

Passing on the fire - To further inspire people to contribute to the management of animal genetic resources

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Summary

In light of the upcoming first International Technical Conference on Animal Genetic Resources (September 2007), experts have been interviewed to tell about their experiences in the management of animal genetic resources over the past fifty years. They identified three milestones in the history of Animal Genetic Resources (AnGR) management: the foundation of the Rare Breeds Survival Trust (1973), the FAO/UNEP 1980 Technical Consultation on AnGR, and the signing of the Convention on Biological Diversity (1992). Conservation of AnGR started at grassroot level and eventually led to policies at governmental level. The passion of civil society organizations remains vital to conserve local livestock breeds. Technical and financial support will be crucial for the future of AnGR conservation. The next milestone will be a Global Plan of Action that is expected as one outcome of the International Technical Conference.

Résumé

En vue de la prochaine Conférence Technique Internationale sur les Ressources Génétiques Animales qui aura lieu en septembre 2007, on a interrogé une série d'experts pour connaître leurs expériences dans la gestion des ressources génétiques animales au cours des derniers 50 ans. Trois points principaux ont été identifiés tout au long de l'histoire de la gestion des Ressources Génétiques Animales (AnGR):

1. la création en 1973 du *Rare Breeds Survival Trust*;
2. la Consultation Technique sur AnGR organisée par la FAO/UNEP en 1980; et
3. la signature de la Convention pour la Biodiversité de 1992.

La conservation de AnGR commence à un niveau de base et éventuellement conduit à des politiques au niveau gouvernemental. Les supports technique et financier seront d'importance cruciales

pour le futur de la conservation de AnGR. Le prochain défi sera la Plan Mondial d'Action qui on espère sera un des résultats à la fin de la Conférence Technique Internationale.

Resumen

En vistas de la próxima Conferencia Técnica Internacional sobre Recursos Zoogenéticos que tendrá lugar en septiembre 2007, se han entrevistado una serie de expertos para conocer sus experiencias en la gestión de los recursos zoogenéticos en los últimos cincuenta años. Han identificado tres puntos principales a lo largo de la historia de la gestión de los Recursos Zoogenéticos (AnGR):

1. la creación en 1973 de *Rare Breeds Survival Trust*;
2. la Consulta Técnica sobre AnGR de la FAO/UNEP en 1980; y
3. la firma de la Convención sobre la Diversidad Biológica del 1992.

La conservación de AnGR empieza a nivel de base y eventualmente conduce a políticas a nivel gubernamental. Los soportes técnico y financiero serán cruciales para el futuro en la conservación de AnGR. El próximo reto será el Plan Mundial de Acción que se espera sea uno de los resultados de la Conferencia Técnica Internacional.

Keywords: *Animal genetic resources for food and agriculture, NGO, Research, Government, FAO, State of the World, Interlaken.*

Introduction

Why have animal genetic resources for food and agriculture (AnGR) become more prominent on the international agenda over the past fifty years? And what moved people to conserve and promote the sustainable use of the incredible diversity of cattle,

pigs, sheep, goats, poultry, and the many other existing livestock species?

This paper gives some answers to these two questions. The occasion to look into these questions is the forthcoming International Technical Conference on Animal Genetic Resources, which will be held from 1 till 7 September 2007 in Interlaken, Switzerland. As it is the first such Technical Conference, and is expected to adopt a Global Plan of Action for Animal Genetic Resources, it represents an important milestone in the history of AnGR management. Hence, it is opportune to look back into the past and discover what milestones have preceded the upcoming event, and to show what the motivation is of people who have been or still are wholeheartedly involved in the management of AnGR.

The paper is based on a series of interviews with AnGR experts from all over the world. The names of many of our informants are mentioned, however, innumerable individuals and institutions or constituencies have contributed to the AnGR programme. The lack of reference to such key partners in the text does not imply the non-recognition of their inputs.

The structure follows the three milestones they identified over the past half-century: the first milestone was laid in 1973, when the first NGO - the Rare Breeds Survival Trust (RBST) - was founded in the United Kingdom. The FAO/UNEP 1980 Technical Consultation on AnGR that took place in Rome was the second. Finally, the signing of the Convention on Biological Diversity in 1992 represents the third milestone. Building upon this structure, the paper recounts the invaluable experiences of experts to show their never-ending passion - the same passion that we as human kind will need in the coming years to sustainably use and conserve Animal Genetic Resources for food and agriculture in all regions of the world.

The first milestone: the start of conservation at grassroot level

"It has been my perception that interest in conserving farm animal genetic resources began almost simultaneously and independently in many different countries and at many different levels. Most of the beginnings occurred during the 1960s", says Roy Crawford (Canada). "Yet the first milestone was laid in 1973, when

Lawrence Alderson started the Rare Breeds Survival Trust in the UK".

Arthur da Silva Mariante (Brazil), later involved in setting up Rare Breeds International that took the work of the RBST to an international level, gives the Trust the same credit: *"It became the first NGO to fully commit itself to the conservation of local breeds".*

Three decades earlier, in the 1940s, the picture looked completely different: 'conservation' was not on the agenda. It was a time of fast changes in the livestock sector. In many developed countries, the levels of production were raised in response to the rapid rise in demand for animal products. Animals were selected that could provide meat and dairy products in the shortest time possible, and efficient breeding programmes were applied to use these animals on a large scale.

An important factor in these breeding programmes was the availability of new breeding techniques. The most important one was developed by the Russians in 1899: reproduction via Artificial Insemination (AI). This revolutionized the use of livestock, not only in the developed world, but also in the developing countries. As mobility had been given an enormous boost - people could now travel in no-time to other parts of the world, by train, boat or airplane - this meant that also animals or their genetic material, together with related production technologies, could now easily be moved around the globe.

