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„Game management in sustainable forestry”
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Forestry and game management: benefits and conflicts

András Náhlik
Institute of Wildlife Management and Vertebrate Zoology
Faculty of Forestry
University of West Hungary

Relationship of forests and ungulates in natural ecosystems

- The evolutionary shape of plants was formed under the selection pressure of the large herbivores.
- In most of the temperate ecosystems the density of large herbivores is relatively low because their populations are regulated by density dependent and independent factors or even by social behavior.
- Herbivores consume less than 10% of the primary plant production and even a small proportion of that is consumed by large herbivores (***Putman, 1986***).

Putman, R.J. 1986. Grazing in Temperate Ecosystems: Large Herbivores and the Ecology of the New Forest. Croom Helm-Chapman and Hall, London, 210. pp.

Relationship between forest and ungulates in commercial forest ecosystems

- The multifunctional concept of forests leads to conflicts between interest-groups preferring particular functions. (***Nießlein, E., 1980***).

- Damage caused in afforestations and reforestations is problematic because the density of ungulates is increased artificially and the object of their feeding is the cultivated commercial and/or protection forests.

- Therefore in cultivated forests the overpopulation of ungulates leads not only to economic damage but also to ecological one. (***Putman, 1996***).

Nießlein, E., 1980. Waldeigentum und Gesellschaft : e. Studie zur Sozialbindung d. Eigentums. Hamburg-Berlin, Parey, 174 pp.
Putman, R.J. 1996. Ungulates in temperate forest ecosystems: perspectives and recommendations for future research. Forest Ecology and Management, 88: 205-214

The effect of ungulates' feeding

The form of damages: browsing, eating of mast, bark stripping, stem breaks, antler rubbing, scraping the antlers against the tree.

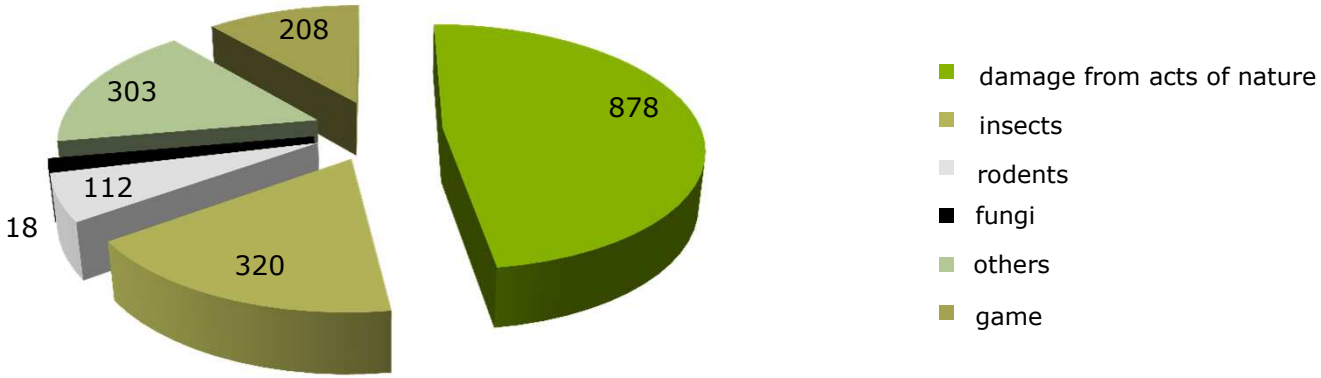
- Quantitative damage
- Qualitative damage

BUT

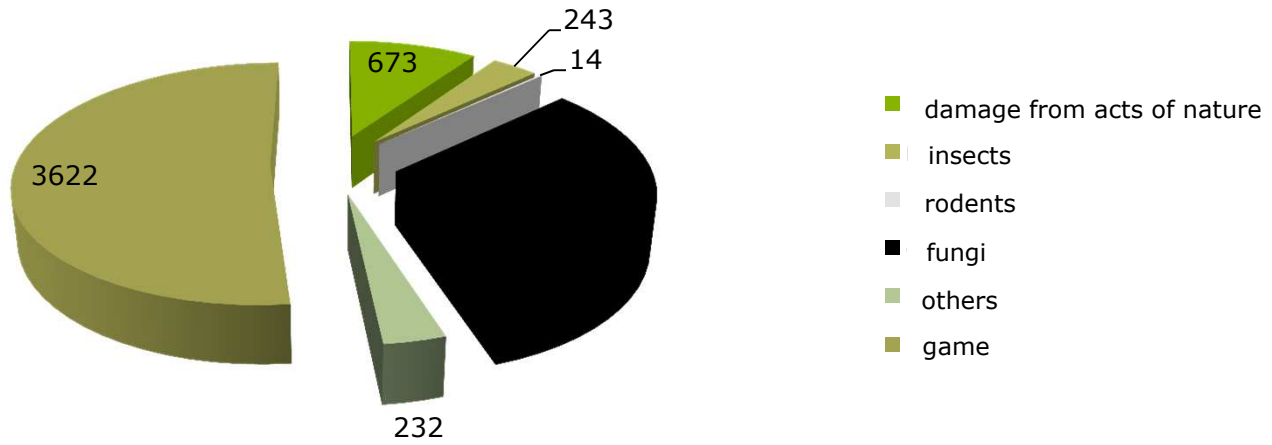
not every browsed twig, stripped or rubbed stem, eaten mast should be valued as damage!

