

SAVE e-News 1/2015

Safeguard for Agricultural Varieties in Europe

The quarterly electronic information service of the SAVE Foundation



SAVE Project Office

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Conservation of Cattle Genetic Resources: The Role of Breeds



Genetic diversity on a Swiss pasture

Cattle are kept on all continents, all climate zones and for various reasons. This is why the development of the breed variety is bigger than with any other livestock. The Dutch scientists Marleen Felius, Bert Theussen and Hans Lenstra speak of breeds when the reproduction is completely or partially under human control – with the objective to improve the characteristics, even if the herd books often are maintained not really correct. After the development of agriculture in Mesopotamia 12'000 year ago cattle were spread around Eurasia and Africa together with sheep, goats, pigs and crops. In the Neolithic period 5'000 to 2'500 years ago in Europe site de-

pendent pastoralism and agriculture developed. For cattle this was the beginning of a series of genetic developments. The animals as companions of humans became adapted to all environmental conditions. Over time livestock owners began to select bulls with desired characteristics for reproduction. In the 18th century farmers in England practised for the first time a systematic selection and delimitation of longhorn and shorthorn cattle. This method was spread over whole Europe. An important change to “non-scientific” breeding methods were strict breeding controls, selective cross breeding, the definition of breeding objectives, the documentation of pedi-

gree and herd book keeping. Breeding objectives change over the time. In the 20th century for example traction lost its importance due to the mechanisation of agriculture. Since the 19th century popular breeds were more and more kept outside of their regions of origin. Today Holstein-Friesian is the most widespread breed in the world. Exports led to the development of local breeds with the respective names or they were part of a globalised breed with international exchange of genetic material. Furthermore, breeds were divided into different populations and bred country-specific. The Simmentaler is, depending on the country, a pure milk-breed, a meat-breed or a dual-purpose breed.

Experts consider the developed diversity of breeds as worth for protection. Breeds never have been static but rather a subject to permanent development. The results of a recent molecular study show that different breeds of the same species, despite phenotypical dissimilarities, differ in their DNA only marginally from animals from the same breed. Genetic distances between breeds indicate regional clusters of breeds, which reflect former or present gene flow between neighbouring populations.

The authors suggest four criteria which allow to distinguish breeds more differentiated than the current FAO criteria:

- Local cattle, which originate from cattle present in the region in the 18th century or earlier and may have been influenced by cattle from other regions
- Cattle that emerged later by crossbreeding with cattle from other regions. Even though their genetic roots derive mainly from outside the region, there are many examples of crossbreeds from the 19th century that are commonly perceived as belonging to the local heritage
- Highly productive imported cattle with international exchange of breeding material.
- Cattle that are still maintained by crossbreeding with breeds of other origin or with other bovine species.

The authors give an overview over 5'574 names of cattle breeds and their varieties provided with synonyms in local languages and English. Information is complemented with an alphabetical register. For comparison: The FAO livestock information system

lists 951 animal names. For the authors traditional breeds are an important primary source for breeding. An overview over the countries shows the wide spectrum of global widespread up to unknown local breeds. The Prespa cattle, one of the local breeds supported by SAVE Foundation, could be kept without external genetic influence.

Most of the breed names refer the region of origin, fur colour or horn size. Some breeds are nearly identical but have different names. This applies, for example, to the Swiss Eringer cattle which is called Hérens in the French speaking part of Switzerland. Within the modern improvement breeding the breeds get surprisingly honest names like Beef Machine, Beefmaker or Tropicarne. Cattle breeds are also used for other reasons like some American breeds serve as basis for the back-breeding of aurochs.

Breeds convey identity – not only for breeders but often for a whole region. Not every breed has characteristics worth for protection. Genetic markers do not provide any information about adaptability or other valuable attributes. Therefore an adaptability index as criteria for conservation measures is proposed. Valuable morphologic and breed specific characteristics are convincing arguments for conservation.

Breeds as a management units

Today, the conservation of each breed is an isolated act of breeders and associations. Instead of units of conservation, breeds may be considered as what they really are: units of management. For this, herd books, recordings of pedigrees and other useful documentation is needed in order to estimate the risk of inbreeding and trace special peculiarities. Defined breeds should have a broad genetic base. Controlled crossbreeds have never been a drawback for a breed as long as it could remain its typical characteristics.

