

# Ecological animal breeding in sustainable agriculture

## An approach to holistic criteria

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### INTRODUCTION

If you read “ecological” animal breeding, you should be aware how it is meant. Häckel has defined “Ecology” as “Science of the interactions between organisms and their dead or living environment” - so every animal breeding would be ecological because it is dealing with organisms and influences their interactions with environment.

As one can learn from the words “Ökologischer Landbau” “Ecological Farming”, “ecological” today is understood as “ecological positive” or “environmental friendly”. That is the way it is used here. Now: Breeding is always a mighty and powerful intervention in evolution of species and its rhythms, so some people may conclude that it can never be ecological positive.

But every kind of human activity, especially agriculture, is an intervention in natural biotops. Nevertheless it is possible to define ecological agriculture and divide it from unsustainable forms of land use.

Indeed, ecological animal breeding is a complex problem with many aspects and so some structure might be helpful to answer the question, which type of animal breeding could be defined as ecological positive, as environmental friendly, as “sustainable”?

### WHICH CRITERIA CAN BE USED FOR ECOLOGICAL EVALUATION OF AN ACTIVITY

To decide whether a type of activity has positive or negative impact to the environment everyone of us

has her or his own thinking model about the interactions between humans and nature, a guideline for what is environmental pollution, a personal paradigm. An Austrian team of scientists has developed a non monetary indicator system for describing “environmental impacts”[1].

They found that all our thinking models can be integrated in four paradigms of environmental protection.

#### *Toxicity*

Chemists and medics are used to ask for “toxic” substances, toxic mostly meant as toxic for (male and grown up) humans.

So we have the first question, is there any toxic release caused by the type of activity I want to analyse?

#### *Natural Equilibrium*

If one studied biology, climatology or maybe agriculture the person is likely to think in “ecosystems” with “natural equilibriums”, correctly defined as “flowing equilibriums”.

So the second question is, does the type of activity influence/disturb natural equilibriums?

#### *Entropy*

Coming from thermodynamics and very modern now in ecological economics is the paradigm of “entropy”: Every closed system wants to turn from

order to chaos. As a result useful energy is transformed into non useful energy, called entropy. The task to society is to use not more energy per time than is coming into the system "earth" in the same time from the sun. You can enlarge this to other resources than (fossil) energy.

Your question will be the third one, does the system use more energy/resources than renewed per time?

### *Conviviality*

Not common in natural science, more familiar in ethics or philosophy is the thinking model of "conviviality". Convivere means "living together" and this paradigm assumes that all living beings are part of nature, there is nothing like "humans and the environment around them". Humans are part of nature as well as any other species and they have no more valuable right to live than those. On the contrary humans have the obligation to respect and protect other species and so respect and protect the world they themselves are part of.

Assuming this, your question will be the fourth one: Does the activity (more than necessary) affect the living conditions of other living beings, of other than human species? Where can we reduce this?

Every single one of the four paradigms has its own structure of arguments, its own scientific and political tradition and public awareness. Nevertheless they often lead to the same action. But sometimes a solution optimal according to one paradigm is intolerable according to another. Which paradigm should be used for animal breeding? Very simple and complicated at the same time: The demand on a type of activity that wants to be accepted as ecological by different people with different paradigms is to fulfil them all. Evaluating animal breeding under the four paradigms will also prevent actions that only shift damages from one paradigm to another. What is won for the environment if you pay less toxic releases by the use of more fossil energy?

Until now we have 4 questions to ensure that our type of activity does not harm the environment, that it "maintains the potential of the biosphere to meet the needs and aspirations of future generations". More or less all the 4 points are "Do not ...!" instructions.

Furthermore we want the type of activity and its products "to yield the greatest sustainable benefit to

meet the needs of the present generations". We want it to be useful for a satisfying and good life. To evaluate this point I suggest to consult the three action-principles of "Caring Economy", because this feminist concept of sustainable development includes productive work as well as the large and mostly forgotten field of (social) reproductive work, and animal breeding is a big productive business and at the same time very important for feeding / reproduction of human beings. The three action-principles of Caring Economy were developed in opposite to those of economy (repairing, competition, orientation by monetary profit) according to those you use to care for a happy family and its household [2]. They are "Please do things this way ...!" instructions: If all people act along them, the result would be sustainable development.