Proportion of different types of quantitative and qualitative damages in Hungary

Quantitative damage



Qualitative damage



Effect of browsing on the growth of the seedlings

- Single browse doesn't necessarily lead to decrease of the height or biomass of a seedling ***(Eiberle 1975, Hoogester & Karlsson 1992)***

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Kullberg, Y. and Welander, N.T. 2003. Effects of simulated winter browsing and drought on growth of *Quercus robur* L. seedlings during establishment. Forest Ecology and Management, 173: 125-133.

Náhlik, A. und Walter-Illés, W. 1998: Die Einwirkung des Wildverbisses auf die Mortalität und das Höhenwachstum der Pflanzen verschiedener Baumarten – ein simuliertes Experiment. Beiträge zur Jagd- und Wildforschung, Halle/Saale, Deutschland, 23: 95-105

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- In other cases due to an overcompensatory growth, lightly browsed seedlings are even taller than the not browsed ones ***(Náhlik & Walter-Illés 1998, Kullberg & Welander 2003)***.
- However, the overcompensation at low quality habitats is not working ***(Danell et al. 1991)***.
- The repeated or more intensive browse of seedlings can result in a strong decrease of the height or even in the mortality of the seedlings ***(Eiberle 1975, Náhlik & Walter-Illés 1998)***.

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Economic consequences of the browsing on the level of a stand

- Incomings shortfall: quantitative and qualit
  decrease of the quality of the forest stand (
  Náhlik et al 2007).
- Increased expenses: extra expenses of sec
  replacement of seedlings, expenses of extr
  mitigation costs (e.g. pruning), extra exper
  to change the regeneration method,
- Other expenses: costs of the protection of forest stands/individual trees, and penalties (unclosed canopy of the regeneration after a defined deadline or after the 10 years' revision) (Náhlik et al. 2007).

Náhlik A.; Tari T. & Sándor Gy. 2007: Az erdei vadkár keletkezésének okai és következményei, a vadgazdálkodás
időszerű kérdései, 7.-Vadkár
Olofsson, J. and Strengbom, J. 2000: Responses of galling invertebrates on *Salix lanata* to reindeer herbivory. Oikos, 91: 493-498.
Pepin, D.; Renaud, P-C.; Boscardin, Y.; Goulard, M.; Mallet, C.; Anglard, F. and Ballon, P. 2006. Relative impact of browsing by red deer on mixed coniferous and broad-leaved seedlings – An enclosure-based experiment. Forest Ecology and Management, 222: 302-313.
Reimoser, F; Armstrong, A. and Suchant, R. 1999. Measuring forest damage of ungulates: what should be considered. Forest Ecology and Management, 120: 47-58.

Long term effect of browsing

- In Hungary 4-6,000 ha of regenerations are damaged by browsing. The compensation payed amounts to 450,000 EUR + 4 million EUR paied for fencing.
- But we do not know if it was justified the protection by fence of all the forest compartments, because we know a little about the long term economic effect of browsing
- We investigated a sessile oak regeneration 17 years after planting. It was documented in average 55% browsing damage during 7 years. We have found the following ***(Náhlik et al. 2012)***:

Náhlik, A., Dremmel, L., Sándor, Gy. & Tari, T.: A csemetekori vadrágás következményeinek vizsgálata rudas állományokban. Erdészettudományi Közlemények. 2012 (2) 1: 163-172.

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- We investigated a sessile oak regeneration 17 years after planting. It was documented in average 55% browsing damage during 7 years. We have found the following ***(Náhlik et al. 2012)***:
  - Browsing caused a slight but significant, 50 cm decrease in the height of trees and a high ratio of fork growth.
  - We concluded that despite heavy browsing activity which lasted several years timber quality at harvesting didn't decrease.
  - Browsing raised the costs of regeneration due to the expenses of increased weeding (normative subvention 358-363 EUR/ha during 5 years, but if after 3 years the closure of the seedling doesn't reach 70% it won't be payed onwards, and a penalty has to be paied).

