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Assessment of status risk of the Polish local breeds – a preliminary results

G. Polak, J. Krupiński, National Research Institute of Animal Production

The Convention on Biological Diversity (CBD, 1992) specifies the need for monitoring biological diversity, with particular attention to components of biodiversity requiring urgent conservation measures. The importance of monitoring the level of risk of animal genetic resources is underlined in the **Global Plan of Action for Animal Genetic Resources** (FAO, 2007a): "Complete national inventories, supported by periodic **monitoring of trends and associated risks, are the basic requirements for the effective management of animal genetic resources**". In adopting the Global Plan of Action, countries agreed to establish or strengthen country-based early warning and response systems for their animal genetic resources. Assessing the risk status of the country's breeds is an essential element of such systems (FAO, 2013).

Reasons for protecting animal genetic resources

- source of unique genetic combinations;
- high quality traditional products - food, clothing, textile products, handicrafts;
- extensive farming and farming (e.g. agritourism farms);
- maintaining arable land in culture and controlling vegetation;
- inclusion in commercial production systems (crossing);
- landscape conservation and care;
- element of culture and tradition;
- investment in the future of the next generations;
- direct contact with animals,
- respect for the animals as living entities.

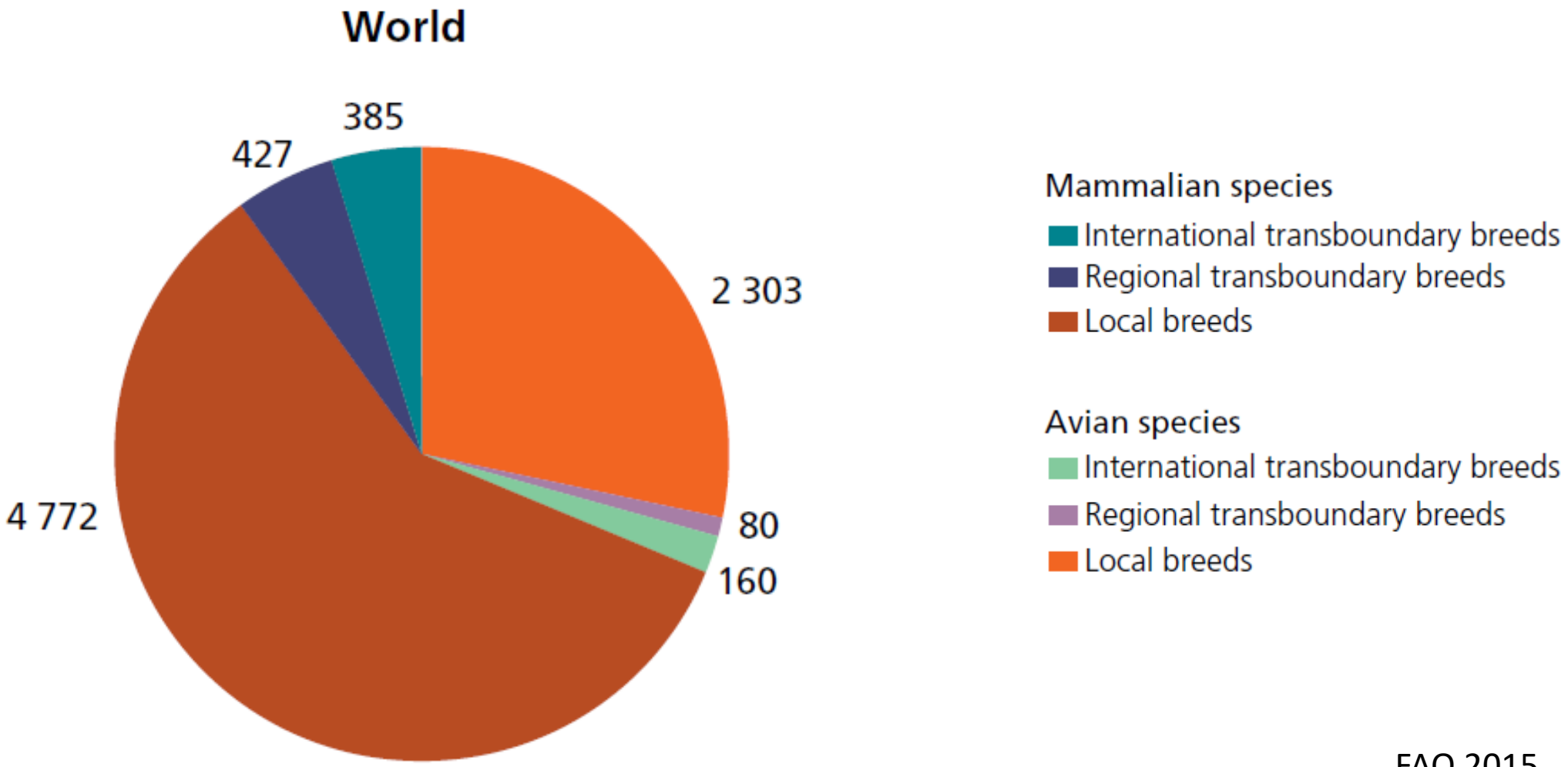






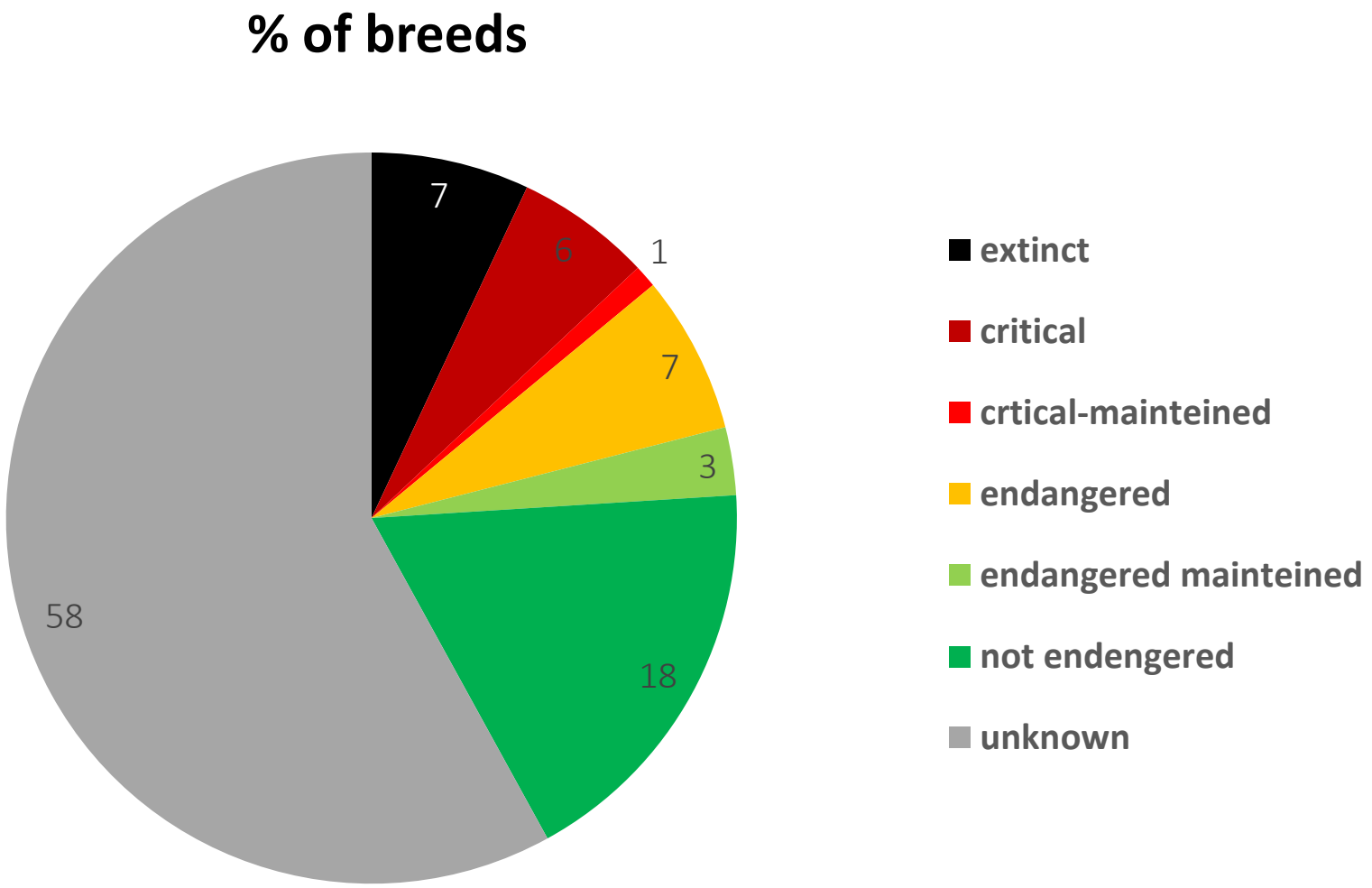
Fot. J.Gruszczynska

Number of local and transboundary breeds at global level



FAO,2015

The share of the world's breeds by category threat status



FAO, 2015

Breeds status risk categories