In the same period, just after the Second World War, the FAO was founded (FAO, 1945). It became directly involved in this global move. As the mandate of FAO was *"to improve agricultural productivity, better the lives of rural people and contribute to the growth of the world economy"*, the new knowledge on farm animal breeding was soon transferred to the rest of the world. The exportation of temperate breeds into tropical and subtropical areas, which had already started a few decades earlier, was continued.

"Few people realized that these exotic breeds could be harmful for local breeds", tells John Hodges (United Kingdom). Yet he adds: *"Some people were aware of the problem. Government officials who came back from the colonial states had witnessed the problems of introducing exotic breeds into tropical areas"*. Despite the awareness, however, governments and donors in developed countries would not refrain from exporting breeds with high yield potential, in their well-meaning attempts to improve production also in developing countries - yet without always

providing the necessary expertise on how to manage these breeds.

Attention for this matter was also raised at the FAO. In 1946, the FAO convened a meeting of a Standing Advisory Committee on Agriculture. One of the topics for this meeting was 'Animal Genetic Resources'. Ralph Philips (United States of America) was invited to the Committee: *"One of my contributions to its work was the drafting of a recommendation – which the Committee adopted – that the FAO should undertake work on the cataloguing of animal genetic stocks"* (Philips, 1981). Although FAO created an international study group in 1965 to issue recommendations on the evaluation, utilization and conservation of AnGR (FAO, 1967), cataloguing would remain the primary activity for many years.

On an individual basis, the cataloguing had already been started by Ian Mason¹ in the 1940s. His work was a significant step in the evaluation of the existing livestock breeds, although compiling catalogues of breeds was just a first step in the conservation of breeds. As the process of introducing 'improver' animals continued, many indigenous breeds in and outside Europe became rare. But things changed in the 1960s.

"It began very naively in 1964 when I recognized the rapidly advancing erosion of poultry genetic resources, I felt that something had to be done to stem the tide, and presumed that I was the only one who cared about the situation", says Roy Crawford. Crawford decided to take care of rare poultry breeds at the university and even at home. *"His situation was typical for the sporadic activities that came about elsewhere"*², says Imre Bodó (Hungary). Interestingly, one of these early initiatives would develop into a major step forward in the management of AnGR.

"In the early 1960s, a small group of people belonging to the Zoological Society of London realized that many native breeds were endangered, and they decided to keep small herds in London Zoo in order to preserve them," tells Lawrence Alderson (United Kingdom), *"The first farm animals that were saved were cattle and sheep; other species like horses, goats and pigs soon followed"*.

Alderson himself joined this London-based group of conservationists in 1969. He had spent his youth on a dairy farm, and was now a young business consultant with a special interest in native breeds. He realized that the best way to promote the conservation of AnGR in the UK was by creating a separate organisation. In 1973, Alderson's idea resulted in the foundation of RBST – most probably the first NGO in the world concerned with the conservation of endangered breeds.

The creation of RBST was the first milestone in the history of AnGR management. Roy Crawford believes it is no coincidence that it was set up by a grassroot organisation. *"Conservation work requires passion – grassroots have that in abundance"*, says Crawford, *"That is why grassroots started the movement."*

Grassroot organisations, like RBST, had already seen the need for conservation in the 1960s. It would take almost two decades before this consciousness would move up – from the bottom – to the agenda of governments. RBST was founded in the middle of this process and provided the first input to the government from the level of NGOs.

The second milestone: FAO adopts 'conservation'

"This was the real beginning of the AnGR movement!" says Stuart Barker (Australia), referring to the Technical Consultation of 1980 held in Rome. Kalle Maijala (Finland) and Louis Ollivier (France) agree: *"The Technical Consultation in 1980 was most important."*

It was in the 1970s that the concept of 'conservation' entered the picture at a governmental level. This process was generally slow. Grassroot organisations had to convince both the general public and the scientific community that more public and financial support was needed. *"It took a long time to convince agricultural advisors as they still thought that replacing breeds was good,"* tells Hans-Peter Grunenfelder, founder of the Swiss NGO Pro Specie Rara and the European umbrella organization SAVE Foundation. With the support they gained, *"NGOs did a lot to convince governments about the need for conservation"*.

At the FAO, the process was equally slow. *"It was Ian Mason who brought the interest in indigenous*

¹ Ian Mason (14 February 1914 - 21 May 2007) belonged to the first people involved in AnGR management. He has worked his entire life on the documentation and conservation of breeds from all over the world. His most famous work *A World Dictionary of Livestock Breeds, Types and Varieties* was first published in 1951 and has been an important information source ever since (the fifth edition appeared in 2002).

² Changes could also be observed at a governmental level. In 1963, the governments of France and Hungary were the first to provide subsidies for the conservation of local breeds.

breeds, and thus in conservation", says John Hogdes. "Mason came as Animal Breeding Officer to the FAO in 1972. He had already started the documentation of breeds in the 1940s, and then carried on making his filing cabinet at the FAO, collecting breed data from Africa, Asia and Latin America". Referring to the same period, Edward Rege (Kenya) notes: "Although the question 'Is new germplasm successful in a traditional environment?' had arisen, still no action was undertaken in the form of new policies".

In 1974, in conjunction with the United Nations Environment Programme (UNEP) that was born at the 1972 Stockholm Conference, FAO launched the project "Conservation of animal genetic resources". Over a period of six years, extensive surveys were carried out to describe the status of local breeds in a wide range of world regions, while a few studies were initiated with the aim to develop methodologies for conservation and management.

In the meantime, an important conference was organised in 1974 by the International Committee for World Congresses on Genetics Applied to Livestock Production. It was the first World Congress organised by the Committee and "the first opportunity for scientists to discuss the genetics of farm animal breeding and breed conservation at an international level", explains Stuart Barker. Genetics was a new tool in breeding programmes. "At that time", says David Steane (United Kingdom), "we knew how to improve the traits of interest in breeding, but no-one knew which genes and – more importantly – which gene-combinations to save for the future".