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f mast eating

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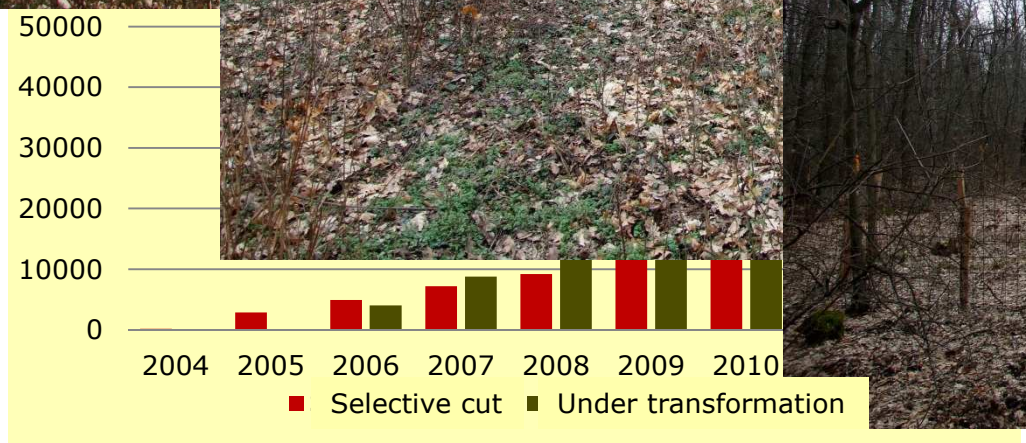
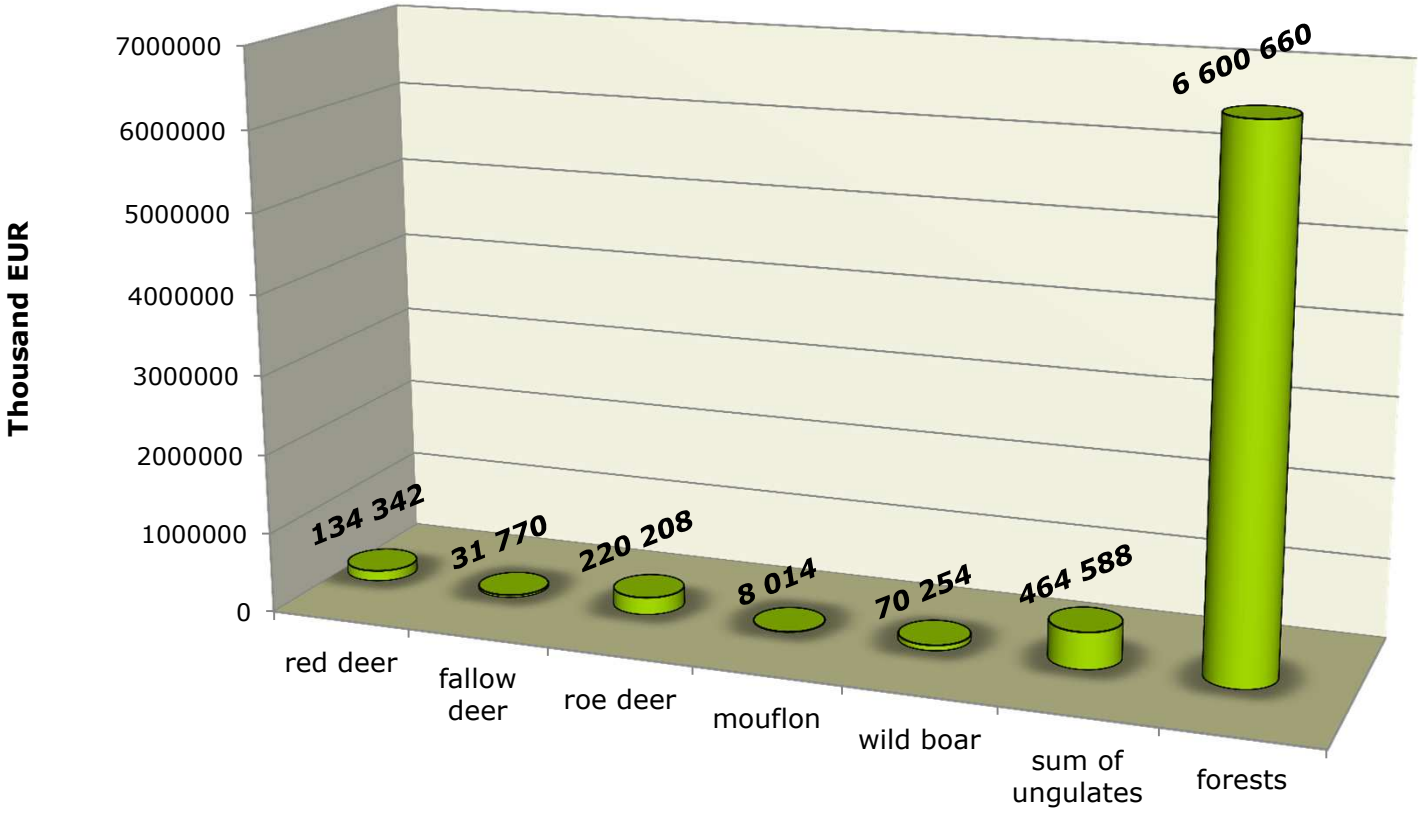
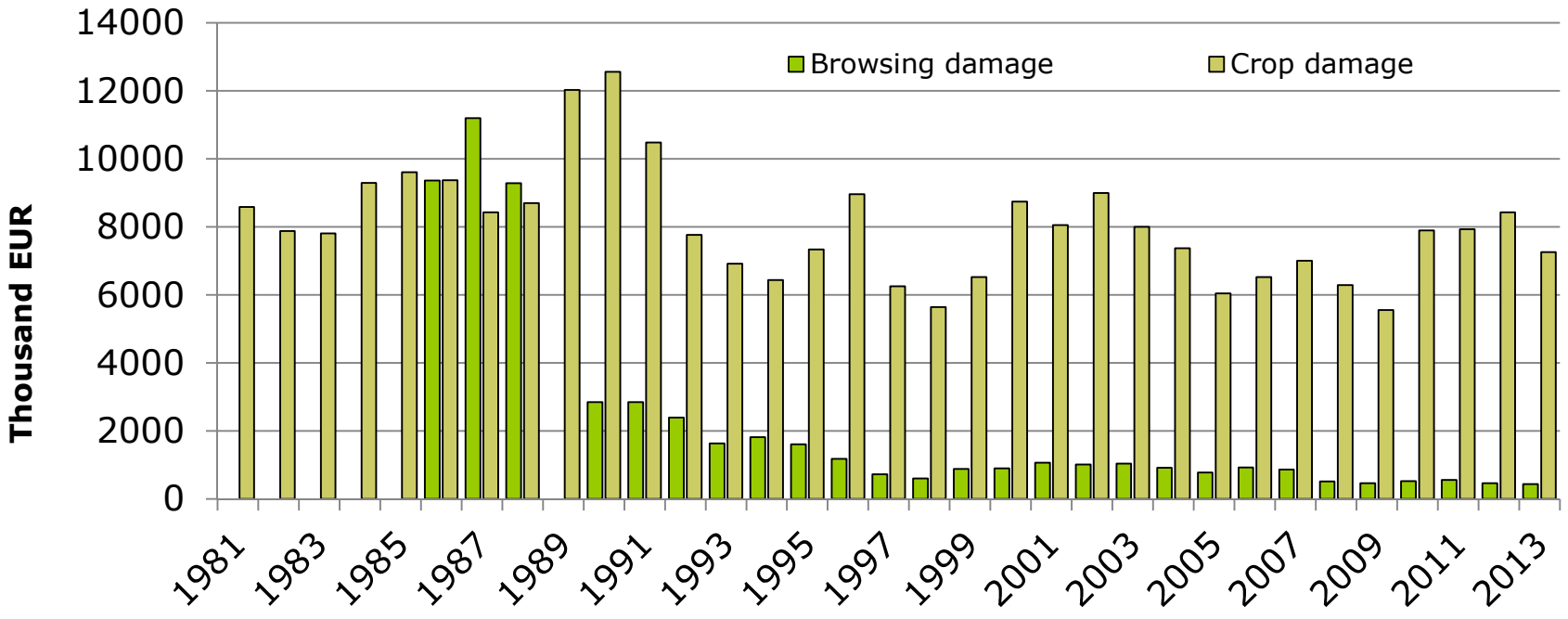
and/or artificial



