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Session 33

The future of native horse breeds

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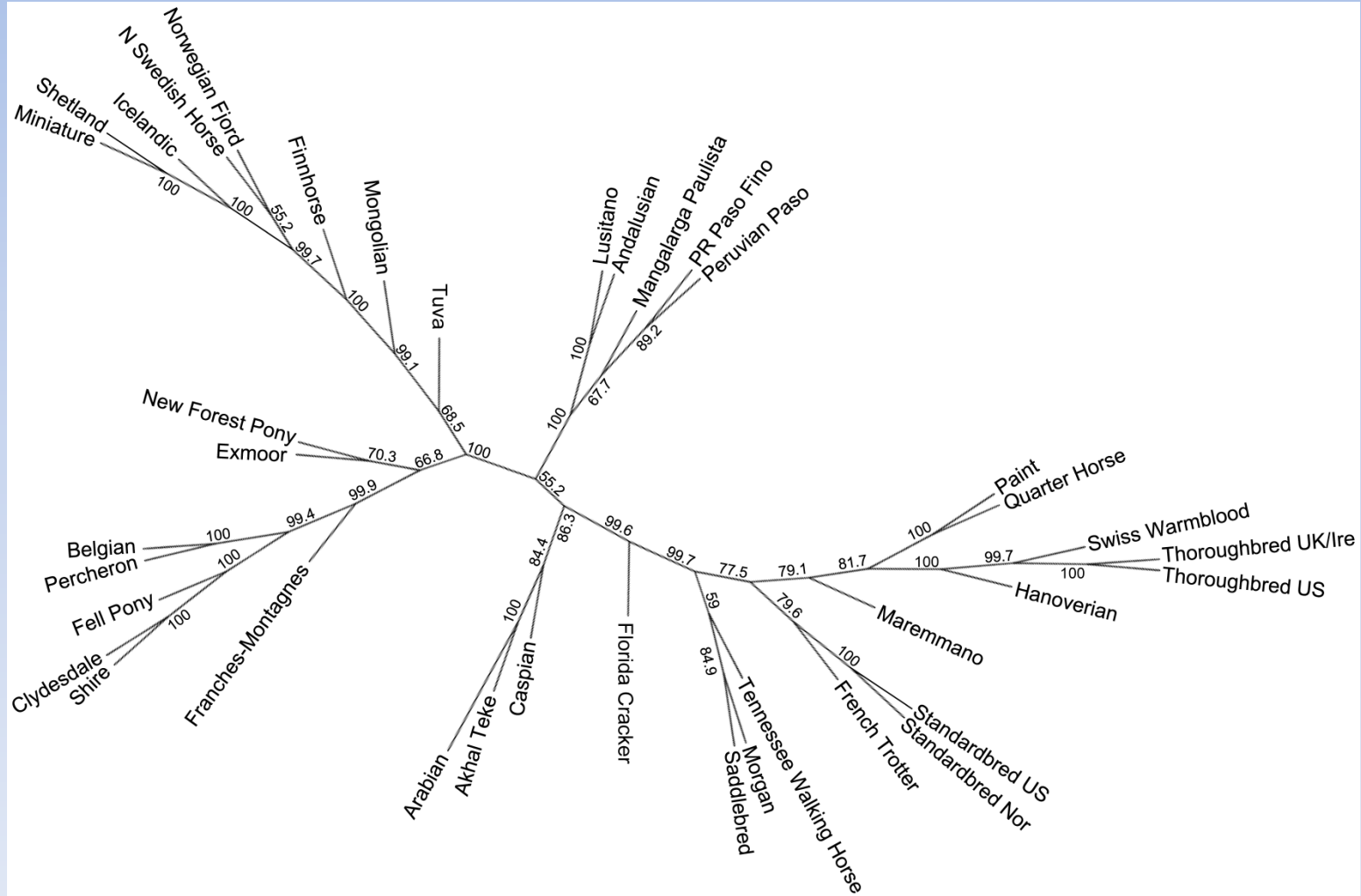
Finnhorse – multipurpose breed



Risk status of horse breeds (FAO 2015)

Risk status	Number of breeds	Breeding females	Breeding males
Unknown	479	?	?
Critical	104	100	5
Critical - Maintained	10	100	5
Endangered	67	100 – 1 000	5 – 20
Endangered - Maintained	21	100 – 1 000	5 – 20
Not at risk	137	>1 000	>20
Extinct	87		
TOTAL	905		

Breed relationship tree identifies genetically related breed groups. The tree is based on Illumina 50K SNP BeadChip genotyping of 36 horse breeds (Petersen J.L. et al. 2016. PLOS ONE 8(1): e54997).