The full article is available at: Journal of Agricultural Science (2015), 153, 152-162. (c) Cambridge University Press 2014, doi:10.1017/S0021859614000124

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Breed categories and subcategories on the basis of recent history (Sub) category

Category	Description	Examples
1. National or regional local breeds and their derivatives, with or without influence from imported cattle		
Landrace	Non-improved, locally adapted or feral cattle of local origin	Betisoak; Prespa Dwarf
Authentic breed	Original, selectively bred since the 18 th or 19 th century with or without herd book, with limited or no influence of imported sires; originating from older landraces or (as in the case of American authentic breeds) historic imports; in some cases recognized outside their country of origin as imported global breed (e.g. Limousin); in other cases carrying the same name as an Americanized derivative	Hereford; Jersey; Limousin; Telemark
Authentic variety	Original variety of a breed (colour type, breed line, polled, etc.)	Dun Galloway; Fleckvieh beef; Polled Limousin; Gurtenvieh
Reconstructed breed or variety	Completely or almost lost breed rebred from animals with another origin	Blue Albion; Bordelaise nouvelle; Glan; Maltese
Local derivative	Local breed derived in the 19 th century from females of local landraces or authentic breeds by incrossing exotic sires	East Flemish White-and-Red; Dalmatian Grey; Cika
Local crossbreds	Breeds emerged in the 19 th or 20 th century by crossbreeding of local breeds: - unplanned regional crossbreds - multiple composite modern breed from the 19th century bred by using sires from several different breeds - diffuse breeds with continuous influx of neighbouring populations - breed emerged amalgamating older local varieties and breeds.	Swona; Piemontese; Aosta Red Pied; Austrian Yellow; Yellow Franconian; Massanaise; Marisfèña; Macedonian Busha; Kea; Blonde d'Aquitaine
2. Breeds emerged by crossbreeding of cattle from different regions		
Local population of international breed	Modern breed developed by crossing local females to sires of international breeds, morphologically close to the imported ancestor and maintained as purebred population; local transboundary breed; mostly dating from the 19th century.	Several Black-Pied Friesian; Fleckvieh; Brown Mountain; Shorthorn populations; Pinzgavac; Minhota
Composite breed	Synthetic breeds developed by planned crossbreeding of two or three non-related breeds	Uckermärker; Girolando; Santa Gertrudis
	Breed still being developed by using both own sires and sires from parental breeds	Viking Red; Borguni; Piemonel
Multiple composite breed	Breed of multiple origin	Heck cattle; Shaver; Droughtmaster
Bovine composites	Breeds that emerged from crossbreeding with other species than taurine and zebu cattle	Madura; Beefalo
3. Breeds and varieties that since the 20th were imported and are bred pure with continuing genetic influx from the parental breed; established as or developing into international transboundary breeds		
Global or international purebred breeds	Originating from local breed; elsewhere imported or upgraded to being at least 15/16 identical to imported; kept within continents (African, Asian and European) or on most of all inhabited continents with international exchange of breeding material	Holstein-Friesian; Simmental; Angus; Brown Swiss; British Blue; Charolais Limousin
Americanized local breed	Breed from the first category reformed by using American stock tracing directly to the original breed	Ayrshire; Swiss Brown; Dutch Black-Pied Friesian; Guernsey
American-European composite	European breed from first category reformed by strong infusion of an unrelated American breed and developing towards the American breed	Danish Red Pied; Pie Rouge des Plaines; Czech Pied Dairy
International multiple composite breed	Breed of multiple origin kept on most continents	Brahman
4. Populations maintained by crossbreeding		
Continuous cross	Mix of several breeds with continuous input of parental and other breeds	Norwegian Red; Montana; Little Rowdy; Stabilizer
Terminal F1	Crosses with high performance by first-generation heterosis but not used for breeding	Bluegrass; Black Baldie; Nelorford
Bovine hybrid	Terminal crosses of taurine or zebu cattle with gayal, bangal, yak or bison	Selembu; Yakow

BushaLive – Living Diversity



Busha herd above Dubrovnik

An example for the big diversity within a meta population shows the Busha cattle of the Balkans. This was investigated within the project “BushaLive” supported in the frame of the UN-FAO Funding Strategy for the Global Plan of Action for Animal Genetic Resources in close collaboration with the national coordinators and actors since spring 2013.