Gross asset value (GAV) of ungulates and forests in Hungary



Evaluation of the damages caused by ungulates in Hungary (corrected by inflation)



- The paied crop damage in 2013 was 7,259,703 EUR
- The paied forest damage in 2013 was 431,838 EUR, while the costs of forest protection against ungulate damages was 4,000,000 EUR

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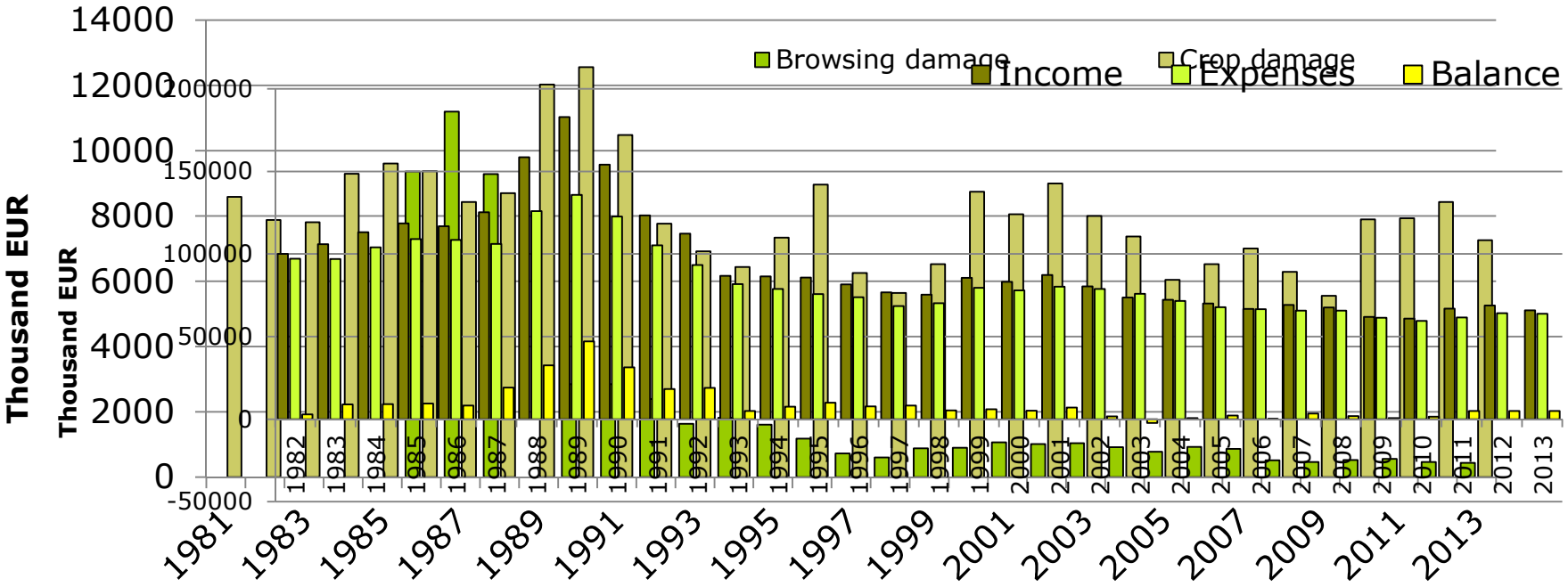
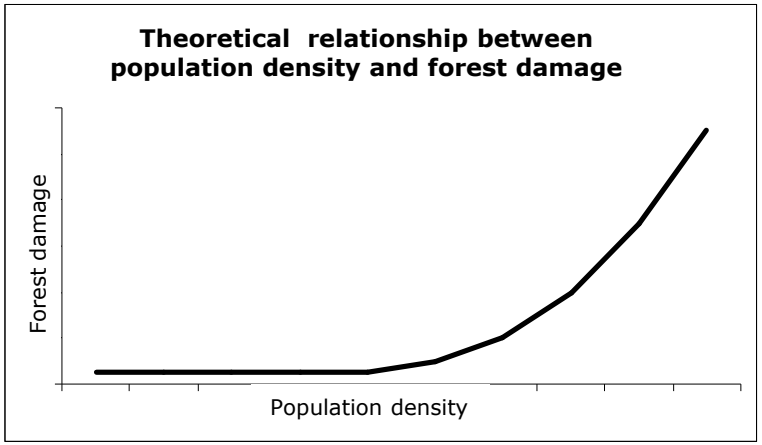


- The paied crop damage in 2013 was 7,259,703 EUR
- The paied forest damage in 2013 was 431,838 EUR, while the costs of forest protection against ungulate damages was 4,000,000 EUR
- The income from game management in 2013 was 63,892,253 EUR, while the balance was 4,897,203 EUR

