

Frequency and Advantages of Animal-Powered Logging for Timber Harvesting in Hungarian Nature Conservation Areas

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Abstract

Despite the fact that the management of forests in nature conservation areas represents a key interest in Europe, animal-powered logging is only rarely covered by scientific papers. The main aim of this study was to explore the occurrences of this practice in Hungarian nature conservation areas (i.e. that belong to IUCN Categories Ia, II or V as well as Natura 2000 SPA or SAC sites) that are owned by the state (i.e. about 75% of all the forested nature conservation areas), and compile the characteristics, advantages and disadvantages of animal-powered logging according to interviews with loggers. All the Forest Districts in Hungary (116) were contacted by phone. 26% of the Forest Districts apply animal logging regularly (draft horse in every case), but only 2.6% (a mere 3 Forest Districts) own a horse stock for this purpose, while the others (27) employ contractors. 7.76% (9 Forest Districts) use animal power for skidding only occasionally and none of them own horses. All operate at least partially on nature conservation areas. Although 2.6% of the Forest Districts own a horse stock, they do not use animal power for skidding. The average animal logging operation consists of two animals and three people (one of them leads the horses) that do thinning in young stands and selection work. Data on advantages and disadvantages was gathered via semi-structured on-site interviews. The daily logging capacity of a single draft horse ranges from 4.5 m³ to 30 m³, depending on topography and weather conditions. Resulting advantages include: less harm to topsoil, wood stands, and saplings, the support of natural regeneration of forests, horses are more economical than machines in thick snow, there is no use of fossil fuels, more jobs are created, and preservation of native horse breeds is supported. Conversely, output capacity is less compared to the use of machines, and only few people want or are able to work with draft horses. It is mostly the terrain conditions (especially efficient in steep terrain) and the environmental constraints that determine the use of horses instead of skidders.

Keywords: animal logging, draft horse, horse breed, nature conservation area, log skidding, forest district

1. Introduction

Skidding of logs requires high attention to the forest topsoil, the wood stand, and saplings. Animal-powered logging is considered to be gentle to the soil (Zimmermann 1994) and reduces damage to residual trees and seedlings (Rodriguez and Fellow 1986, Wang 1997). This is why skidding with animal power still carries a high value, especially in nature conservation

areas, despite the fact that fully mechanized harvesters and forwarders have almost completely ousted the draft horse from the woods (Engel et al. 2012).

Before the mechanization of the timber harvesting industry (i.e. the 1950s), animal power had been extensively used for skidding of logs throughout Hungary. Since the 1990s, however, it has almost disappeared from practice (Firbás 1996). This is similar to the

worldwide trend of the fast mechanization of logging, leaving behind the traditional systems such as horse and mule logging (Rodriguez and Fellow 1986). The timber harvesting industry went through a rather quick mechanization process in Hungary after World War II in that 50% of skidding had been mechanized by 1954 (Keresztesi 1982).

Strengthening environmental consciousness and the commitment to sustainable development have brought animal-powered skidding to light, especially after the adoption of the new Forest Act in 2009, which ordered a step-by-step conversion from intensive forest management methods towards continuous cover forestry (CCF) in the case of the state Forest Districts. Based on this legislation, small-scale timber harvesting methods, as well as close-to-natural skidding, are expected to prevail. National park directorates, which coordinate conservation management of nature conservation areas, have also urged for the application of less harmful methods e.g. by logging invasive tree trunks from valuable areas in ways that cause minimal harm to the forest floor. The main constraint in terms of forestry utilization process in national parks and landscape protection areas (i.e. IUCN Category II and V) is that the condition (state of naturalness) of forests must not decay, and it should be subordinated to nature conservation goals. The same applies for Natura 2000 SPA and SAC sites. In strictly protected areas (IUCN Cat. Ia), only conservation management is permitted, which is without any economic aim.

Despite the fact that the management of forests in nature conservation areas represents a key interest in Europe (especially after the introduction of the Natura 2000 regulations), animal-powered logging is only rarely covered by scientific papers. Thus, our objective was to provide new information on the utilization of this forestry management process. The main aim was to explore the occurrences of animal-powered logging in Hungarian nature conservation areas (i.e., that belong to IUCN Categories Ia, II or V as well as Natura 2000 SPA or SAC sites) that are owned by the state (this means about 75% of all the forested nature conservation areas), and compile the characteristics of the practice, the aspects that determine why horses are used for logging instead of machines, and the advantages and disadvantages according to interviews with loggers.

2. Materials and methods

This study covers the whole area of Hungary. Altogether, 116 Forest Districts manage the National Forest Estate. All of them were contacted by telephone between February and October 2014. Besides basic data

(operational area, and nature conservation areas within that, etc.), they were asked about using animal power for skidding, and whether they own a horse stock for this purpose, or employ contractors (enterprises).

