

# Similarities in foraging patterns of wisent, red deer and various breeds of European primitive horses

Daniel Klich

Chair of Applied Ecology, John Paul II Catholic University of Lublin

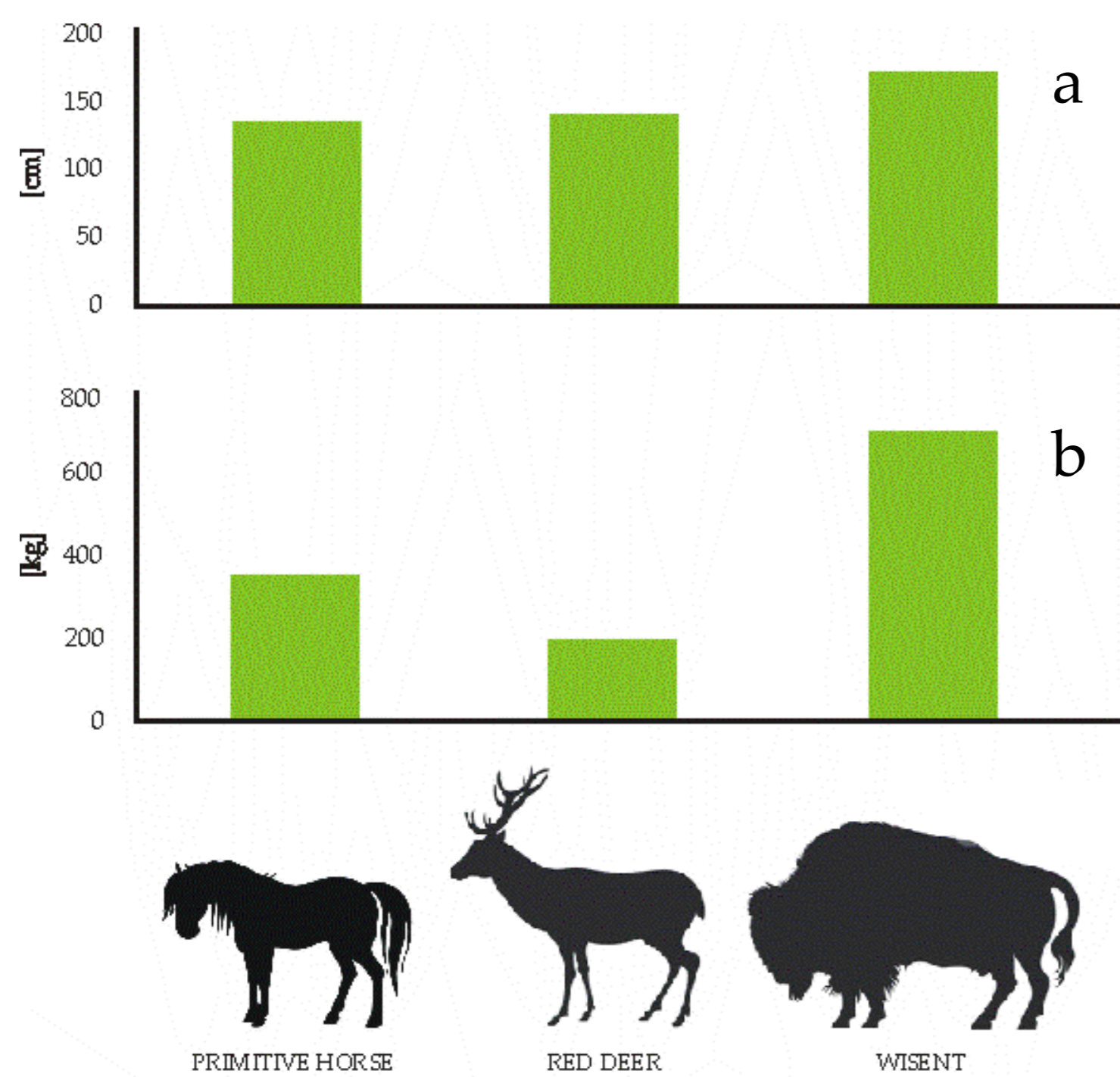


Fig.1. Mean height to withers (a) and body mass (b) of adult male of primitive horse, red deer and wisent.