The importance of farm animal genetic diversity

- The genetic diversity within a farm animal species is the resource to realise required changes in the phenotypic characteristics of a population. The major breed could benefit from alleles available in minor breeds using crossing and genomic introgression, and genomic marker information to introgress favorable alleles, while keeping favorable alleles for production traits in the major breed
- To maintain adaptation potential of a species
- Insurance against future changes
- Opportunities for research
- Present socio-economic value
- Cultural heritage
- Ecological value

Overview of basic conservation schemes for farm animals

Conservation

In vivo
Live animals

In vitro
Cryo-conserved materials

- Semen
- Oocytes
- Embryos

In situ
In the natural habitat and
production environment

Ex situ
In an artificial environment
(e.g. zoo)

Cryo-conservation of horse semen

- One of the challenges is dealing with the stallion to stallion variability in the cryosurvival of their semen (Loomis P.R. & Graham J.K. 2008. Anim Reprod Sci 105: 119-128).
- Individual sperm physiology affects the ability to survive freezing and thawing
- To understand how these differences affect cryosurvival, we need to understand what happens to cells during cryopreservation, what types of damage occur to the cells and when during the process that damage occurs.
- It is likely that more than one method for cryopreserving sperm will be necessary

Cryo-conservation of horse embryos

- A significant difference between embryo transfer in cattle and horses is that a very predictable superovulation regime is available for cattle and typically six transferable embryos are available from each flush (Squires E.L. & McCue P.M. 2016. J of Equine Vet Sci 41: 7-12).
- In contrast, superovulation is not currently available in horses, and consequently, embryo recovery is based on only one ovulation and generally ranges from 50% to 70% embryo recovery per cycle.
- In research conditions using e.g. equine pituitary extract: 2 – 3 (max. 4) embryos have been obtained.

FAROE ISLAND HORSE



From 1 stallion and 4 mares to 80 animals

- Effective population size (N_e) = 34
- Average inbreeding coefficient of breeding animals 25.6%.
- 12 microsatellites genotyped in 13 horse breeds
- H_{exp} in Faroe Island horse 0.44, in other breeds 0.59 – 0.74
- Genetic relationship among the breeds: Icelandic horse is the closest relative.



<http://www.rossid.com/>

References

- Berg, P. et al. EAAP2013. Nantes, France
Mikko S. et al. 2004. ISAG2004, Tokyo, Japan.