Contractors and forestry workers (if the horse stock is owned by the Forest District), who use animal power (i.e. loggers) for skidding in nature conservation areas (either national parks (IUCN Cat. II) or landscape protection areas (IUCN Cat. V), and strictly protected sites within them (IUCN Cat. Ia) that are also designated Natura 2000 SPA or SAC sites) were contacted in person between June and September 2014. Their names and addresses were provided by the Forest Districts during their phone call. We prepared semi-structured interviews based on open ended questions following the method of Babbie (2012). The interviews were done on-site with individual responses given in person with a dialogue structure that gave opportunity for discussions. Participants were asked about why they log with animals, where they work with them, what equipment they use, what is the average quantity logged by a horse for 1 turn and the daily capacity of a single horse, the size of the area that is logged by horses, the number of horses and workers, and the nature conservation values of the area that justify the use of animal power. After this, we asked them to present their opinion on the advantages and disadvantages of using animal power for skidding, horse breeds and types used for skidding, and the characteristics that make them beneficial for this purpose.

Loggers were interviewed in 17 different areas while logging (Fig. 1). These study areas are all covered by mixed broadleaved stands: 9 of them in the Northern Hungarian Mountain Range, 6 of them in the Trans-danubian Mountains, and 2 in the Southern Transdanubian Region. They belong to 11 different state Forest District companies.

Photo and video documentation was recorded during field observations.

3. Results

3.1 Occurrences of animal-powered logging in Hungarian nature conservation areas owned by the state

Interviews by phone showed that almost 26% of Hungarian Forest Districts (i.e. 30 Forest Districts) regularly use horses for skidding (and on-site processing). However, only 2.59% of them (a mere 3 Forest Districts) own a horse stock for this purpose (number of horses is 2 to 8), while the other 27 Forest Districts employ contractors (enterprises) for skidding. 7.76%

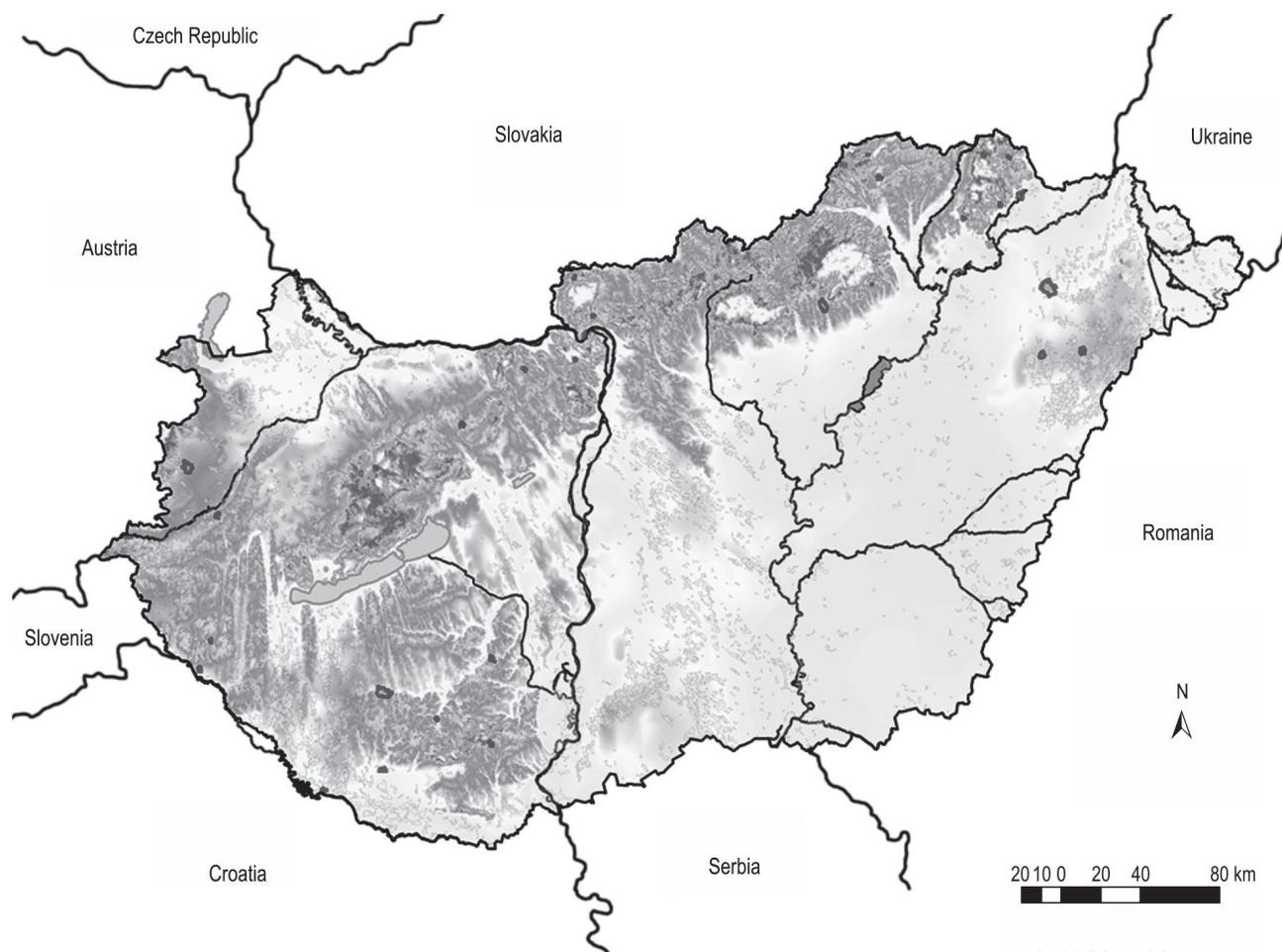


Fig. 1 Study sites, venues of field interviews

(9 Forest Districts) have reported that skidding with animal power is used only occasionally (2 or 3 times per year, skidding about 100–200 m³ timber); and none of them own horses for these works. Although 2.59% of the Forest Districts own a horse stock, they use animal power for transporting forage for games (winter feeding) or for hunting rather than skidding (Fig. 2).