Beginning of march 2015 stakeholders of the different fields of conservation met in Dubrovnik, Croatia, to discuss the results of the field research and molecular genetic investigations of the occurring strains of Busha cattle in Albania, Bosnia & Herzegovina, Bulgaria, Croatia, FYR of Macedonia, Kosovo*, Montenegro and Serbia. In collaboration with different universities and farmers a comprehensive survey of individual animals took place as well as blood samples of at least 20 animals per country and region. The blood samples were investigated through the SNP chip technology at the Ludwig-Maximilian University of Munich, Germany. Here already a lot of molecular genetic studies on European cattle took place and therefore a lot of material for comparison is available. Aim of the Project was to find out the similarities and differences of the different strains of Busha cattle in the Balkans. The brachyceros dwarf cattle breed occurs in all Balkan

countries but in different strains. The Busha cattle is endangered by the changes in agriculture as well as crossbreeding with larger breeds. The still occurring strains are kept in the Balkan countries in small or very small numbers. The investigations took place to find out a suitable model for cross-border conservation of Busha cattle.

The samples used included 2 Outliers, 14 Busha strains, 42 European breeds from a large geographical area divided into clusters.



Croatian Busha cattle

Country	Breed name	Abr. Breed	Sampling area	Country	Breed name	Abr. Breed	Sampling area
Albania	Lekbian Busha	LKB	(Lekbibaj)	Kosovo	Dukagjini Busha	DGB	Deqan
Albania	Skodra Busha	SKB	Back Rrjoll, Rrjoll	Kosovo	Red Metohan B.	RMB	(Blag, Kuklibeg)
Albania	Dibra Busha	DBB	Dibra Lashkize & Dardhe	Kosovo	Schaari Busha	SHB	Dragash
Albania	Middle Albania B.	MAB	(Divjake)	Monte Negro	Motenegrian B.	MNB	Andrijevica, Plav-Gusinje, Ulcinj, Berane, Plav, Herceg Novi, Niksic
Albania	Prespa Cattle	PRE	(Prespa)	Serbia	Serbian Busha	SRB	Stara planina
Macedonia	Macedonian B.	MKB	Strumica, Ohrid-Kicevo, Kvatraci, Trpejca	Bosnia and Herzegovina	B&H Busha	BHB	Buhovo
Bulgaria	Rhodope Shorthorn	RHS	Kardzali, Haskovo, Smolyan	Croatia	Croatian Busha	HRB	Sestanovac, Gospic

The results showed impressingly the still occurring diversity. There is a high diversity in all samples. The relationships between the individual animals samples were studied using Identity By Descent (IBD) Probability provide a Genome-wide realised relationship based on genetic marker.

The expected inbreeding can be assessed to show the state of the sampled cluster population and can then be compared to the global diversity. In this way the introgression from other breeds can also be judged so the status of "purebred Busha" can be given. Also the relationships between the strains sampled in the project can be shown. Through this animals can be excluded from the conservation programme and others can be chosen for genetic exchange with other groups. This is the reason why so many European breeds were included as refer-

ences in the analysis. Including some older samples in the project and comparing with the 2014 samples shows that both inbreeding and introgression are slowly increasing. The results need to be taken into the practical work in the field and they will help decision making for a (cross-border) conservation practice. This has previously been based on phenotypical information. The Busha is a part of the cultural value of the area and this project has connected it to the most modern technologies, which is very important for the future conservation. The project BushaLive shows that SNPs (Single Nucleotide Polymorphism) are very important for the future of conservation projects of animals in small populations as inbreeding and introgression can be minimised.