## Introduction

The population numbers of free-living wisents (*Bison bonasus*) increased considerably since the initiation of their restitution and conservation. After the decline in 1990s, the current population trend is increasing (Pucek et al. 2004, Olech 2008, Krasieńska et al. 2014). Possibilities of wisent's population development are high, since only about 1% of its original range is now occupied, and there are a number of potentially suitable habitats in Europe (Kuemerle et al. 2011). However, following an increase of population numbers, potential conflicts may occur, involving other species, such as the red deer which is considered the most important competitor regarding foraging relations (Pucek et al. 2004). Red deer (*Cervus elaphus*) is also among the most numerous herbivorous mammals of Europe, occurring in various landscapes and inhabiting now similar area to original range of wisent in Europe (see: Pucek 1991, Lovari et al. 2008). Primitive horses (*Equus caballus*) on the other hand, ceased to belong to the native fauna of Europe long time ago, but nowadays they, or rather their hybrids, are frequently used in free grazing programs in grassland-type and meadow-forested mosaic areas, oriented towards the prevention of biodiversity loss in Europe (Vera 2009, Kugler, Broxham 2014, Merckx, Pereira 2014). Current trends suggest that free ranging primitive horses may in time develop a feral metapopulation of this species. The aim of this paper was an attempt to analyse similarities in foraging patterns and possible competition among the three species: wisent, red deer and primitive horse, occupying similar habitats in Europe.

**Key words:** Diet, bark stripping, foraging activity, habitat selection, competition

## Diet

Red deer is mostly regarded as an intermediate feeder, and the woody plants content in its diet ranges between 40% to over 90% (e.g Gebert, Verheyden-Tixier 2001). The European bison is recognized as a grazer, and woody plants compose much lower percentage of its diet (7-33%) (Pucek et al. 2004). Primitive horses as typical grazers only marginally forage upon the woody plants (Cosyns et al. 2001). Both red deer and wisent are ruminants but vary regarding feeding patterns and body mass (Fig.1). Mean body mass of adult red deer male reach approximately 200 kg (Okarma, Tomek 2008), while a wisent may be 2-3 times heavier (Krasieńska, Krasieński 2002), therefore their requirements of food intake per unit of body mass will be different. The ability for food selection depends also from the width of a jaw, which in turn is connected with body mass of an animal (Hanley 1982). Primitive horses' body mass is comparable to that of red deer, but both species differ regarding their feeding patterns. Grazers (horse and wisent) usually have to deal with different plant composition (forbs and grasses) on a meadow than browsers (shrubs and trees) in woodland. In Białowieża Forest, a diet overlap between wisent and red deer was assessed at about 40%. Thus the red deer is regarded as a main natural competitor for the wisent (Pucek et al. 2004). On the other hand, the wisent diet contains high proportion of grasses and herbaceous plants, which suggest possible high diet overlap with primitive horses. Various studies conducted in temperate ecosystems on grazing equids and bovines, demonstrated a high overlap of their diet (between 65 to 95%) (Menard et al. 2002). Although cattle belong to a different genus than a wisent, they characterise in similar body mass and digestive tract. We may also expect similarities in the diet of primitive horses and a wisent. Grasses and sedges compose 80-99% of polish koniks' diet (depending on site and a season), over 90% of Shetland ponies' diet (Cosyns et al. 2001, Lamoot et al. 2005, Chodkiewicz, Stypiński 2011) and at least 65% of wisent's diet (Gębczyńska et al. 1991) (Fig.2).

