

Data integration, GIS and multi-criteria decision making for the monitoring of livestock genomic resources

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In 2007, FAO initiated the Global plan of action for Farm Animal Genetic Resources (FAnGR) to reduce further loss of genetic diversity in farm animals. One of the key issues mentioned is to identify endangered breeds to support conservation prioritization programs.

In this context, the Swiss Federal Office for Agriculture attributed a mandate to explore the feasibility of the implementation of a monitoring concept. The report mentioned the relevance of including the geographic location of the populations monitored. Accordingly, we used open source software (PostgreSQL, PostGIS, OpenLayers, Geoserver), to develop a WebGIS platform prototype (GenMon) designed to assess pedigree information, geographical concentration, socio-economic and environmental information.

GenMon includes PopRep developed by the Institute of Farm Animal Genetics (FLI, Germany) to run the pedigree analysis and to provide parameters such as inbreeding coefficient, effective population size and introgression. Current developments will soon make it possible to process these indices based on genetic information also. In parallel, the combined socio-economic/environmental index assesses the attractiveness and the risk of potential future agricultural practice abandonment in the regions where populations are bred. Finally, a multi-criteria decision support tool aggregates criteria using the MACBETH method, which is based on a weighted average using satisfaction thresholds.

The system permits to upload basic information for each animal (parents, birth date, sex, location, introgression) to set weighting parameters, and to choose relevant thresholds. Based on these inputs, the system completes a pedigree analysis, and computes a final ranking of breeds based on an integrated prioritization score to be visualized on a geographical map.