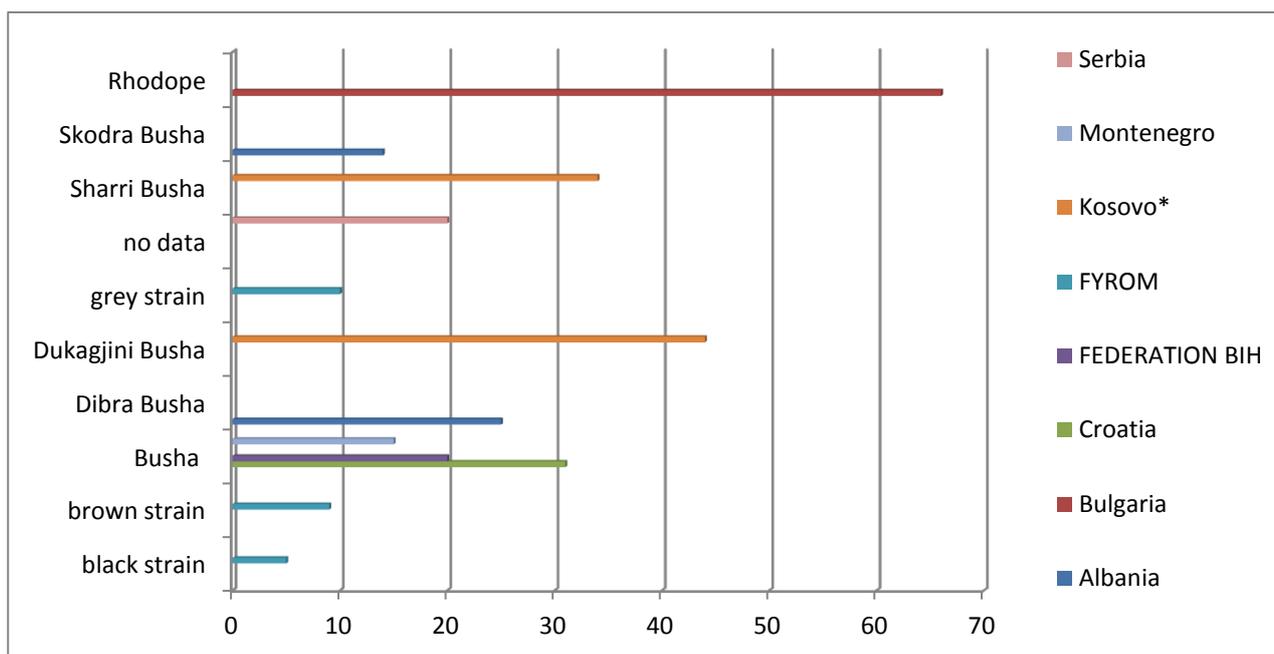
Preliminary Results of the survey

224 surveys were received from 7 countries; there were 203 females / 21 males. When presenting the results, it became clear that some of data provided on the survey must be incorrect. Therefore, this data needs to be corrected before all the results are presented. As assumed the population trend is mainly decreasing:

Croatian Busha cattle

Country	decreasing	increasing	no data	stable	Total
Albania			39		39
Croatia		16	15		31
FEDERATION Bosnia and Herzegovina	20				20
Macedonia (FYROM)	3			21	24
Kosovo*	33	36		9	78
Montenegro	9			6	15
Serbia	20				20
Total	85	52	54	36	227

Different strains in the countries



Also phenotypical characteristics are very different

The occurrence of black or dark mucous membranes for example has been used as a phenotypical indicator of the Busha breed. However, animals with “tiger” markings or in the same blood lines tend to have light mucous membranes. The hair colour of Busha is always unicolour and not patched or in different colours. The so called “tiger” Busha are usually tigered (brindled) over the whole body. The occurrence of an “eelstripe” has previously been used a phenotypical indicator of Busha. However, this only present in few populations in Croatia and Serbia.

The survey data show the difficulty of comparing phenotypical data collected by different people as much of it is a question of interpretation. Only the data that are objective (withers height etc) can

really be used together with the genotyping to create a profile of the animals.

A strategy for ongoing breeding management

Within each country it is important that the breeders are in contact with each other and that the recording of the strains takes place. This recording should also include the ISO codes to support the ongoing exchange of animals or material with a unique ID of the animals. The exchange, guided by the results of the genotyping, can be used to solve the problems of inbreeding and introgression within population groups

**This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and ICJ Advisory opinion on the Kosovo declaration of independence*

Conclusions of the Workshop

Regular exchange and reporting is an important objective so that the aims of the BushaLive project

do not get forgotten and that the conservation of the Busha cattle is assured.



The use of the animals is the best way to conserve them and to increase the stock numbers. Not only products but also services need to be assessed and promoted. Busha keeping is one of the best models for eco-conservation in protected areas – for example in grassland management or food for vultures. Organic farming is a way of adding value to products and gaining more subsidies and recognition for the ecological value of the Busha.

Participants BushaLive Meeting in Dubrovnik / 4 – 6 March 2015

Newsflash

9th European Seminar in Agrobiodiversity 2015 “Unrecognised and Isolated Populations of rare Breeds and Varieties” SAVE Network Meeting in Greece

The SAVE Meeting 2015 will take place in Greece Lake Kerkini National Park, Prefecture of Serres, Greece, 11-13 September 2015. The topic of the



Greek water buffalo, Kerkini National Park

9th seminar on agrobiodiversity is “Unrecognised and Isolated Populations of rare Breeds and Varieties”. At as workshop the new structures of SAVE

Foundation, the project office and the network office will be explained, possibilities and pitfalls of the new structure will be discussed.

