
  - cryoconservation (limited but developing)

Example from practice: Linking conservation with rural development

- Promotion of:
  - traditional products (PDO/PGI)
  - organic production
  - agrotourism

Integration link:

- In situ: animals gain economic value → sustainable populations
- Ex situ: ensures long-term genetic security

Key synthesis (what "integration" looks like in Serbia)

In Serbia, integration is not one single program but a **combined system (actions):**

Core integration pathways:

1. Farm animals ↔ AI centers (cryobank)
2. Breeding programs ↔ genetic databases (herdbooks)
3. Rural economy ↔ conservation policy
4. Traditional systems ↔ scientific research

Conclusion:

- The system of organization and coordination needs to be improved because *in situ* and *ex situ* conservation must be integrated;
- *Ex situ* material is still not used because we are building a core collection and many breeds lack a gene bank;
- Provide more money in the budget for ex situ conservation;
- Improve communication and cooperation between all stakeholders;
- Develop biotechnological methods;
- Launch a digital platform with all stakeholders to promote integrated in situ and ex situ conservation;

Thank you for attention