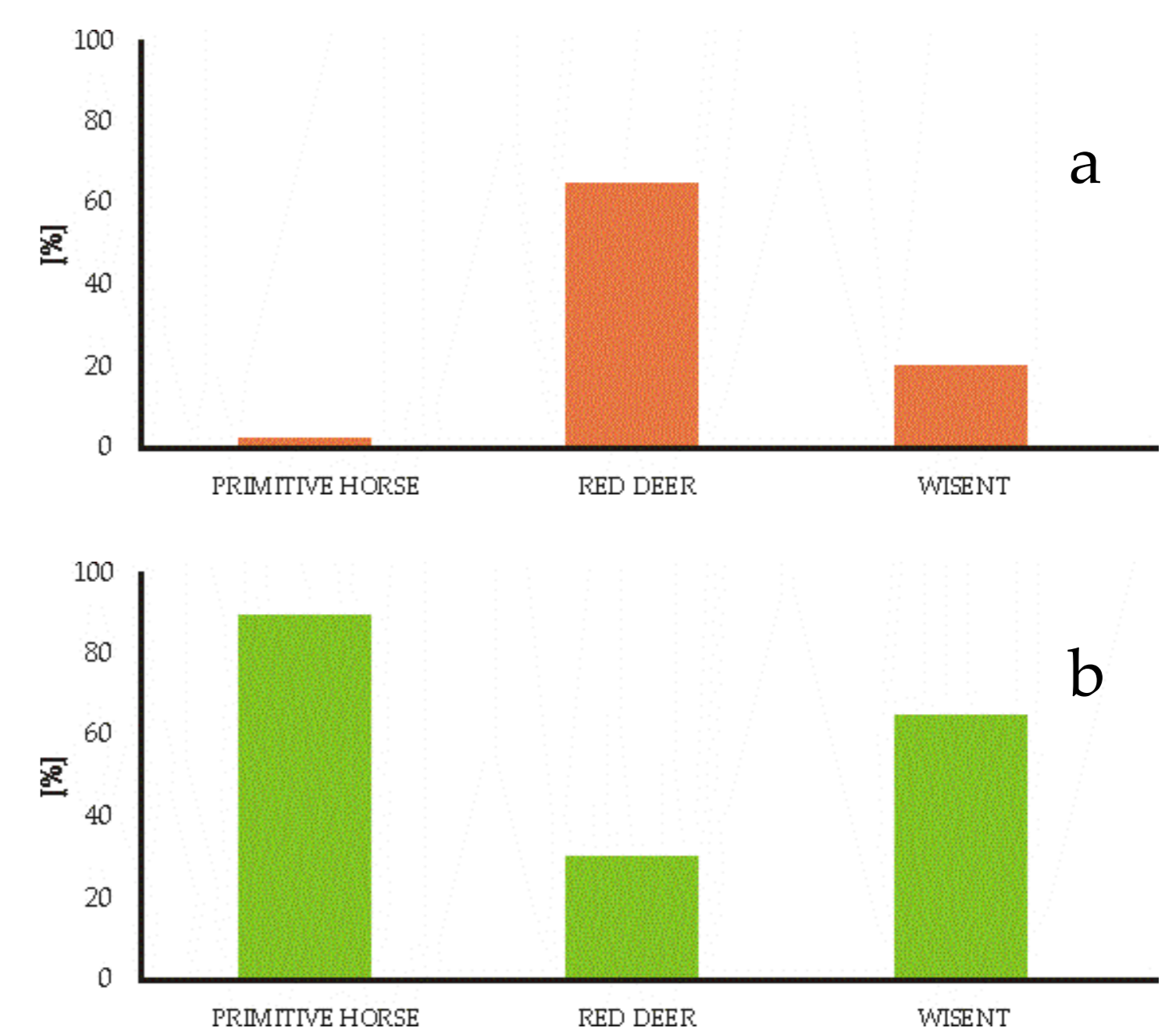


Fig.2. Mean proportion of woody plants (a) and grasses and sedges (b) in the diet of primitive horse, red deer and wisent.