Extinct: A breed is categorized as extinct when there are no breeding males or breeding females remaining and any cryoconserved genetic material that may be available is insufficient for breed reconstitution.

Critical: a breed in which the total number of breeding females is less than or equal to 100 or the total number of breeding males is less than or equal to 5; or the overall population size is less than or equal to 120 and decreasing and the percentage of females being bred to males of the same breed is below 80%; and which is not classified as extinct.

Critical-maintained: a breed that meets the criteria for inclusion in the critical category, but for which active conservation programmes are in place or populations are maintained research institutions or by commercial companies.

Endangered: the total number of breeding females is greater than 100 (300 for species with low reproductive capacity) and less than or equal to 1 000 (3 000); or the overall population size is greater than 80 (240) and less than 800 (2 400) and increasing in size and the percentage of females being bred to males of the same breed is above 80 percent; or the overall population size is greater than 120 (360) and less than or equal to 1 200 or (3 600) and the trend is stable or decreasing; or the total number of breeding males is less than or equal to 20 and greater than five (i.e. ΔF is between 1 and 3 percent)

Endangered-maintained: a breed that meets the criteria for inclusion in the endangered category, but for which active conservation programmes are in place or populations are maintained by commercial companies or research institutions.

Not at risk: a breed not in denger of exctintion

Polish native/local breeds under conservation programs (2018)

Species	No of breeds	No of herds	No of fameles	Mean no fameles/herd
horses	7	1 459	6 808	4,8
cattle	4	802	8 502	10,8
sheep	15	884	63 772	75,5
goats	1	15	43	10,3