At a Lake Kerkini boat excursion the Greek Water Buffalo can be seen. The area of the lake hosts the largest number of water buffalo in Greece. A visit to local Sykia cattle, Greek goats and black pig in the Mountains near Lake Kerkini will complete the interesting program. For the first time a post workshop tour to the lake Praspa with a visit to the unique Praspa cattle will be organised.

The SAVE meeting will be held in cooperation with the Greek SAVE partner organisation “Amaltheia”. Invitations will be sent out soon. For early registration please contact the SAVE Network Office in The Netherlands Albert Meijering

albert.meijering@save-network.com.

The Wild Ancestor of Modern Apples



Fruit Forests in Central Asia

In the frame of the „Future of foods“ series, the national geographic reported about the ancient woodlands of Kyrgyzstan—and of the four neighbouring former Soviet republics of Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan which are home of

more than 300 wild fruit and nut trees. Studies showed that the domesticated apple acquired genes from other wild varieties as it spread west along the Silk Road. The wild crab apple in particular was a "major secondary contributor" of genes to the modern domesticated apple beginning about 1,500 years ago. In fact, the domesticated apple is now more closely related to *M. sylvestris* than to its original ancestor in the Tien Shan mountains. According to tree experts from Fauna & Flora International, around 90 percent of the fruit and nut forests of Central Asia have been destroyed in the past fifty years. Conserving both wild populations and their descendants is crucial to keep this important genetic diversity. See:

<http://news.nationalgeographic.com/news/apples-of-edem-saving-the-wild-ancestor-of-modern-apples/>

With commitment to the future

The project office of the SAVE Foundation is now located at the Neugasse 30 in the centre of the old city of St. Gallen. The former managing director Hans Peter Grünenfelder made his extensive experience in the conservation of rare breeds and varieties now available to the Board of Directors while Martin Arnold serves as the new Managing Director (right). Claudia Felder beside him is dedicated to administrative tasks very creatively. In the centre of the picture is Waltraud Kugler. After 20 years with the SAVE Foundation she is something like the heart of the SAVE project office. She brings in contextual knowl-



edge, inspires the direction of the future path of the SAVE project office and is impulse generator regarding the speed that we take. Beside her stands the impulse generator on technical matters. Without Werner Schachtler and his computer and program-

ming skills many ideas would not be possible to set into force, which is inevitable in the digital world. Last but not least: Urs Fitze, a key person in our currently most important project, the Internet-based

knowledge platform www.fundus-agricultura.net. The networking of the SAVE Foundation is now located at our partner in Wageningen, Holland. Don't hesitate to drop by if you are nearby. We look forward to your visit in St. Gallen.

Present and Future of the Bosnian Mountain Horse



For centuries, the indigenous Bosnian Mountain Horse (BBK) was the most important horse breed in the Balkans. The breed was influenced by the different historical sovereigns, who crossed it with oriental horses, English horses, Lipizzaner and Hutsul. After the Second World War, the state stud "Ergela Borike" was founded. In addition to the pure breeding also targeted crossings with Arab stallions took place to improve temperament and size of the BBK without losing the original type. This was crucial for the consolidation of the breed in type and frame.

In the stables Borike (Bosnia), Planido (Slovenia), Gorski Kotar (Croatia), Ziga (Bosnia) and Bosnaikenhof (Germany), the original type BBK is kept. In the territory of Bosnia and Herzegovina cross-breeds and herds of the BBK type which have been abandoned during the war have been seen in re-

cent years. Pure-bred BBK only have been obtained in the stud Borike in a small population.

In order to ensure the conservation and the future of the Bosnian mountain horse, the "Initiative of the International Association of Breeders of Bosnian Mountain Horse" was founded by A. Dolinsek, D. and E. Voloder Žiga in 2010 in Borike.

In recent years, attempts are being made to strengthen the public interest in the breeding of BBK by the International Association and with the assistance of some enthusiasts and lovers of the Bosnian mountain horse.

The number of purebred BBK is alarming small. All four stud farms and breeding centres have joined 117 BBK of all categories, including 57 breeding mares and 11 stallions. The individual horse breeders or owners in Bosnia and Herzegovina, Slovenia, Croatia, Serbia and Germany have 35 purebred BBK of all categories, including 12 mares and 6 stallions, a total of 152 purebred BBK.