WORKING GROUP REPORT ABOUT THE NORWEGIAN NATIVE HORSE BREEDS



Foto: Landsaet for nordlandshest/westhest

Nordland horse



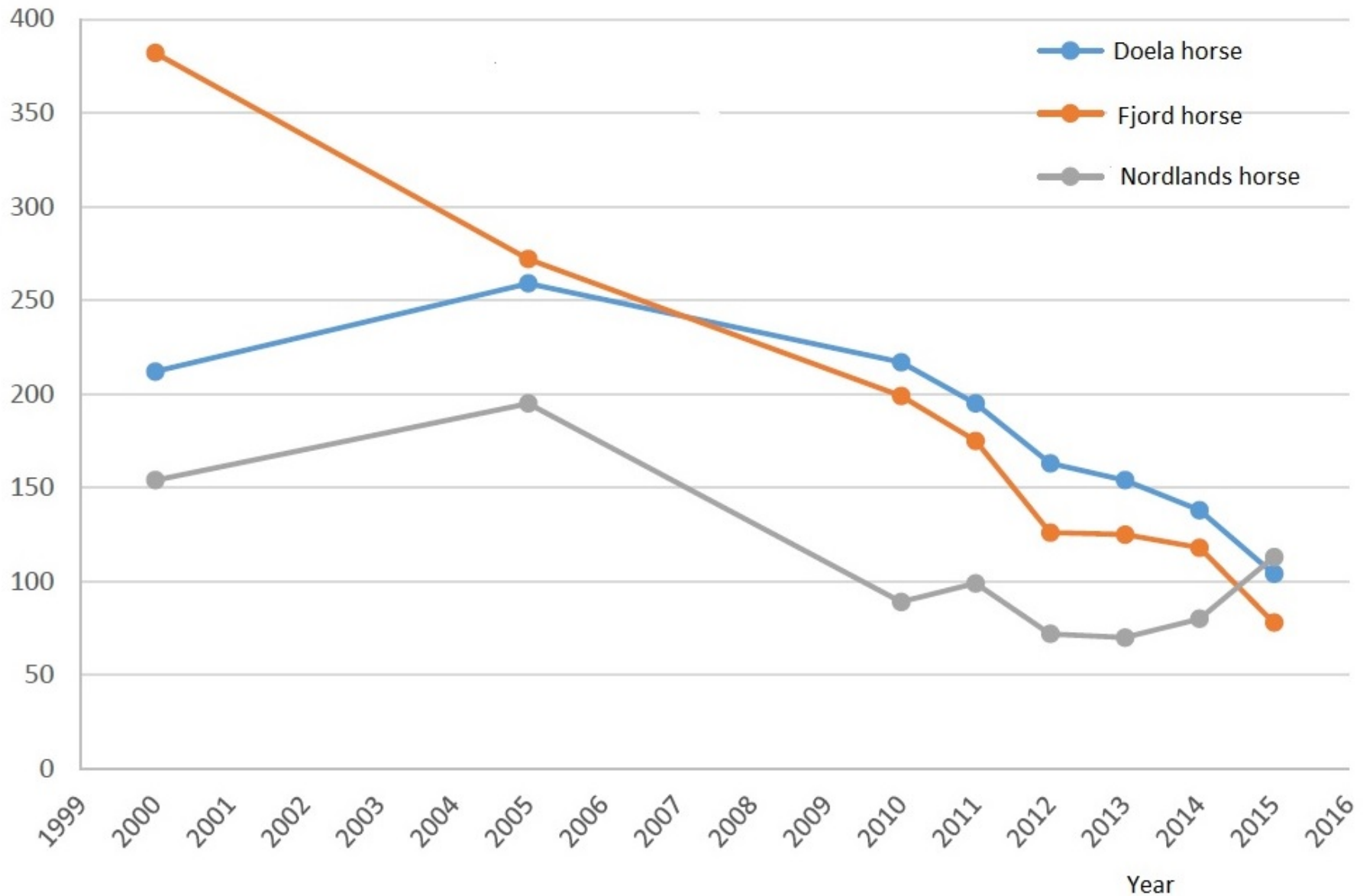
Fjord horse



Doela horse



Number of foals born in 1999 - 2015



The Norwegian working group's suggestions

- Some revisions in breeding goals and plans (e.g. rare family lineages should be maintained)
- Cryo-conservation
- Building competence in organizations responsible for horse breeding and conservation work
- Utilization of programs in monitoring of inbreeding (EVA program)
- Marketing of the Norwegian native horse
- Indicators for controlling the success of the revised breeding and conservation plan for the Norwegian native horse breeds (number of foals born annually, number of stallions in breeding, inbreeding coefficient)

FINNHORSE



Finnhorse stallions for cryo-conservation

- Target in the Finnish cryobank: 25 stallions, 50 – 100 doses per stallion
- EVA program was used to calculate population parameters.
- The suggestions for suitable stallions for cryobanking were based on optimal contribution selection.

Reference: Tenhunen S. & Salompää T. 2016. Selection of Finnhorse stallions for cryopreservation. BSc thesis. Savonia University of Applied Sciences.