The 3 principles are:

### CARING

"Vorsorge", "Caring" includes the precautionary principle to avoid damages. But it is more because over and above that it means to take loving care of someone/something. It needs carefulness, error-friendliness as defined by Christine von Weizsäcker [3], structures that keep mistakes in tolerable limits, and slowness for a remaining chance to correct errors. It also means circumspection to associated effects, so only assessable actions are allowed. Of course "circumspection to associated effects" should happen with the intention of "environmental protection". So one could put the first 4 questions under this point "Caring". But as I said: Caring is much more than avoiding damages, and the natural scientist in me finds it very helpful to put those "damages" in concrete terms using the 4 paradigms of environmental protection and give them single points.

Our fifth question is now, is the activity we are evaluating in harmony with the action-principle "caring"? Does it act responsible? Is it careful, error-friendly, slow enough to correct errors? Does it include circumspection to associated effects and respect for grown and created systems? Are its interventions assessable (in the dimensions of space and time) to allow circumspection?

### COOPERATION

The next action-principle "Cooperation" is necessary because all beings share ONE world. It needs commu-

nication, solidarity and agreements. So the sixth question is, is the activity in harmony with the action-principle "Cooperation"? Do all involved people work together as a team? Do the structures and general conditions within promote solidarity?

#### ORIENTATION BY ESSENTIALS OF GOOD! LIFE

"Orientation by Essentials of good! life" means to ask: "What do we need for a good and satisfying life?" It pays attention to material needs (food, clothes, habitat, mostly coming from productive work) and as well to needs for services (clothes must be washed, food has to be bought and cooked, flat should be cleaned now and then, normally that belongs to housework and is done mainly by women) and to emotional needs (we need someone who listens, someone who really cares if we are sad, someone to educate children and someone who gives us the feeling to be at home and loved even if we are old and not competitive any more, those emotional services are given in the private sector as well as in the context of "productive" work). Again women are specially trained and used to do this, all social reproductive work is mostly unpaid and the job of females.

Asking for the real demands of human beings leads us to the seventh question, is the activity guided by the "Essentials of good! life"? Are its products useful for a satisfying life? Does it or its side-effects avoid anyone from a good, satisfying life?

Maybe we come to the conclusion that we really do not need a car that is totally grown on the field, because we need our fields to produce food and because the real demand of humans is not mobility but availability of goods and services.

Because a healthy environment is one main point we all need, because "nature" is essential for life to go on, the 4 questions of environmental protection also belong to this point, but as I pointed out before, I prefer them to be single points. And orientation by the essentials of good life is more than "only" paying attention to a healthy nature.

#### HOW TO EVALUATE ANIMAL BREEDING ACCORDING TO THOSE CRITERIA?

We have 7 nice questions now to check an activity. But where is the connection to animal breeding? In

an economic sense, animal breeding is nothing else but "producing" the "product" farm animal. Within an ecological activity the product as well as the way of production must meet the demands of the 4 paradigms and the 3 action-principles. The product, the farm animal, should fit in sustainable agriculture. Whether the type of agriculture is sustainable, has to be examined by the 7 questions above [4]. It is influenced and formed by the breeding goals, they are the first field of action, that I have defined as "Breeding for Sustainable Agriculture [5]".

Also the way of production, the daily breeding work, should be able to sustain, should satisfy the seven check-questions. So the second field of action was defined as "Sustainable Breeding [5]".

#### BREEDING FOR SUSTAINABLE AGRICULTURE

Some breeding goals for "Eco" animals are listed in the following Table 1.

The most important toxic release out of agriculture are pesticides. So we need animals that can grow by the kind and amount of fodder that can be produced without pesticides. They should be as healthy as possible because every veterinary drug applied to them can be found in their droppings again. Via the manure e.g. antibiotics come into the soil and may disturb the soil-microorganisms onerous [6].

Animals should not need fodder that has to be brought into the local cycle from other regions. Their "output", products as well as the dung, should be suitable for the local cycle again.

Use of fossil energy should be reduced as far as ever possible: If the animals are satisfied with regional (different!) conditions as climate, terrain, nutritional level, water supply for stock, management, specific diseases ... we do not need energy input to nivellate those conditions to a perfect airconditioned stable.