At the end of the first FAO/UNEP cooperation, a joint Technical Consultation on Animal Genetic Resources, Conservation and Management (1980) was organised. The Consultation took place in Rome and represented a turning point in AnGR management. The alarming results from the surveys of endangered breeds, together with the growing understanding of genetics and the recent fruitful efforts at different levels in society to conserve local breeds, finally provided the impulse to convince governments of the need to conserve AnGR. Poultry- expert Roy Crawford: "The effect of the 1980 Consultation was huge. People were first thinking alone. This conference was a landmark, as it provided an opportunity to create international liaisons".

The meeting in 1980 embodied the second milestone in AnGR history. Lawrence Alderson: "The Consultation was the biggest milestone in terms of going forward. It drew everyone together; it created friendships between NGOs and governments."

The third milestone: 'sustainable use of biodiversity'

"We struggled for the inclusion of agrobiodiversity in the Convention on Biological Diversity (CBD) but we got help from the powerful "Business Council for Sustainable Development"³", tells Hans-Peter Grunenfelder. The CBD was signed in 1992 by 150 government leaders at the Rio Earth Summit.

The recommendations of the 1980 Technical Consultation (FAO, 1981) finally provided a response at policy level to the long-standing issue of displacing native breeds and crossbreeding them with a few highly-selected breeds. Following the recommendations, a Joint FAO/UNEP Project for Conservation and Management of Animal Genetic Resources was set up. Coordinated by John Hodges at FAO from 1982 till 1990, the project laid the foundations for a worldwide infrastructure for AnGR conservation (Hodges, 2002). Although the project was largely supported by UNEP, "funding was limited", says Hodges. Practical guidance came from a Panel of Experts from UNEP and FAO who gave technical advice about a new approach to the global management of AnGR.

Major developments in AnGR conservation were published in FAO's Animal Production and Health papers. "These papers were the 'bible' for us in Brazil", says Arthur Mariante, "They are still used as a reference by our students nowadays". Information on conservation projects and studies around the globe were published (and are still being published) in the FAO Animal Genetic Resources Information Bulletin (AGRI) since 1983. After John Hodges, Jean Boyazoglu (Greece), Daniel Chupin (France), Salah Galal (Egypt) and Ricardo Cardellino (Uruguay) served as its editors, and AGRI continues to be the only journal of its kind.

In Europe, conservation activities were boosted in 1980 by the European Association for Animal Production (EAAP). EAAP set up a European Working Group on Animal Genetic Resources (WG-AGR) which initiated surveys of European

³ The Business Council for Sustainable Development (BCSD) was founded in 1991 by the Swiss industrialist Stephan Schmidheiny, and is now called the World Business Council for Sustainable Development (WBCSD).

breeds and populations in 1982. Five years later, the survey data could be entered in a novel electronic databank that was created by Detlef Simon. In close cooperation with FAO, the Hannover databank began storing world data on AnGR in 1988, until their transfer to FAO in 1991. This transfer provided the starting point for the FAO database for AnGR, the backbone of the Domestic Animal Diversity Information System or DAD-IS (now in its third version). Consequently, the Hannover databank was renamed EAAP Animal Genetic Data Bank and provided the first information on AnGR at regional level.

Another emerging NGO partner of FAO – at a global level – was Rare Breeds International (RBI), established in 1991. *“Lawrence Alderson gave the initial push on behalf of the RBST. Other people, including John Hodges, Imre Bodó, Arthur Mariante and myself, continued the work”*, recounts Roy Crawford. The funding and facilities of RBI were meagre: *“The secretariat was at my lunch table in Canada”*. Nevertheless, the organisation would become a common voice for the increasing number of national and regional bodies interested in conserving rare livestock breeds. Keith Ramsay (South Africa): *“While FAO had a network at a governmental level, RBI was important for creating liaisons at grassroot level”*.

While the international network of governments and NGOs kept on growing, the concept of ‘sustainability’ (Brundlandt, 1987) was getting a firmer grip on society. As a result, the UN planned the Conference on Environment and Development (UNCED) or ‘Rio Earth Summit’ in 1992 to incorporate this concept in global environmental programmes. In line with the aim of Agenda 21 – a global partnership for sustainable development – three conventions were adopted soon after the Rio Earth Summit. One of them was the Convention on Biological Diversity (CBD).

The impact of the CBD was tremendous. On the one hand, it was a large leap forward for the conservation and sustainable use of natural resources in general. On the other, however, the Convention was a disappointment for the AnGR movement, as it lacked a specific framework for AnGR conservation. This might seem detrimental; yet the consequence was surprisingly positive. Lawrence Alderson compares it with the effect of the disease outbreaks that occurred later in the 1990s and at the beginning of the 21st century: *“The CBD had the same impact as disease epidemics like BSE and food-and-mouth disease. The fear of loosing breeds served as a powerful trigger for people to react.”*

The CBD was thus the third milestone in the global evolution of AnGR management.

Passing on the fire – time for action

David Steane: *“Perhaps the biggest challenge is now to raise awareness in order to get funds”*. He adds: *“I doubt if nations really can keep all breeds but we do need to maintain the overall genetic diversity”*.

“It is the livestock keepers who will always be the main actors in the conservation and sustainable use of all our animal genetic resources – without a diversity of livestock keepers, it will not be possible to maintain livestock diversity. Their needs have to be recognized by policy makers, researchers, and even consumers” says Ilse Köhler-Rollefson of the League for Pastoral Peoples and Endogenous Livestock Development.