Currently four major breeders conserve through their own work, own resources and big personal commitment more than three quarters of all BBK. Therefore the Bosnian Mountain Horse is extremely threatened with extinction and final disappearance of this globe. It is essential to prevent this in the near future. For more information:

fainbuch@t-online.de.

HealthyMinorCereals

An integrated approach to diversify the genetic base, improve stress resistance, agronomic management and nutritional/processing quality of minor cereal crops for human nutrition in Europe

The productivity of European and global agriculture has been vastly improved through focussing on a relatively small number of crop species (for cereals grown in Europe mainly on common wheat and barley) bred for high yields, and dependent on large inputs of mineral fertilizers. However, this strategy has left agriculture with a reduced genetic variation and diversity which makes crops more vulnerable to biotic and abiotic stresses, and high inputs of fertilizers and energy lead to environmental damage.

In comparison to conventional common wheat, minor cereals typically grow well in poor soils or under low input conditions, and have retained far greater concentration of micronutrients that have been bred out of common wheat. They are hence valued highly by both producers and consumers of organic foods, and increasingly also by conventional farmers. See:

www.healthyminorcereals.eu/

Events (extract)

- 12 April 2015
Key Contact Workshop of the Mountain Research Initiative on global change in mountain regions, Vienna, Café Landtmann's Bel Etage / <http://mri.scnatweb.ch/en/events>
- 14 - 15 April 2015
AAE Seminar, Intellectual Property rights for Geographical Indications: what is at stake in the TTIP, Department of Economics, University of Parma. Parma, Italy / <http://www.145eaae2015.unipr.it/>
- 20 - 25 April 2015
8th Asian Buffalo Congress / Directorate of Provincial Food Agriculture and Livestock, Istanbul, Turkey / www.abc2015.org / contact: arber@arber.com.fr
- 6 - 8 Mai 2015
8th GMO-FREE EUROPE Conference / Future Opportunities and Challenges, Berlin, Germany / <http://www.gmo-free-regions.org/>
- 3 - 6 June 2015
7th Balkan Conference on animal science BALNIMALCON, Sarajevo, Bosnia and Herzegovina / <http://balnimalcon.nku.edu.tr> / contact: balnimalcom2015@ppf.unsa.ba
- 16 - 18 June 2015
9th European Symposium on Poultry Genetics. Sessions on: Genomic selection, Nutrigenomics, Sustainability e and disease resistance, Biodiversity, Breeding for alternative markets, Epigenetics in Tuusula, Finland / www.epgs2015.com
- 17 - 19 June 2015
26th international DAGENE Symposium 2015 Hotel Vita, Terme DOBRNA, SI-3204 Dobrna, Slovenia / <http://www.genska-banka.si/DAGENE2015/>
- 25 June 2015
UEBT 2015 conference 'Beauty of Sourcing with Respect' Conference Biodiversity for Sustainable Development, Paris / <http://ethicalbiotrade.org/beauty-of-sourcing-with-respect-2015-conference/>
- 5 - 8 July 2015
Seeds for future generations - Determinants of longevity. Seed Longevity Workshop; International Society for Seed Science (ISSS), Werningerode, GER / http://meetings.ipk-gatersleben.de/ISSS_Longevity_2015/
- 7 - 9 July 2015
Conference: Mountain Forest Management in a Changing World, Smokovce, High Tatra Mountains, Slovakia / www.nlcsk.sk/mfm-conference/

The conference will provide the opportunity to present and discuss the potentials and limitations of current and possible future approaches to mountain forest management for providing portfolios of ecosystem services under current and future climatic and socio-economic conditions.
- 2 - 6 August 2015
ICBB: 27th Congress for Conservation Biology and 4th European Congress for Conservation Biology: Mission Biodiversity: Choosing new paths for conservation. Montpellier, France / www.iccb-eccb2015.org / contact: iccb-eccb2015@agropolis.fr
- 31 August - 4 September 2015
Innovation in Livestock Production from Ideas to Practice: 66th Annual Meeting of the European Federation of Animal Science (EAAP), Campus of the Warsaw University of Life Sciences SGGW. Polish Society of Animal Production. / <http://eaap2015.syskonf.pl>
- 11 - 13 September
"Unrecognised and Isolated Populations of rare Breeds and Varieties" 9th European Semionar on Agrobiodiversity and Annual Meeting of the European SAVE Network, at Lake Kerkin National Park, Greece. Contact: albert.meijering@save-network.com

For further data see <http://www.save-foundation.net/deutsch/aktuell.htm#Events>