By the first 3 points we made it is clear, that there is nothing like "one best breed for whole the world", only different breeds can fulfil the demands of different regions and allow for meat or milk or animal power production even in very difficult areas of our planet.

The paradigm conviviality again asks for healthy animals: Be aware that health in the WHO definition means wellbeing and is more than only absence of illness. A bad example is today's turkeys bred for large

Table 1. Some breeding goals for eco-animals according to the 4 paradigms and 3 action-principles.

Toxic Release	<ul style="list-style-type: none"> <li>- Frugality (no need for fodder that must be produced using pesticides)</li> <li>- Health (no need for drug application)</li> </ul>
Natural Equilibrium in Ecosystems	<ul style="list-style-type: none"> <li>- Suitability for the specific (different!) basic fodders</li> <li>- 'Output' suitable for the local cycle</li> </ul>
Entropy / Resources	<ul style="list-style-type: none"> <li>- Eco-Efficiency (high output per unit input)</li> <li>- Frugality / Suitability for local (different!) conditions (no need for use of fossil energy)</li> </ul>
Conviviality	<ul style="list-style-type: none"> <li>- Health according to the WHO definition (genetically determined performance limited in a way that allows for well-being)</li> </ul>
Caring (circumspection to associated effects)	<ul style="list-style-type: none"> <li>- Producing the performance without 'Promoters'</li> <li>- without enzymes produced using gene-technology (no activities with non assessable depth of intervention)</li> </ul>
Cooperation (communication)	<ul style="list-style-type: none"> <li>- Animal with communicatable qualities</li> </ul>
Orientation by Essentials of good! life	<ul style="list-style-type: none"> <li>- Highly satisfying taste of the whole animal, e. g. pig (ecological and social tolerable = limited quantity)</li> </ul>

breasts, 24 hours a day they have to carry this heavy backpack in front of them. Even in the best keeping conditions they are not able to live their species-specific behaviour, they just cannot enter their beloved sleeping perches when the night comes.

Pigs with muscles growing so fast that their bones cannot keep up will never be well even in the best outdoor-keeping with high freedom of movement.

If you circumspect to associated effects (a subpoint of Caring), you will not find growth-promoters suitable. Because of its great depth of intervention gene technology is not assessable and so enzymes produced this way should not be used [7]. Furthermore examples from real life show that the use of phosphatase only leads to relatively more pigs per

hectare. That means the same level of phosphate per hectare as before and increase of all other (negative) environmental impacts of the specific farm [8].

If you want to communicate with farmers as well as with consumers, and without communication there is no cooperation, the special qualities of your bred animal should be easily identified. Therefore the concept of a locally well known breed seems more efficient than products from hybrid programs that have to be tested by special institutes every year. An eye-catching outfit, e.g. specific colour or pattern, may particularly facilitate the marketing of your specific product.

Orientation by the essentials of good life leads us to the demand of less food coming from animals and more vegetarian meals. But even more the quality of all products out of the animal is important: Not only the pigs meat should have a highly satisfying taste, the fat quality is important as well. High quality enables us to enjoy the rarer quantity of slaughtered pigs as much as possible.

A special demand by checking a product for being ecological is to examine the whole product life cycle from 'extraction of raw materials' over 'production of intermediates' and 'production' itself to 'use' and finally 'recycling or waste disposal' [9]. Maybe you get environmental benefits by increasing the milk yield and so decreasing methane emissions per litre milk. But if you count the special fodder you need to feed now, all the fossil energy that goes into produce of chemical fertilizers, produce and pressing of pellets, into the transports between the different steps of the products life cycle and into the airconditioned stable that is needed for your high-yield cow, you may find that the associated CO<sub>2</sub> emissions and their effect to the depletion of the ozone layer are several times the amount of what you have won by decrease of methene emission.

## SUSTAINABLE BREEDING

The second field of action has been defined as "Sustainable Breeding" and in Table 2 some examples are listed for breeding methods according to the seven questions mentioned above.

Here we find a speciality of breeding, breeding means selection. Selection needs diversity. So biodiversity of farm animals is an unrenounceable prerequisite for animal breeding that is not fulfilled

today. Many breeds are endangered, a few others dominate daily animal breeding, using only few single animals (e.g. prominent bulls) as parents to contribute genes to future generations. If society really changes to sustainability and to sustainable agriculture, different breeds will be needed again (see Table 1) and there will be no contradiction in terms of suitable breeding goals and biodiversity (= diversity of daily living beings) for enabling the sustain of breeding.