In 1990, the FAO Council recommended the preparation of a comprehensive programme for the sustainable management of animal genetic resources at the global level. In the years following the signing of the CBD the global infrastructure was extended further by FAO, at both national and regional levels. In an FAO Expert Consultation on Management of Global Animal Genetic Resources in 1992, this programme took shape. Supported by the Deputy Director General Philippe Mahler (France) and the Division Director Patrick Cunningham (Ireland), Keith Hammond played a key role in initiating the Global Strategy for the Management of Animal Genetic Resources in 1993, with the aim of supporting countries in developing and implementing national management strategies for AnGR. In 1995, the FAO Commission on Plant Genetic Resources for Food and Agriculture widened its mandate to include also AnGR and became the Commission on Genetic Resources for Food and Agriculture (CGRFA). It established an Intergovernmental Technical Working Group on Animal Genetic Resources in 1997. FAO thus further established its role as *the* intergovernmental technical secretariat for food and agriculture.

Following efforts of the CGRFA, AnGR experts and civil society, the CBD supported the further development of the Global Strategy in 1996⁴ and

⁴Decision III/11 www.biodiv.org/decisions/default.aspx?dec=III/11

⁵Decision V/5 www.biodiv.org/decisions/default.aspx?dec=V/5

established a work programme on agricultural biodiversity in 2000⁵.

The first Regional Focal Point (RFP) for the management of AnGR was set up in Asia with Japanese funding, and managed by David Steane and his Asian colleagues. After six years, in 1999, this pioneering project was forced to end as funds were no longer available. Another Sub-regional Focal Point was established for the SADC region in South Africa but it, too, did not endure after project funds dried up. In contrast, the intensive collaboration of FAO and EAAP, with public support at hand, led to the establishment of a vast network of National Focal Points (NFP) in European countries, until a European RFP was launched in 2000. This regional platform, managed by Dominique Planchenault in Paris, is the first example of a RFP supported by the region itself. Unfortunately, very few RFPs have so far emerged elsewhere in the world, mainly due to the lack of the necessary regional support.

The participation of NGOs and research organisations in AnGR management continued to increase during the 1990s. The EAAP WG-AGR still provided valuable scientific input during FAO consultations. Other research organisations, i.e. the International Livestock Research Institute or the International Society for Animal Genetics, NARS and new national and international NGOs also joined the AnGR movement. FAO's work improved considerably: *"Various international NGOs continued to contribute (...) and a small number were given observer status at the intergovernmental sessions of FAO governing bodies⁶, the CGRFA and its Intergovernmental Technical Working Group on Animal Genetic Resources"*, says Keith Hammond (Australia). Furthermore: *"A larger number of international NGOs supported the development of FAO's work program by contributing to the negotiation of AnGR issues at sessions of the Conference of Parties to the CBD"*. Moreover, as national governments and regional bodies became more aware of the state of AnGR, research programmes saw a slow increase in available funds and rare breeds got more support.

Meanwhile, the cataloguing of breeds by FAO was still going on and resulted in the first World Watch List for Domestic Animal Diversity in 1993. The FAO database and information system DAD-IS (1996) became the primary tool to exchange breed data and know-how on AnGR management. In addition to the collection of breed data, FAO initiated the first global assessment of AnGR. Countries were invited in 2001 to prepare their Country Reports on the status and trends of AnGR, and of the state of institutional and technological

capacities to manage these resources. In 2002, the CBD decided to support this ambitious undertaking⁷.

Now, fifteen years after the Rio Earth Summit, we have a comprehensive overview of *The State of the World's Animal Genetic Resources for Food and Agriculture* (SoW). This report builds on Country Reports from 169 countries – the fruit of many national governments and stakeholders – and the work of civil society and research institutions. Again, collaboration with an NGO, the World Association for Animal Production and its then Secretary-General Jean Boyazoglu, was essential for FAO in the SoW preparation process. At FAO, Keith Hammond played a key role in making the issues known worldwide, and Ricardo Cardellino and Pal Hajas were pivotal in persuading governments to develop Country Reports. The SoW has been adopted in June 2007 by the CGRFA and will be presented in September this year during the Technical Conference. We do not know everything, but the message of the SoW seems clear: diversity means resilience – we should promote it!

One of the expected outcomes of the September Conference will be a *Global Plan of Action for Animal Genetic Resources*. Whatever this plan will look like, it is clear that finding appropriate support will be crucial. Raising public awareness, therefore, remains a key priority. Another priority is to further develop infrastructures and pass on skills for AnGR management. Keith Ramsay: *"We should create more regional focal points and improve the international communication through FAO forums"*. Creative solutions are also required to promote and conserve local breeds. *"Developing value-added products is a good way to draw attention to the uniqueness of local breeds"*, says Ramsay. The colourful hides of N'guni cattle in South-Africa and the camel milk ice cream of India are fine examples of such products. Apart from these two priorities, many other issues will have to be addressed to agree on a meaningful and executable *Global Plan of Action*.

We have learned that the first passionate efforts to use and conserve AnGR in a sustainable way have arisen at the grassroots' level – by people who depend on them in their daily lives, or by people who simply care about them. Ilse Köhler-Rollefson *"Many important breeds are conserved against the odds by people who are poor and marginalized, but who have*

⁶The FAO Commission on Agriculture (COAG) and the FAO Council.