Table. 1. Main tree species debarked by primitive horse, red deer and wisent

Primitive horses	Red deer	Wisent
spruce, willow, poplar, rowan, alder	pine, spruce, willow, poplar, rowan, ash	hornbeam, ash, spruce, lime, hazel, oak

## Bark stripping

All three species exert impact upon trees by stripping the bark. Although the red deer is regarded as a main debarking agent in the European forests, the wisent and primitive horses may also cause similar, significant damages (Kuiters et al. 2006, Paszkiewicz, Januszczak 2010). Red deer eat the bark from more than 20 species. There is not much known so far, regarding horses' foraging patterns upon woody vegetation, but some studies indicate quite similar to red deer set of debarked tree species. Debarking by wisents is generally more oriented towards hardwood species (Tab. 1).

## Foraging activity

Duration of a single foraging bout in case of a wisent may vary between 15' to 5h15' (Caboń-Raczyńska et al. 1987). Time spend on foraging and ruminating changes during the year. From spring to autumn, a mean length of foraging bout may increase from 1-2 h in April to 5-6 h in September. The length of phases increased during the winter, when only two peaks of activity are observed daily (Caboń-Raczyńska et al. 1983). The activity rhythm of red deer in Białowieża Forest show essential differences comparing to that of the wisent. Its bout length was much shorter and did not exceed 1 hour with mean about 42', that gave an average number of bouts of about 12 per day (Kamler et al. 2007). The higher number of bouts per day and shorter bout duration is related to smaller body size in red deer, but is not connected with physiology of foraging (Gordon, Illius 1994). A volume of red deer's rumen approximately equals to 25% of wisent's rumen (Krasieńska, Krasieński 2007). A smaller rumen of red deer needs less time to be filled, and thus shorter foraging bouts are sufficient. This makes a difference, when foraging is interrupted by human (or predators) activity or within resource-poor areas, where smaller patches of high quality food are more profitable for red deer than for wisent. Moreover, shorter bouts give more possibilities for shifts between habitats, which may be also favourable in a heterogeneous landscape. Foraging activity of horses reflects their high flexibility, that is connected to specific morphology and physiology of their digestive tract.



## Habitat selection

Wisents from Polish part of Białowieża forest used mainly deciduous forests and mixed coniferous forests (Krasieńska et al. 1987), but other studies indicate also use of other forest habitats and young plantations up to 10 years old (Dzięciołowski 1991). Open areas are indicated as important part of habitats inhabited by wisent population (Balčiauskas 1999). Red deer prefers similarly like wisent broadleaved and mixed forests, but may also exist in poor coniferous forests (Bobek et al. 1992, Okarma, Tomek 2008). Even in highly forested habitats, red deer search for gaps exposed to the light, i.e. with higher biomass and faster regeneration of forage (Kuijper et al. 2009). This suggests high similarity with habitat selection patterns of wisents, oriented towards perforated forests (Okarma, Tomek 2008). Primitive horses as typical grazers mostly use open areas, nevertheless the partial use of forest is common (Klich, Grudzień 2013, Popp, Scheibe 2014). Their grazing time is mostly spent at grasslands, but also on rough vegetation (Putman et al. 1987, Menard et al. 2002). The use of the forest for foraging purposes is marginal (Lamoot et al. 2005), since the majority of horses' grazing pressure occurs close to the edge to the forest.

## Conclusions

Regarding foraging patterns, the wisent present many similarities to both compared species. Main similarities with the red deer are related to alimentary tract, foraging activity, requirements regarding food quality (better digestible), and habitat selection, as well as in general diet composition and debarking. Primitive horses on the other side present similar feeding type, diet and debarking activity. Lower body mass of red deer and horses, and specific features of digestive tract of horses give some advantages to these species in competition between them and the wisent. Red deer needs less time and thus smaller patches of vegetation to fill the rumen, horses may successfully graze on lower quality food and is more flexible in foraging activity, both species may graze on a lower sward height. In a direct confrontation, we may expect an avoidance behaviour of wisents, weakening food and habitat competition. Nevertheless, a wisent may be outcompeted by both species from a part of feeding grounds.

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