Until that day we have the obligation to conserve breedings very own resource, the diversity of our "heritage breeds" as well as the diversity within breeds [10].

A lower selection-intensity, a higher generation-interval, family size variation not much higher than by random (intrafamilial selection) help to fulfil this

**Table 2. Sustainable breeding (systems / methods). Examples according to the 4 paradigms and 3 action-principles.**

Toxic Release	- No use of hormones to start or synchronize estrus e. g. of sows
Natural Equilibrium in Ecosystems	- Caution against incrossing of breeds coming from regions that have another (higher) input-level
Entropy / Resources	- Basic prerequisite of every selection is biodiversity! ⇒ continuous use of many different breeds
Conviviality	- Respect for the rhythms of females → no E.T. - Tolerance towards other (good in another way) breeds
Caring (circumspection to associated effects)	- Selection-intensity ↓, Generation-interval ↑ - evenly distributed use of available parents ⇒ Chance to correct negative breeding-'gains'
Cooperation (communication)	- Transmission of transparent data/ requirements between breeders and users and society - Estimation of breeding values in different small farms?
Orientation by Essentials of good! life	- How much (time-)resources into animal-breeding? - Respect for beauty-sense also as early-warning-system Diversity of farm animals means emotional richness.

demand and to avoid genetic drift and loss of genes that might be very useful for sustainable farming of tomorrow. Over and above this such "slow" breeding gives us the chance for caring, the chance to correct errors: BLAD in Holstein-Friesian cattle or the Hampshire-factor in some pig-sire lines are warning examples of what may happen if you allow single animals to make too many gene contributions.

Cooperation between breeders, users (farmers and consumers) and the rest of the society needs communication. Farmers should give a feed back about the suitability of the animals for their purposes and tell their demands. Breeders must give data and information about their animals performances and especially about contradictions: If consumers learn that it is not possible to breed a healthy pig without fat they can change their preferences. But therefore it is necessary that animal breeders are able to communicate in normal understandable language, and that they themselves take serious the objections of people that even do not know why heritability is abbreviated  $h^2$ .

Different farms with different conditions and input levels might cause problems for the estimation of breeding values. Farmers should be aware that animals that are best for one system do not have to be best for another. So breeding values might have to include information about the input level they were estimated for.

That leads us to the next and last checkpoint: How much time, how much computer and human work resources should be investigated in animal breeding? As hard as it is for animal breeders: Maybe other work is more important for a good life than calculating new breeding values every 14 days (for different input levels). Or maybe we need an intermediate technology for selection decisions, a possibility to "let the farm judge". That would ensure diversity simultaneously.

Biodiversity of farm animals is part of emotional richness of humans and so it helps to meet emotional needs. There is even the theory that humans preference for diversity is an early warning system: A diverse environment is a good guarantee for survive of living beings including humans as well.

## SUMMARY AND CONCLUSIONS

A summary of the check-system for ecological animal breeding is shown in Table 3.

Table 3. Is my animal breeding ecological? "Seven-criteria-test in two fields of action".

2 Fields of action→	Breeding for Sustainable Agriculture (Breeding goals)	Sustainable Breeding (Breeding methods)
↓ 7 Criteria		
↓ Does my animal breeding ...?		
1 avoid Toxic Release ?		
2 protect Equilibriums ?		
3 watch Entropy/ conserve Resources ?		
4 respect Conviviality ?		
5 help Caring ?		
6 promote Cooperation ?		
7 orient itself by Essentials of good life ?		

This system may enable you to analyse Your whole breeding by asking the seven questions for the breeding goals as well as for the breeding methods. Are the breeding goals good for an agriculture that avoids toxic release and conserves resources? ... Do the breeding methods respect conviviality? ...

If you find a negative effect and therefore you want to initiate reforms, check in all fields of the table 3 whether there is at least one positive effect and no negative ones. Only such reforms are really ecological positive and long term suitable.

Finally only an animal breeding with positive effects in all fields is useful for sustainability. It will be an interesting but worthwhile challenge for animal breeders to reach this destination.

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