⁷Decision VI/5 www.biodiv.org/decisions/default.aspx?dec=VI/5

*a close cultural and emotional attachment to their animals.” Roy Crawford: “It would help if the grassroots could be more actively involved in governmental programs – to provide the spark and fire the passion”. The most important matter now is to create a broader movement, and an enabling and supportive policy framework for AnGR management. “We need joint forces of the government, the NGO and the university side to keep AnGR”, says Hans-Peter Grunenfelder, “Joining forces we will succeed!”. Indeed, we must make sure that the fire is passed on, till we reach the next milestone – the Technical Conference, together with a *Global Plan of Action* – and the many milestones that will follow.*

The fire is crucial for AnGR. For natural disasters it is easy to show the need for immediate action; for protecting agricultural plant diversity it is already more difficult. For farm animals it is even harder to prove the urgent need for conservation. It requires creativity to further catch the public eye and conserve the indispensable diversity of AnGR. Kalle Maijala: *“It is not easy for most people to understand, but I hope, that positive development continues gradually.”*

Crawford concludes: *“I caught ‘the fire’ many decades ago, and have devoted my professional and retirement life to tending the blaze. The fire does NOT go out it seems!”*

Before ending this paper, the authors would like to state that the fire not only exists in the hearts of the experts from grassroots, research or government level we have interviewed. During the past 12 000 years, livestock keepers worldwide had the most important role in the history of animal production. They have been and continue to be the people responsible for the evolution, improvement and safeguarding of the rich diversity of livestock breeds we have today, for all the different production systems and intensity levels. Therefore, we should learn from these very livestock breeders and keepers how to use in sustainable way and conserve our AnGR, and carry the fire together with them.

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List of References

- Brundlandt, G. (Ed.).** 1987. Our Common Future: The World Commission on Environment and Development; <http://ringofpeace.org/environment/brundtland.html>.
- FAO.** 1945. Constitution of the Food and Agriculture Organisation of the United Nations. Quebec, 16 October 1945.
- FAO.** 1967. Report of the FAO study group on the evaluation, utilization and conservation of animal genetic resources. Meeting Report 1966, 9, Rome, pp. 31.
- FAO.** 1990. Animal genetic resources. A global programme for sustainable development. Proceedings of an FAO Expert Consultation Rome, Italy, September 1989. FAO Animal Production and Health Paper 80.
- FAO.** 2007. The State of the World’s Animal Genetic Resources for Food and Agriculture, Barbara Rischkowsky & Dafydd Pilling (Eds). Rome, Italy.
- Hodges, J.** 1999. Jubilee History of the European Association for Animal Production 1949-1999. Livestock Production Science 60, 105-168.
- Hodges, J.** 2002. Conservation of farm animal diversity: history and prospects. AGRI 32, 1-11.
- Mason, I.** 1981. Cooperative work by FAO and UNEP on the conservation of animal genetic resources. In: FAO: Animal Genetic Resources Conservation and Management. FAO Animal Production and Health Paper 24, 15-28.
- Philips, R.W.** 1981. The identification, conservation and effective use of valuable animal genetic resources. In: FAO, 1981. Animal Genetic Resources Conservation and Management. FAO Animal Production and Health Paper 24, 1-5.

Randall cattle in the USA: rescuing a genetic resource from extinction

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Summary

Randall Cattle are a landrace from the northeast USA. The cattle are triple-purpose and well adapted to the cold northeast geographic region. The current population descends from 14 cattle that remained after the death of the original owner, though only 12 of these represented unique founders due to interrelationships among the 14. He had kept the cattle as an isolated strain for nearly 80 years. Blood-typing results point to a north Atlantic origin for the breed, which is consistent with the history. The policy and practice of the American Livestock Breeds Conservancy has been to carefully document landraces and to assure their conservation. Focused breeding strategies have succeeded in rescuing the original 13 animals and expanding the population to nearly 300 in 2006. The breed is gaining popularity as a hardy, adapted and useful genetic resource. Breeding management has decreased overall inbreeding while at the same time managing the contributions of the various founder animals.

Résumé

La race "Randall" est une race locale du Nord-Est des Etats-Unis. Il s'agit d'une race à triple propos et elle s'adapte bien à cette région froide. La population actuelle s'est formée à partir des 14 animaux découverts après la mort de leur propriétaire qui avait conservé son troupeau isolé pendant plus de 80 ans. Le type de sang révèle une origine de la race proche au bovins de la région Nord Atlantique, ce qui coïncide avec l'histoire de cette race. La "American Livestock Breeds Conservancy" a établi un document détaillé des races locales pour s'assurer qu'elles ne disparaissent pas. Grâce aux stratégies d'élevage

du noyau initial on est arrivé à 300 têtes en 2006. La race est appréciée surtout en tant que race rustique, bien adaptée et utile. La gestion de la population a permis la diminution de la consanguinité tout en assurant l'apport de chacun des animaux d'origine. Cette race est en augmentation et son futur est assuré.

Resúmen

La raza "Randall" es una raza local del nordeste de los Estados Unidos. Se trata de una raza de triple-propósito, bien adaptada a esta región fría. La población actual se fundó con 14 cabezas descubiertas después de la muerte del dueño original que había mantenido su ganado aislado durante unos 80 años. Los tipos de sangre colocan el origen de la raza en los bovinos de la región nordatlántica, lo que corresponde con la historia de la raza. La "American Livestock Breeds Conservancy" ha documentado las razas locales para asegurar que no se extingan. Las estrategias de cría han tenido éxito en el rescate de las 13 cabezas originales, y la cabaña ha aumentado hasta 300 cabezas en 2006. La raza es popular como raza rústica, bien adaptada, y útil. El manejo de la población ha disminuido la consanguinidad, pero asegurando la contribución de cada animal fundador. El número de animales de esta raza está ya creciendo y el futuro está asegurado.

Keywords: Local breed, Description, Original herd, Breeding management, Blood-typing, Breed expansion, Conservation.