pigs	3	124	2 934	28,3
chickens	11	17	10 891	661,0
goose	14	15	5 598	358,1
dags	10	10	3 986	423,4
fur animals	13	21	1 104	51,2
bees	5	50	1 828 queens	36,6
∑	83	3331	103 638 (without bees)	

NRIoAP, 2019

Assessment of status risk

1. EC Regulation No. 1974/2006 - number of breeding females of a given breed. It was also the criterion used by FAO to assess threat status (Lotus and Scherf 1993, Sherf 2000).
2. Regulation (EU) 2016/1012 of the European Parliament and of the Council of 8 June 2016, an endangered breed *local breeds, genetically adapted to one or more production systems in that country, whose threat status has been scientifically confirmed by a body possessing the necessary skills and knowledge in the field of breeds threatened.*

However, it is known that the reasons for the disappearance of local populations are various. There are many breeds where the success of conservation programs was due to consideration of **many risk factors.** That is why complex evaluation methods are being proposed more and more often,

Assessment of status risk

- Alderson L., 2010 – Breeds at Risk. Criteria and Classification. Report from a seminar held in London. 16-17 February 2010. Convenor.
- FAO, 2013. In vivo conservation of animal genetic resources. FAO Animal Production and Health Guidelines. No. 14, Rome.
- Sturaro E., 2017. Socio-economic parameters for trends and risks. Report from meeting in Padova 3-4 November 2016. Beograd, 3 May 2017.
- Verrier E., Audiot A., Bertrand C., Chapuis H., Charvolin E., Danchin-Burge C., Danvy S., Gourdine J.L., Gaultier P., Guémené D., Laloë D., Lenoir H., Leroy G., Naves M., Patin S., Sabbagh M., 2015 – Assessing the risk status of livestock breeds: a multi-indicator method applied to 178 French local breeds belonging to ten species. Animal Genetic Resources, Food and Agriculture Organization of the United Nations 57, 105-118.