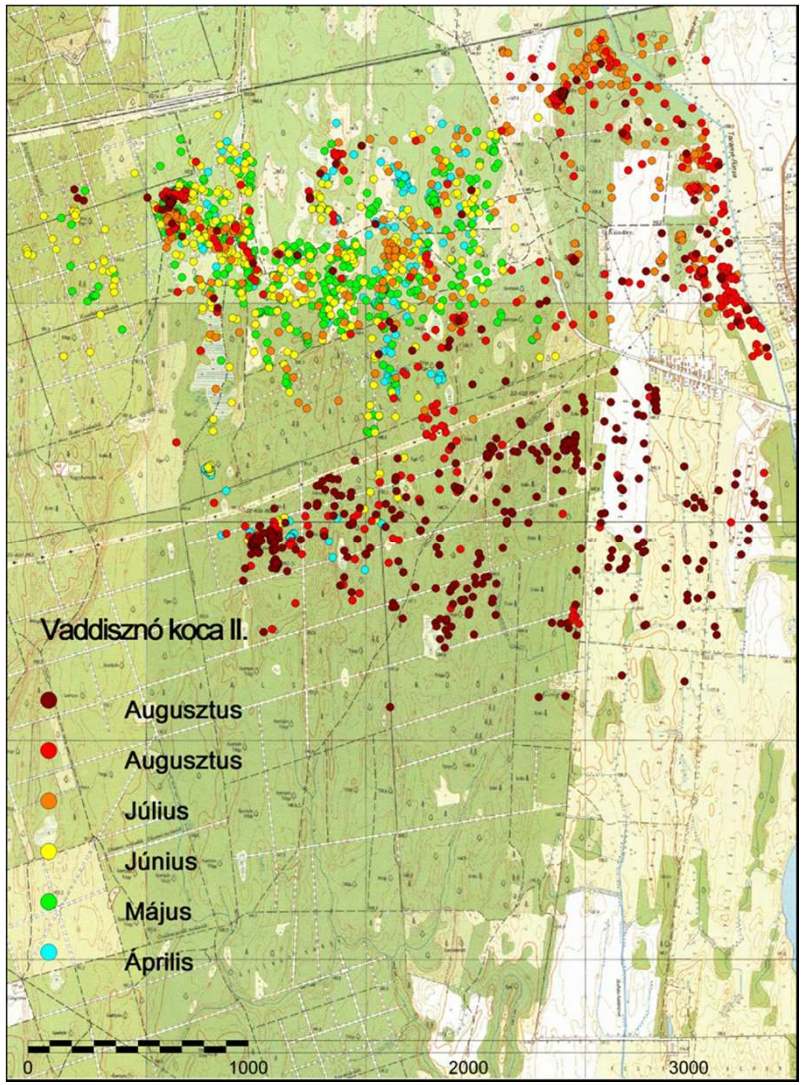
Factors affecting forest damages

- The density of ungulates



Factors affecting forest damages

- The density of ungulates
- Method of regeneration; tree species



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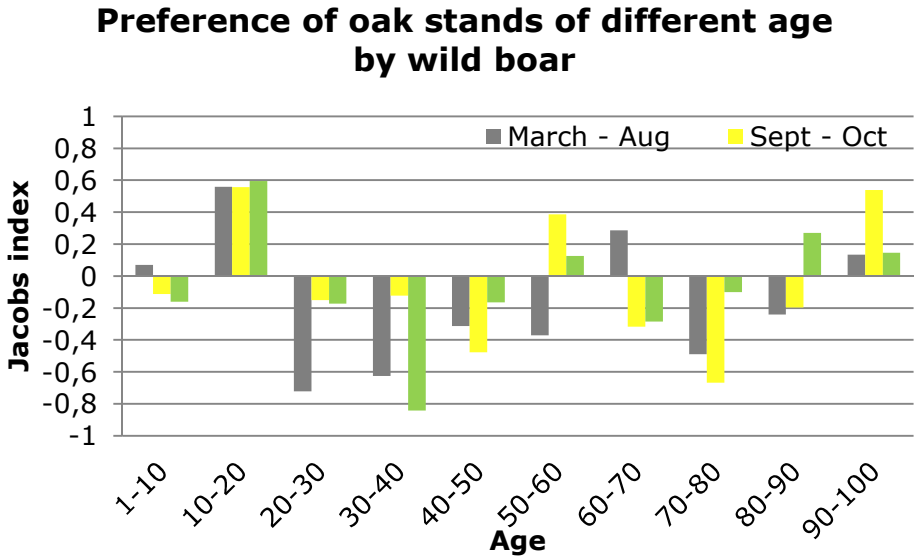

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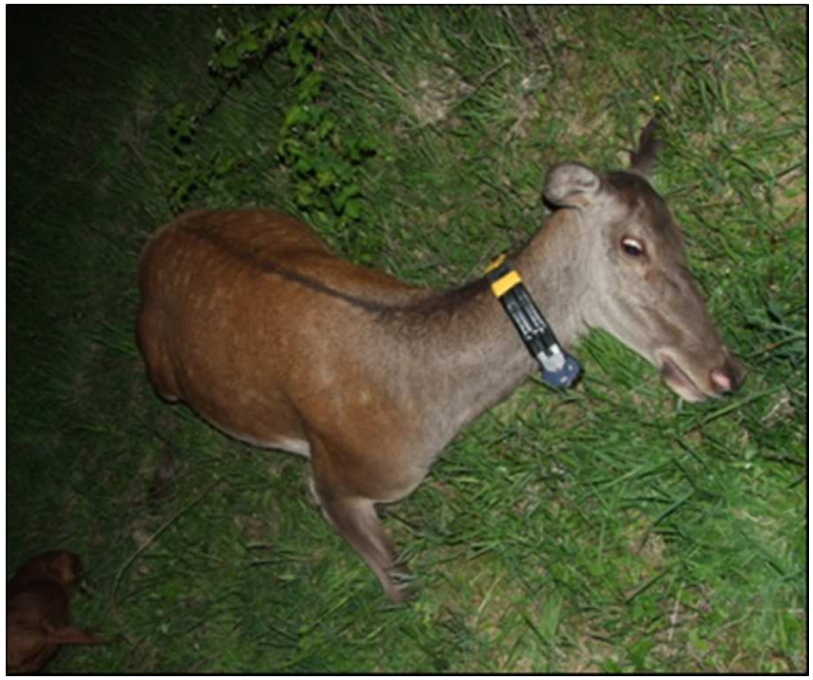