Introduction

Animal production and breed use in the United States of America is typical of most industrialized countries (Rouse, 1973; Sims and Johnson, 1972), with the exception that direct governmental regulation of breeding and monitoring of populations is minimal. For most of the past century livestock production has been based on imported, well documented purebred livestock registered in herd books that are maintained by non-governmental breed associations. In addition, composite breeds based on pure breeds were later developed in an attempt to combine attributes of various founder breeds into new mixtures designed for specific environments or production situations. A final and recent stage of breed development has been industrial strains of livestock, mainly swine and poultry which are designed to be very productive in tightly controlled environments. Industrial strains are based on pure breeds originally, but have usually functioned outside of the purebred livestock community because of their strictly industrial function and their lack of participation in associations or herd books.

A few older and more traditional livestock production systems have persisted peripheral to these mainstream systems. These older types of livestock tend to be overlooked by both governmental programs and scientific investigators, largely because these systems and their animals are considered to be of low productivity and are outside the usual short-term commercial concerns of mainstream American agricultural production. Traditional livestock have, however, persisted in sustainable systems, and are well adapted to harsh and demanding environments, and are therefore genetic resources of potential future utility.

The livestock of peripheral, sustainable systems includes old types that continue to persist in genetic isolation from other livestock genetic resources. The American Livestock Breeds Conservancy (ALBC) is actively engaged in saving the livestock genetic resources of these systems. ALBC is a nongovernmental nonprofit organization that serves an important role as a central source of information, procedures, practices, and technical support for breeders of rare livestock genetic resources. ALBC classifies populations of isolated, traditional livestock as landraces, and has developed procedures for their identification, classification, and conservation (Sponenberg and Christman, 1995). Randall Cattle are one such American landrace, and the rescue of this population from extinction has provided the ALBC

with many insights that have been useful in developing strategies and procedures for working with other small populations of livestock (Christman and Sponenberg, 1997).

History

Well-adapted triple purpose (milk, meat, draft) cattle have been useful in the northeast of the United States for centuries. These cattle were introduced to the region during early colonization by Europeans, and were widely used for production in this region of cold winters, short summers, steep slopes, and poor, rocky soils. One genetic resource that was commonly used was the widely recognized Milking Devon, an isolated type within the more widespread Devon breed (Splan and Sponenberg, 2004). This type is now limited to the United States (Christman and Sponenberg, 1997). Other cattle types within the same region have occurred for centuries, but these others have lacked breed identification and have lagged behind the Milking Devon in breed recognition and conservation programs (Rouse 1973).

One reasonably common type within New England was called '*Linebacked Cattle*'. These cattle were generally black but occasionally red, and had either the colour-sided pattern or '*Pinzgauer*' pattern, either of which is characterized by a distinctive white top-line that gives the cattle their name. Various strains of Linebacked cattle existed, although throughout the 1960s and 1970s they were increasingly crossbred with Holstein cattle to provide higher milk production. Through this slow genetic erosion, nearly all of this type of New England landrace cattle became extinct. In 1986 Everett Randall's herd of Lineback cattle came to the attention of the livestock conservation community. He had kept his herd free from other breeds for nearly 80 years, but with his death the herd's future was in peril.

The Randall cattle went from Everett Randall's estate to a few different buyers. One of these original buyers, a single breeder (C. Creech) became the owner of the vast majority of them, and embarked on a breed rescue and conservation program which has resulted in a growing population of Randall cattle that are now secure as an adapted genetic resource. Two other early breeders obtained a few of the dispersed cattle, and while most of those were lost to the conservation effort, a few have made important contributions to the conservation of the population. Procedures and practices that were developed in the course of rescuing and conserving

the Randall cattle have been essential to their survival as well as helping in the conservation of other rare livestock breed resources.

Description

Randall cattle are moderate but variable in size, and have a type that varies from predominantly dairy to dual-purpose. Mature cows vary from 300 kg to 400 kg, with a few outside of this range. The types within the breed cluster around one that most resembles older Shorthorn type, and others that are more similar to Channel Island breeds such as Jersey and Guernsey. Very few of the animals show a heavier beef type. The range of types is in keeping with the long selection history of use in low-input subsistence dairying. All of the cattle are horned, and the horns are generally short and spread out and upward. A few have horns with a more inward twist. Udders are generally medium-sized with good attachments and medium sized teats.

The color of all of the original remnant cattle was consistently black, with all animals having the 'color-sided' pattern of white spotting. The color-sided pattern within this herd varies from very dark to nearly white. At the dark extreme are animals with only a minimally white top-line and underline and no roaning. In most, however, the head and edges of the white areas are generally roan or speckled even in the darkest individuals, which produces a 'blue' appearance and led to another synonym of 'Randall Blue' for the breed. The palest animals have pale roan sides, with extensively white top-lines and underlines. In the palest animals, dark areas characteristically remain on the muzzle, ears, feet, around the eyes, and there is generally a dark spot on the forehead. In between the dark and pale extremes of color pattern are animals that are distinctly line-backed, but with roan and speckled areas especially where colored and white areas meet. These are illustrated in figures 1 and 2.

In recent years red-based animals have emerged in the herd. These were reported to be in the herd in early years, and the color has persisted as a recessive allele. The red animals have the same distinctive range of expression of the color-sided pattern as do the black animals.

Foundation Population

The original herd presented for conservation consisted of four bulls and nine cows. The herd was examined for age structure as an aid to determining relationships. Everett Randall had used single sires for most of the previous 80 years, so that age-mates were likely to be half siblings. This logic determined that the initial group included five cows and a bull that were likely all sired by the same bull, who was no longer living. These five cows were assumed to be out of different dams. This assumption was especially valid for the animals with the same birth year (one pair of cows from one year, a cow and the mature bull from a second year, and a single cow from a third year).

Also included in the herd were four younger cows and two younger bulls sired by the living mature bull. Dam information was present for this younger group, and only one of these (a cow) was produced by a cow not present in the older group. The other three had been produced by dams that were in the older group. The final young bull calf was produced by one of the younger bulls and an older cow otherwise unrepresented and unavailable for the conservation effort.