Proposal of a model for assesing the status risk of breeds in Poland

The purpose of developing the model was to assess the status risk of Polish breeds covered by conservation programs of farm animal genetic resources, **taking into account the specificity of environmental conditions and the impact of anthropogenic factors (no. of farm, av. area).**

Material and methods

The source of information for the study were data from the databases of the National Research Institute of Animal Production (4 selected breeds covered by conservation programs for the of farm animal genetic resources and benefiting from EU and national funds).

Basic information about the size of the population:

Podhale sheep: 9116 mother sheep and 297 rams, N_e = 1050;

Polish red cattle: 2975 cows and 55 bulls, N_e = 216;

Sztumskie horses: a) 1254 mares and 244 stallions (breeding stallions), N_e = 817;

Sokolski horses: a) 1228 mares and 237 stallions (breeding stallions), N_e = 795.

Cakiel podhalański sheep

Polish red cow

Sztumski horse

Sokolski horse

Taking into account the available results of world research, analysis of the implementation of conservation programs in Poland and environmental conditio, was proposed and evaluated a model based on three factors, two main: the number of females (N) and the effective size of the population (Ne) and an additional factor (A):

$$X = \frac{1}{3}\sum_{i=1}^{3} \mathrm{N}i + \mathrm{N_e}i + \Sigma\ 0{,}5\mathrm{A}\ i$$

Objectively measured factors (N, Ne) were defined according degree of danger: "critical ", "endangered-requiring action", "endangered-requiring monitoring", "not at risk", assigning them points, respectively from 0 to 3.

It was assumed that the result:

- ≤1 point means that the breed is in critical condition,
- 1 and ≤2 points means that the breed is at risk and requires protective measures,
- > 2 and ≤3 points - the breed is at risk and requires monitoring;
- > 3 points, not at risk.

6 elements of third factor (A) were scored from 0 to 1 (0; 0.5; 1) due to the subjectivity of the assessment. The weight 0,5 of this factor was used for reducing its impact on the final result and the error of estimation.

Main factors

Given the available results of international research and analysis of the implementation of programs for the protection of farm animal genetic resources in Poland, the authors proposed a model based on three factors.

I Factor – numer of female (N)

was adopted according to the concept used in France by Verrier et al. with amendment to Polish conditions.

Species	Points							
	0		1		2		3	
Horses		≤ 150		1250		10 000		30 000
Cattle		≤ 150		1000		7500		25 000
Sheep & gouts		≤ 150		1000		6000		20 000
Pigs		≤ 75		300		1000		3000
Poultry		≤ 75		200		500		1500

≤1 point - critical, 1 to ≤2 points at risk, requires protective measures, > 2 and ≤3 points - at risk and requires monitoring; > 3 points, not at risk.

factors	Cakiel podhalański sheep	Polish red cow	Sztumski horse	Sokolski horse
No of famele (N)	9116	2975	1254	1228
points	3	2	2	1

II Factor - effective population size (N_e)

The effective population size (N_e) was taken into account, in the method used in Germany, including the correction for random selection, according to Santiago and Caballero (1995): N_e = original N_e x 0.7:

0 points - $N_e \leq 50$ - critical;

1 point - $50 < N_e \leq 200$ - endangered (requires protective measures);

2 points - $200 < N_e \leq 1000$ - endangered (requiring monitoring);

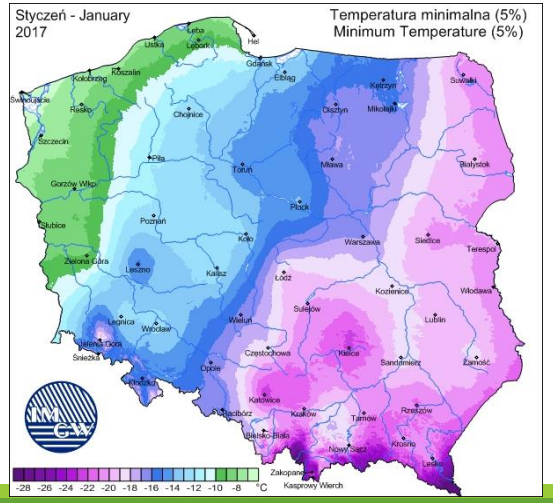
3 points - $N_e > 1000$ – not at risk.