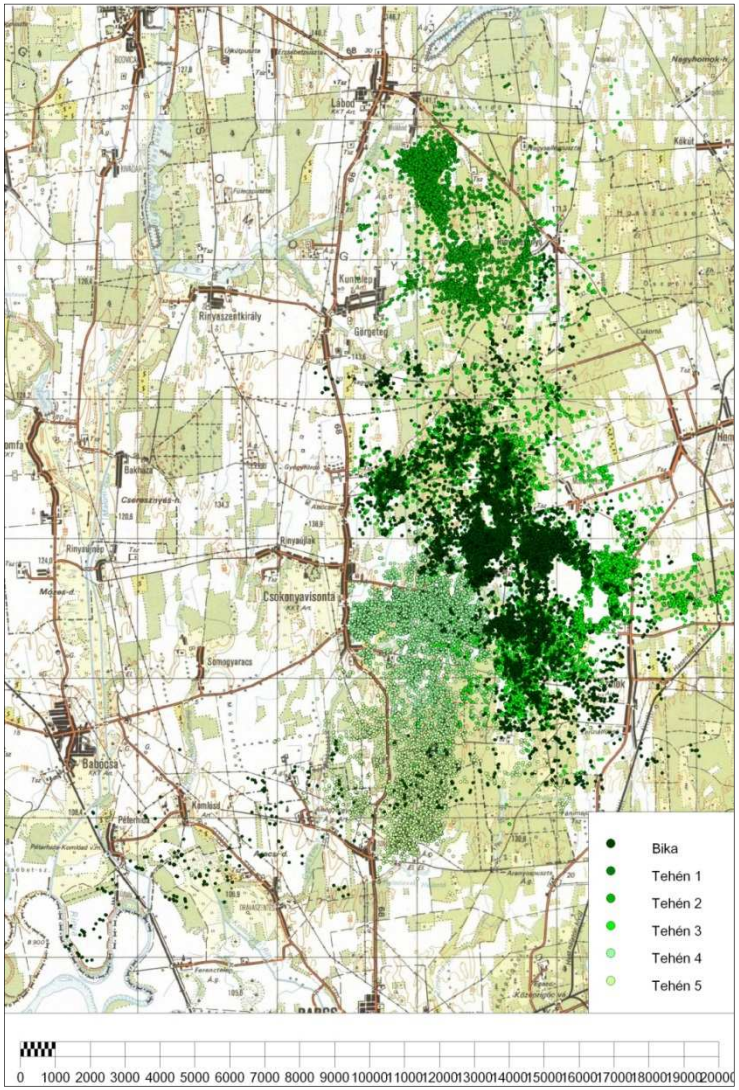

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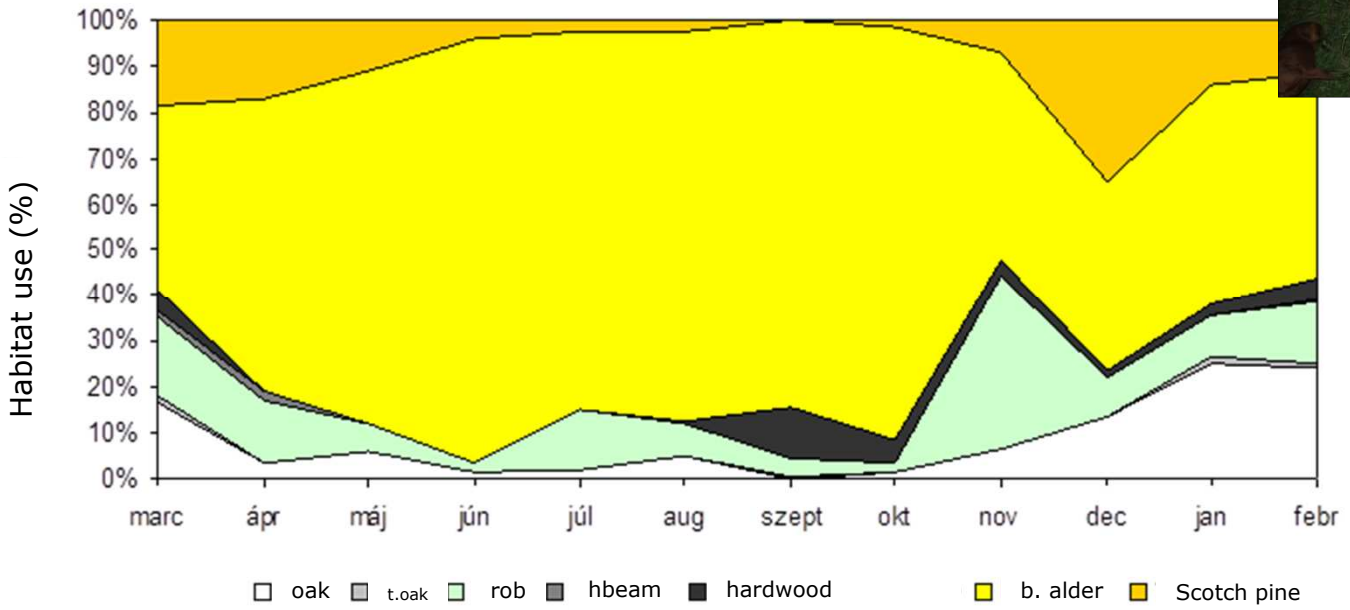
Forest habitat use of red deer