The animal pedigree information was used to create a spread sheet that enabled tracking of the population. Specific information that was tracked included sex, year of birth, sire, dam, and the contribution to the animal from each of the founders.

Breeding Management

The relationships among the founders and their descendants were used to design a breeding program that followed a few general principles. The goals of the breeding program varied for different matings. Most matings attempted to minimize inbreeding, in an effort to reduce the risk of inbreeding depression in what was already an inbred population.

In contrast, a few specific matings were constrained to produce line-bred offspring that concentrated the contribution of each of the specific founders. This strategy produced cattle each of which was a high percentage of one of the founders. The goal for this strategy was especially to provide bulls from which semen could be frozen as an



Figure 1. Randall cows with a lighter manifestation of the color-sided pattern.

insurance against the loss of certain lines within the population. This was important as freezing of semen is relatively inexpensive compared to other assisted reproduction techniques, and in the absence of governmental subsidy or support attention needed to be paid to the economic aspects of the breed rescue.

The inbreeding strategy was used as an attempt to ensure that some individuals, though highly inbred, would be high percentage specific founders, and would therefore be less distantly related to most other animals in the population. These line-bred animals could then be used over large numbers of other animals in the breed to produce more out-bred offspring that still retained significant influence of the various founders but without significantly high inbreeding. This would have been impossible if a strategy of uniformly reducing inbreeding had been used to guide all mating decisions, and the risk of loss of the distinctive contributions of the various founders would have been greater by following that strategy.

Breeding management was also deliberately changed from the original single-sire system. It is common in the USA for landrace herds to use a single sire for multiple years, and then to replace him with a son. A new and more genetically sound strategy was developed, so that multiple bulls were

used (generally no fewer than two per year) and each bull tended to be used for only a single year. The result was a more rapid turnover of males, and by that means an avoidance of the genetic bottleneck that males can easily present to a small population.

Semen was frozen on individual males that were either foundation animals, or that had high percentages of the breeding of individual foundation cows. This strategy provided for the availability of this genetic material for the future of the breed, and especially served to provide the genetic material of the founders in a readily accessible form (semen versus oocytes or embryos) that was economically feasible.

The consequences of the breeding management decisions can be appreciated in table 1. A few of the founders, such as the sire of the majority of the original animals, were bottlenecks to the population. The percentage contribution from various founders ranges from 35% to 0.9%. Of more importance to the long term survival of the population is the range in percent contributions of the various founders. It is clear that the influence of Founder 1 (the sire of the original older group) will never be minimized to a proportionate contribution because no animal lacks his influence. He is the bottleneck to the population. Other founders have

minimal or no contribution to at least some animals in the population. This allows, at least for that one founder, the planning of matings to counteract any overrepresentation (inbreeding) to that one founder.

Some founders, usually by virtue of contributing to only one individual early animal, will never have the potential to contribute much to the overall population. Examples are Founder 8 and Founder 10, with the maximal representation of 19% and 13% respectively in any individual animal in the population. For others, such as Founder 12, the minimal overall contribution can be countered by using a relatively high percentage bull across several animals. Founder 12's contribution comes from one of the bulls used in a smaller herd away from the main conservation herd. Fortunately semen is available, and this provides an opportunity to manage this founder's contribution and to provide for its inclusion across broader portions of the breed.

Most of the founders are represented by animals that have at least 25% of the genetic influence of the founder. Semen from such animals has been frozen where possible. In some cases these high percentage animals are females. In those cases the strategy has

had to shift to planned matings that increase line-breeding to the high percentage founder. The goal of these matings is to produce bulls that are a high percentage of the founder and that can have semen frozen for future representation of that founder.

Blood-typing

Conventional blood-typing of the population was accomplished at a relatively early stage in the conservation program in an effort to determine relationships among the founders as well as possible breed origins of the population.

Blood-typing of the population (17 animals) was done in 1992, and the results are shown in table 2. The results of the blood-typing indicate low variability at many loci, which is consistent with the long history of isolation of this population. One locus remains highly variable, B, at which many alleles remain.

The specific variants that are present point to a north Atlantic origin for Randall cattle, which is consistent with the history of the region in which



Figure 2. Randall cow with a mid-range manifestation of the color-sided pattern, and with a pale calf at foot.

Table 1. Management of percentage contributions of founder animals through breeding management.

Founder	Average % of all cattle	Average % in cattle alive in 2005	Target % for long term management	Minimum % in cattle alive in 2005	Maximum % in cattle alive in 2005
1	35	33	30	12	48
2	16	16	11	0	50
3	15	15	11	2	25
4	5.7	5.7	6	0	38
5	7	7	6	0	25
6	4	4	6	0	50
7	5.9	5.9	5	0	25
8	2.8	2.5	5	0	19
9	4.3	4.6	5	0	25
10	2.8	2.4	5	0	13
11	2	2.1	5	0	25
12	0.9	1.5	5	0	50

Table 2. Blood-types within the Randall cattle herd.

Locus	Allele	No.
A	A1	20
	A1H	2
	A1DH	5
B	01	9
	I103J'K'O'	4
	E'3	5
	B28	9
	PQI'	2
	I'	3
	E'3G'	1
	I1	1
C	C2EW	8
	R1WX2	2
	C2EWX1	1
	L'	1
	R1X1	1
	C2EWX2	1
	EWX2	1
	EW	3
	E	1
F	F	30
	V	4
J	J	11
	-	14
L	L	13
	-	10
M	1	34
S	SH'	all
Z	Z	5
	-	24
	Z2	1
R	S'	11
	R'S'	7

they were found. Specific variants found in the population are also found in Holstein, Jersey or Guernsey, and Shorthorn cattle. A few, such as I1O3J'K'O' are rare in all other breeds, and indicate the antiquity and uniqueness of the Randall cattle.

