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## INTRODUCTION

To assess the long-term effects of grazing on vegetation patterns and structure, insight is needed in the processes by which ungulates affect the regeneration of shrub and tree species in vegetation mosaics. Grazing of grasslands may promote the invasion of shrub species by opening up herbaceous vegetation cover. In woodlands natural regeneration may be totally impeded by ungulate grazing, due to browsing of young shrubs and trees. In the long run this may lead to a shift in vegetation structural types at the landscape level, which affects the diversity of plant and animal communities. Studies are carried out in two- or three-phase vegetation mosaics consisting of grassland, (dwarf)shrubs and woodland on contrasting soil types.

## RESEARCH SITES

- *Staatsdomein*: a heath-woodland grazed by wild ungulate species, i.e. red deer, roe deer and wild boar
- *Baronie Cranendock*: a heath-woodland with abandoned fields, grazed by Iceland ponies since 1972
- *National Park Veluwezoom*: a heath-woodland with abandoned fields grazed by Icelandic ponies, red deer, roe deer and wild boar
- *Beuningen floodplains*: riverine grasslands and woodlands with abandoned fields grazed by cattle (Brandred breed) and Konik horses.

## METHODS

- Chronosequences of vegetation maps from aerial pictures
- Repeated measurements on regenerating shrubs and trees (spatially located by GPS)
- Permanent plot surveys
- Exclosure experiments
- Observations on animal movements and foraging behaviour



*Konik horses grazing in a riverine floodplain*



## CONCLUSIONS

- Palatable woody species such as rowan (*Sorbus aucuparia*), alder buckthorn (*Rhamnus frangula*) and pedunculate oak (*Quercus robur*) were severely browsed by wild ungulate species (red deer and roe deer)
- Selective browsing promoted less-browsed species, i.e. Scots pine (*Pinus sylvestris*) and beech (*Fagus sylvatica*), which showed successful regeneration in woodlands with heavy browsing pressure.
- Successful regeneration of browse-sensitive species such as pedunculate oak may occur when it is found associated with browse-tolerant species such as bramble (*Rubus* spp.) or hawthorn (*Crataegus monogyna*). This mechanism of 'associated resistance' allows oak to regenerate successfully in grazed grasslands.
- Bark-stripping is another impact ungulates have on woodland dynamics. In woodlands on sandy soils beech was one of the species preferentially selected by horses. Bark-stripping rate was dependent of dbh (smaller trees more preferred), tree location (lane trees were less stripped than stand trees) and bark structure.

## REFERENCES

- Kuiters, A.T. & P.A. Slim. 2002. Regeneration of mixed deciduous forest in a Dutch forest-heathland, following a reduction of ungulate densities. *Biological Conservation* 105: 65-74. Kuiters, A.T. & P.A. Slim. 2003. Tree colonisation of abandoned arable land after 27-years of horse-grazing: the role of bramble-shrub as facilitator of oak wood regeneration. *Forest Ecology and Management* 181: 239-251.