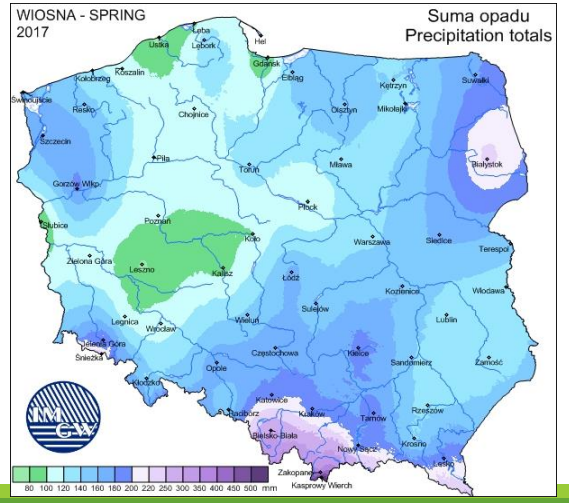
factors	Cakiel podhalański sheep	Polish red cow	Sztumski horse	Sokolski horse
Effective population size (N_e)	1050	216	817	795
points	3	2	2	1

III Factor - additional factors (A)

For III factor, was used 6 additional elements. Their use results from the specificity of breeding conditions in Poland:

A1. geographical concentration. Due to the big territory of Poland, exceeding 300 000 km^2 (large spectrum of environmental conditions), it was necessary to use a factor taking into account the region of occurrence of breeds: 1 point - ≥ 75% of the population is concentrated in the region of origin of the race, 0 point - if only ≤ 25% of the race occurs in the region of origin; 0.5 points, if the concentration is intermediate. In the case where the population is present in a very small number of flocks ≤ 3, regardless of the final result, it was assumed risk of extinction and required protective measures. Geographical concentration: ≥75% of individuals in the breed generation region - 1; > 25% outside the region - 0





(http://old.imgw.pl/klimat/)

A2. **demographic trend** in the last 5 years. This is an important and objective factor of population development. Three variants of scoring were also used: 1 point - upward trend, 0.5 point - stable trend, 0 point - downward trend.

A3 - cultural value of the breeds (documented connection with tradition, region, rite): 1 point - has cultural / historical value, 0.5 points - has low cultural / historical value, 0 points - no cultural / historical value.

A4 - origin test: exist - 1 point; partially - 0.5 points; not exist - 0 points

A5 - crioconservation: exists - 1 point; partially - 0.5 points; not exist - 0 points

A6 - anthropogenic factors - breeding organizations, activity of breeders, financial suport: 1 point - occurs, 0.5 points - partially; 0 points – not exist.

It was assumed regardless of the final result, that:

a. the number of females < than 150 (horses, cattle, sheep, goats) or 75 females (poultry and pigs) or
b. effective population size ≤50 or
c. the numer of herds is ≤3 the breed is endangered and requires conservation measures.

Values of 6 additionals elements (A)

breed	A1	A2	A3	A4	A5	A6	Σ
Cakiel podhalański sheep	1	1	0	1	0,5	1	**4,5**
Polish red cow	0	0,5	0,5	0,5	1	0,5	**5**
Sztumski horse	1	1	0,5	1	0	0	**3,5**
Sokolski horse	1	0,5	0,5	1	0	0	**3**

Values of 3 factors determining the status risk of 4 analysed populations

factors	Cakiel podhalański sheep	Polish red cow	Sztumski horse	Sokolski horse
No of famele (N)	3	2	2	1
Effective population size (N_e)	1	1	2	2
Additional factors (A)	4,5	4,5	3,5	3,0

Results of four tested breeds covered by genetic resource conservation programs

breed	Cakiel podhalański sheep	Polish red cow	Sztumski horse	Sokolski horse
points	2.1	1.4	1.9	1.5
Status risk	requiring monitoring	endangered requiring monitoring	endangered requiring monitoring	endangered requiring monitoring

Points: ≤1 - critical condition; > 1 to ≤2 - endangered breed requiring conservation; >2 to ≤3 - endangered requiring monitoring; > 3 – no risk of extinction

Conclusion

- The use of a model that takes into account additional factors affects the level of threat to breeds
- The introduction of presented solution for assessing the status risk allows differentiation of level of status risk.
- The application of the new formula objectively justifies the need for further use of conservation programs for the analyzed breeds.

Thank you for attention