Specific blood-typing results indicate that only eight B pheno groups were found in the 17 samples, including the rare I1O3J'K'O' type, represented by four copies in the population, and in every case were heterozygous. The A system shows a few type D, with many homozygous for its absence. The S system is non-variable in this population, as all are SH'. An older reagent, the 'Wisconsin' reagent was negative in two animals, and is noteworthy because the reagent is rarely non-reactive.

The blood-typing results are interesting in that several loci reflect the history of closed breeding within a small herd. Even though several loci have minimal variability, others have retained great variability. Singh and Nordskog (1981) suggest, after detailing similar findings in inbred lines of chicken, that certain loci may retain variability in inbred populations due to their role in fitness and adaptability.

Landraces are notoriously difficult to define, and ALBC has found that blood types or DNA fingerprinting can greatly aid in landrace definition. This is especially the case for decisions as to inclusion or exclusion of individual animals. Blood-typing of the Randall cattle was useful in determining the legitimacy of one bull which had passed through multiple owners before being rediscovered as a potential Randall animal. His history raised some doubts about his relationship to the breed, but blood-typing showed that he was indeed of the breed and a useful founder animal.

Strategies for Breed Expansion

As a result of the targeted rescue and conservation work, the breed received publicity through the ALBC. This was accomplished through the ALBC newsletter, as well as through the network of individuals that characterizes the active breeder members of ALBC. The initial phase of the rescue was accomplished with very few breeders, so that a formal breeder organization was not essential. As animals were sold into an increasing number of herds, the breeders organized a breed association, and formalised the registration and documentation of animals within the breed.

The breed is now finding demand as a low-input subsistence animal suited for home dairy production, as well as for the production of beef. In

addition, excess males find a ready market in a small but strong demand for oxen. Their aptitude for draft is high, as they are active as well as willing, and those using the oxen specifically note that they are very quick to learn. The organization of breeders as well as the increased availability of animals has resulted in a demand for the breed that assures breeders of a consistent market for breeding animals as well as for oxen. This has all been accomplished by diligent work on the part of the non-governmental sector. The breed is numerically still very rare, and it will take several years of expanding numbers before it becomes a mainstream production breed. It has, however, found a secure if small niche in American agriculture, so that numbers are increasing rather than decreasing. It is therefore very unlikely to face a census crisis or danger of extinction.

Discussion

Rescue of the Randall cattle from the very doorstep of extinction has provided the ALBC with useful experience in working with a 'worst case' situation where a numerically rare livestock genetic resource has needed careful strategies for breeding and population management to avoid its outright extinction (through sale to slaughter) as well as a slower extinction through inbreeding depression. The lessons learned have had wide ranging repercussions for the conservation of traditional livestock genetic resources, especially in view of the lack of direct governmental support and oversight for conservation programs in the USA. Developed countries such as the USA present special challenges for the conservation of traditional, adapted livestock because these resources differ from the usual breeds of interest which are selected for immediate commercial utility.

It is important to note that landraces still persist in developed countries, but are very likely to be overlooked in organized conservation efforts due to their poor documentation. Landraces tend to fall from notice when compared to standardized breeds with active breed registry organizations, and this is especially the case when governmental agencies and non-governmental entities focus only on the more readily identifiable standardized breeds with well-developed breed associations that advocate for their breeds. In this situation it becomes all too easy to conclude that if there is no breed association, then there is no breed.

In the USA, no other strain of landrace cattle from New England has survived to be available for

conservation work, despite the anecdotal persistence of several of these up until the 1970s or 1980s. This unfortunate fact is due to the long practice of ignoring landraces as legitimate genetic resources. The success of the conservation of Randall Cattle stands in contrast to a more general failure to conserve related strains of this overall type of cattle that would have provided greater genetic diversity within this type of cattle.

Randall cattle illustrate the successes that can be experienced with small populations that are fortunate enough to have caretakers that are dedicated to their survival. Most of the Randall cattle recovery has been due to a single breeder (C. Creech) functioning as a private individual with no governmental support. Importantly, contributions from a few of the original animals that remained outside of this main conservation herd have also been essential for the conservation of these cattle, usually because these animals represented a diversity absent from the main conservation herd. Fortunately for the breed, many other breeders are now contributing to its survival and its genetic management.

Randall cattle serve as a reminder that while inbreeding depression is a threat to breed conservation, not all inbred populations decline from depression. While a few cows have had reproductive failures, the majority of the cattle remain fertile and have good health. Managing the levels of inbreeding is clearly an important priority, and requires carefully constructed breeding plans and population-management procedures. The easier solution in the face of such small numbers is to resort to crossbreeding, but this strategy only

assures the premature loss of important adapted genetic resources.

List of References

Christman, C.J., D.P. Sponenberg & D.E. Bixby. 1977. A Rare Breeds Album of American Livestock. The American Livestock Breeds Conservancy. Pittsboro, North Carolina.

Rouse, J.E. 1973. World Cattle III: Cattle of North America. University of Oklahoma Press. Norman, Oklahoma. 1973.

Sims, J.A. & L.E. Johnson. 1972. Animals in the American Economy. The Iowa State University Press. Ames, Iowa.

Singh, H. & A.W. Nordskog. 1981. Biochemical Polymorphic Systems in Inbred Lines of Chickens: A Survey. *Biochemical Genetics* 19: 1031-1035.

Splan, R.K. & D.P. Sponenberg. 2004. Characterization and Conservation of the American Milking Devon. *Animal Genetic Resources Information* 34: 11-16.

Sponenberg, D.P. & C.J. Christman. 1995. A Conservation Breeding Handbook. The American Livestock Breeds Conservancy. Pittsboro, North Carolina.