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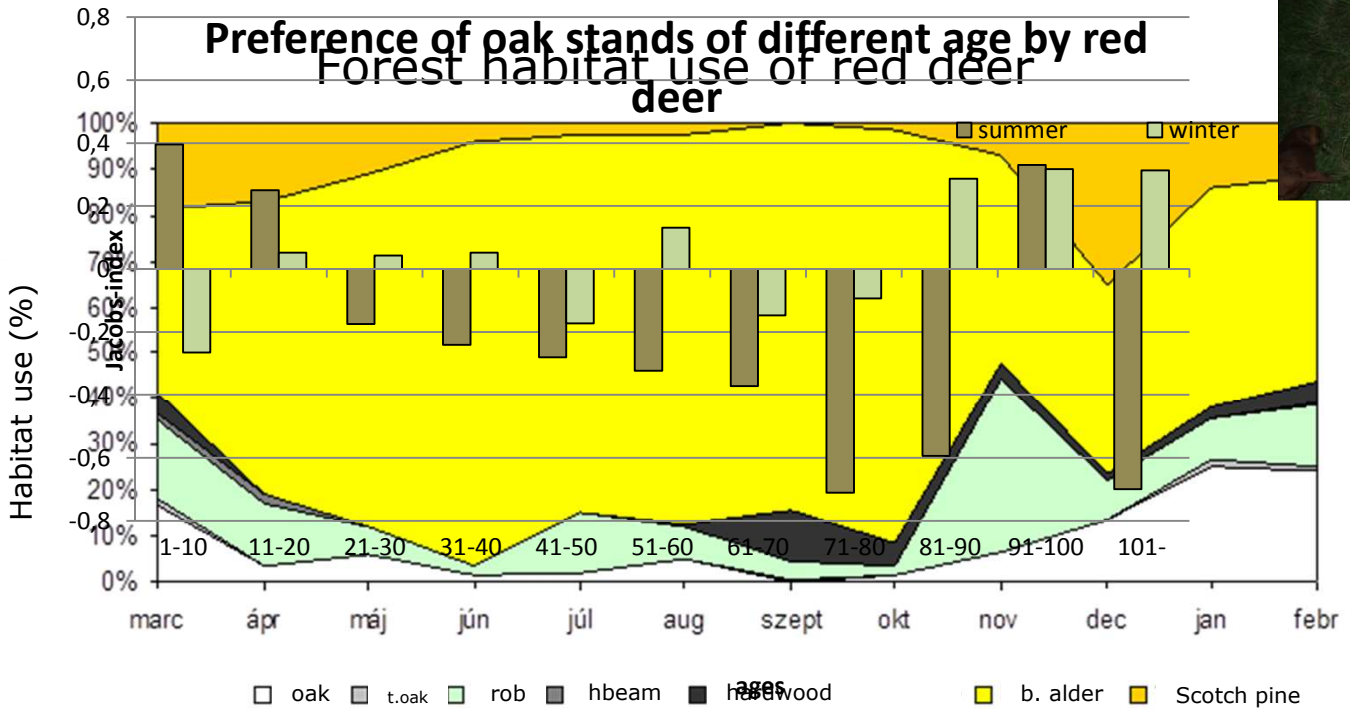

Factors affecting forest damage

- The density of ungulates
- Method of regeneration; tree species
- The age of the seedling
- The collateral plants beside the seedlings
- The position of the regeneration within the area
- Method of protection against damage – efficiency vs. cost
- The access to the natural and supplementary food
- The way of supplementary feeding
- The weather in winter
- The disturbance of the ungulates

Conclusions regarding management

- Ungulate density should be decreased to an extent when its influence on economy and ecosystem can be tolerated.
- Such a density limit could be e.g. when natural regeneration and/or continuous forest cover management can be performed.
- Taking into consideration the economic and ecological goals, it is desirable to plan the ungulates' harvest successively monitoring the status of the forest and having permanent feedback about the success of the natural regenerations.
- However, we should keep in mind that density is not the only factor affecting forest damages. Consequently, exclusively decreasing the population density wouldn't be a stable management tool.

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Not every browsed twig should be considered as a damage to the seedling and not every perished tree means damage to the forest!

A gazdálkodásra vonatkozó következtetések

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In the future the limit of ungulates' density will be more and more determined by the goals of the forest protection

Dziękuję za uwagę!