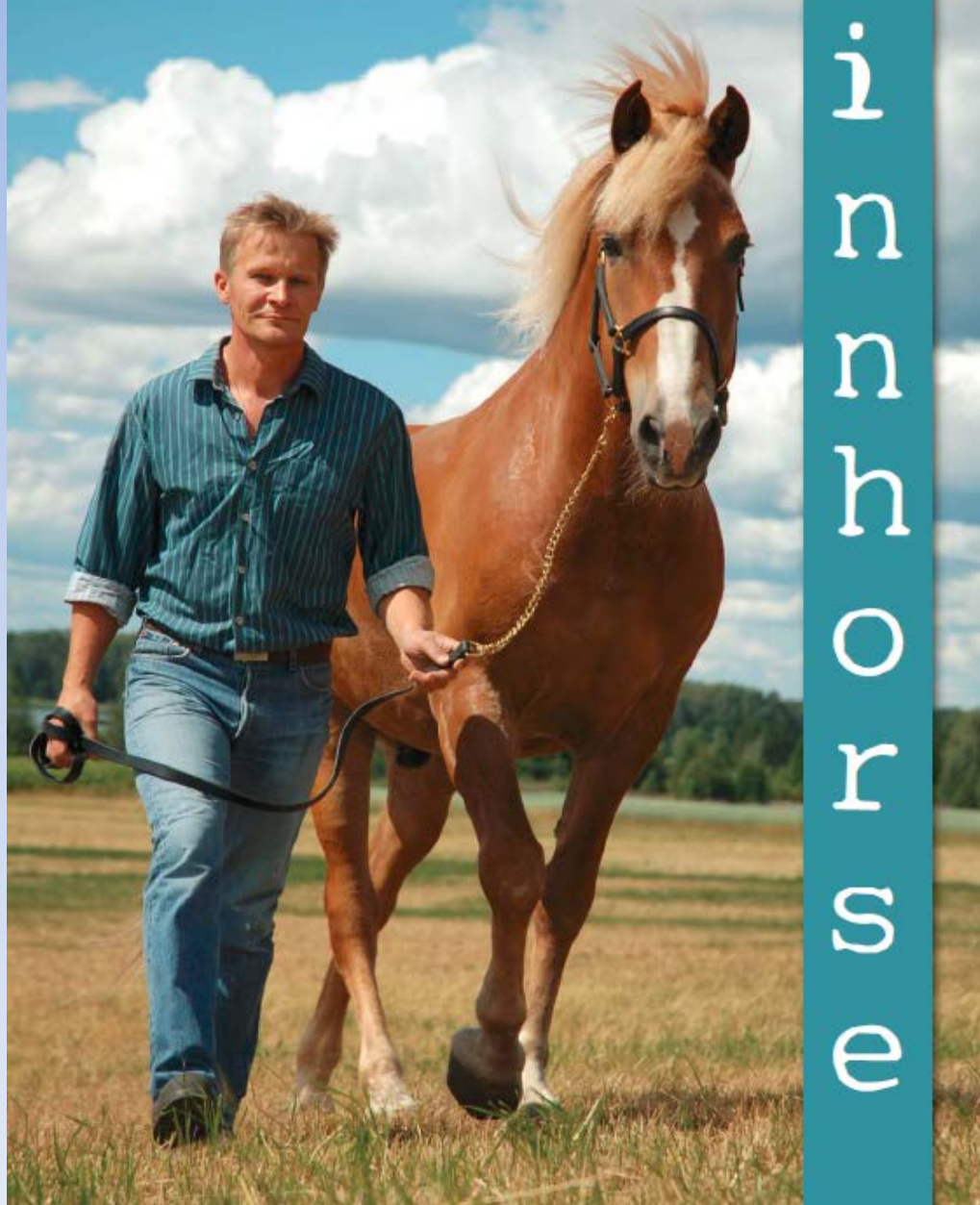
The screenshot shows the NordGen website with the following content:

- Logo:** NordGen and Norden. Below the logo, it says "NORDGEN ÄR EN INSTITUTION UNDER NORDISKA MINISTERRÅDET".
- Navigation:** Home, Om NordGen Husdjur, NordGens Råd Husdjur, Aktiviteter, EVA-programmet, Hvorfor og hvordan bevare?, Bevaringsarbeidet i Norden, Internasjonale avtaler, Publikasjoner, Nordisk forskning på klimaendring, Tidligere temaer.
- Main Article:** "Cryopreservation of Finnhorse semen". The article states: "Two Finnish students have finished their bachelor theses in which they assessed the selection of Finnhorse stallions for semen cryopreservation. Finnhorse is the only native horse breed in Finland. It has a long history and is an invaluable part of the Finnish cultural and historical heritage. The hardworking Finnhorse was used in agriculture and forestry, and it bravely served in the war fronts. In the past, the population size was over 400 000 horses but now the population has decreased to only 20 000 individuals. Yearly registrations of foals born have gone down to around one thousand animals. The Finnhorse is part of the National Animal Genetic Resource Program administered by the Natural Resources Institute Finland (Luke). At present, the conservation of the Finnhorse relies only on private horse owners. Saija Tenhunen and Tytti Salompää evaluated cryopreservation options of stallion semen in their bachelor theses."
- Image:** A photograph of a brown Finnhorse being led by a man in a green vest.
- Caption:** "Stallion Isäntä: the National champion of working Finnhorses in Ylivieska 21.5.2016. Isäntä is owned by Siru Saarinen and was handled by Pentti Sarja (photo: Saija Tenhunen)."
- Other News:** "Successful OCS workshop at Häfjell", "Genomic selection awarded", "Conference on grazing", "Second global assessment of AnGR", "Characterization of native Nordic Breeds", "Swedish Mountain Cattle Documentary", "Nordic Brown Bee Plan of Action".

LIITE 1: ORILISTA KOKO POPULAATIOSTA, IKÄRAJA 14 VUOTTA

Rekisterinumero	Nimi	Orin tiedot	Kantakirjaus/ muut
1520-02	Railin rasmus i. Karski ei. Raino	Syntymäaika: 2.6.2002 Väri: Punarautias	
1043-07	Lenni Mek i. Menni ei. Vekseli	Syntymäaika: 27.4.2007 Väri: Vaaleanpuna rautias	
2254-02	Juholan Jojo i. Likan Poika ei. Vauhti-Poika	Syntymäaika: 17.6.2002 Väri: Punarautias	
1529-04	Kesäsade i. Kesä-Toto ei. Uskimus	Syntymäaika: 25.4.2004 Väri: Punarautias	
1981-03	Virkku-Hirnu i. Vikunen ei. Tosi-Pinko	Syntymäaika: 7.8.2003 Väri: Kulomusta Suuntaus: Pienhevonen	Ei palk KTK
1377-04	Savelan Hemuli i. Lerkkana ei. Jonnen-Valtti	Syntymäaika: 5.6.2004 Väri: Rautias Suuntaus: Ratsu	KTK
1557-03	Pojan Naskali i. Pilven Poika ei. Tosi-Pinko	Syntymäaika: 11.6.2003 Väri: Tummanpuna- rautias	
1868-04	Veihaivei Jii i. Apeli ei. Peto	Syntymäaika: 8.6.2004 Väri: Punarautias Suuntaus: Ratsu	KTK
1604-05	Kvartaali i. Ruutun Ruksi ei. A.P. Passeli	Syntymäaika: 16.6.2005 Väri: Punarautias	
2120-05	Pikku-Laakeri i. Taika-Laakeri ei. Pikku-Muisto	Syntymäaika: 8.6.2005 Väri: Punarautias Suuntaus: Työhevonen	Ei palk KTK
2295-05	Arska Poika i. Pilven Poika ei. Selmeri	Syntymäaika: 3.6.2005 Väri: Punarautias	
246001S00141163	Maarian Arvo i. Knuutilan Veikko ei. Apeli	Syntymäaika: 11.5.2014 Väri: Vaaleanruunikko	

 mmm.fi Get to know the



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Project on northern and Arctic domestic animals

Arctic Ark. Human-animal adaptations to the Arctic environment: natural and folk selection practices
(Arc-Ark)



University of Porto



Yakutian Scientific Research Institute of Agriculture



North-Eastern Federal University in Yakutsk

In the Arctic, traditional animal husbandry is based almost exclusively on reindeer (*Rangifer tarandus*) but in Lapland, northern Russia and Siberia also other locally adapted animals, namely cattle (*Bos taurus*) and horse (*Equus caballus*) are used for food production and other societal and cultural needs.

Arkhangelsk

- Kholmogor cattle
- Mezen horse
- Nenets reindeer

Finnish Lapland

- Northern Finncattle
- Finnhorse
- Fennoscandian reindeer



Yakutia

Eveno-Bytantaj

- Yakutian cattle
- Yakutian horse
- Evenki and Even reindeer

Finnhorse



Yakutian horse



Mezen horse



Garranos





IN the Arctic Ark PROJECT

Genomics studies

- Whole-genome sequencing
- Gene expression studies

The future of native horse breeds:

Action points

- Old breeds, new uses
- Repurposing native breeds in tourism, therapy and leisure
- Native breed genetics: genotypes and traits
- Managing small breeding populations
- Scientific innovations in breeding for native breeds
- Native breed horses and place-based identity, traditional knowledge
- Working group, EAAP2017 Session on the topic

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- Pictures, useful materials etc

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Thank you!

Global plan of action

1. Characterization, inventory of genetic resources and monitoring of trends and associated risks
2. Sustainable use and development
3. Conservation
4. Policies, institution and capacity-bulding



NATURAL RESOURCES
INSTITUTE FINLAND