If animal power is applied for logging, it is draft horses that are used for skidding (100%) and no mules are used in Hungarian forests. A probable reason for this might be that timber may be harvested only beyond the vegetation period in nature conservation areas and horses tolerate cold weather much better than mules, as argued by Shrestha and Lanford (2005).

All of the Forest Districts that use horses for skidding (either occasionally or regularly) operate (at least partially) on nature conservation areas as well.

66.38% of Hungarian Forest Districts do not apply animal power in any way. 6 of them claim to use animal power, but due to various difficulties they have so far

not been able to implement horses for skidding. These difficulties include the lack of people with deep knowledge of the skidding methods and horse care. Another reason is the lack of a state-owned horse stud that might be selected for forestry works, and in some cases, the amount of work is too low to maintain a contractor.

22 of those Forest Districts that do not apply animal power were asked about the last year they did it; they reported that it was 2 to 33 years ago. Some of them owned as many as 60 horses at that time (and even more before the mechanization of the timber harvesting industry). This suggests that this historical way of logging has only just recently started to disappear from the Hungarian forests.

3.2 Characteristic factors of animal-powered logging in Hungarian forests

The size of each area that was logged by horse(s) at the time of our on-site interviews ranged between 0.5 ha and 23 ha, with the average being 6.05 ha. This

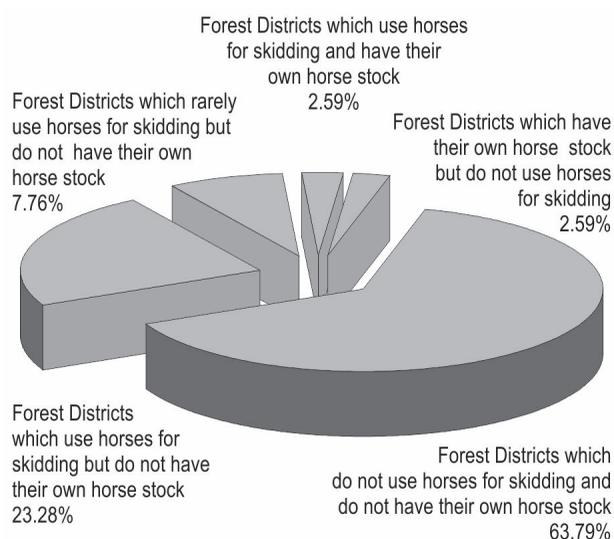


Fig. 2 Frequency of horse logging in Hungarian state-owned forests

also means that all of the studied animal loggers work on tracts with low timber volumes.

The ratio of animal logging, compared to the use of machines, varies highly among the Forest Districts. In some mountain areas, the use of animals is almost exclusive. Still, horse logging is not negligible in several flat areas.

Among forestry works, horses are mostly used for thinning and selection works, but clearcutting also occurs.

The types of forest stands logged by horses are in most cases beech or beech-hornbeam mixed forests (40%), Turkey oak – sessile oak stands (18%), Sessile oak – hornbeam stands (12%), European black pine (in 1 case mixed with hornbeam) (18%), Norway spruce (6%), and black locust (6%).

Trees are felled at the stump and then delimbed in order to avoid harm to the topsoil, wood stand, and saplings during skidding.

The average animal logging operation consists of two horses (varying between 1 and 3; being 2 in 14 cases out of 17) and three people (varying between 2 and 5; being 3 in 9 cases out of 17) (Table 1). Usually one worker performs tree felling, another performs tree processing, and a third one is engaged with leading the (usually two) horses. This is similar to the data found by Dubois et al. (2001), which was collected in a comparable US area, and also strengthens the statement of Magagnotti and Spinelli (2011b), who said that if there are two horses per driver, it increases the cost-efficiency of horse skidding with a dramatic increase of the average payload.

Most of the loggers (37%) apply the cross-breeding of warm-blooded and cold-blooded horse due to their pace and smaller size. Others reported the use of cold-blooded types due to their capacity, such as *Muraközi*, *Percheron*, *Nonius* and the *Hungarian cold-blooded horse*. The cold-blooded types are slower and calmer, and therefore they rarely suffer foot injuries. Horses are usually fed three times a day; forages are oat, maize, barley, alfalfa and hay.

The logging capacity of a single draft horse in an average day is 15.5 m³. However, this amount ranges on a wide scale from 4.5 m³ (this was measured on a steep area, covered by snow) till 30 m³ (on a plain area, with dry weather conditions and 5 workers). Based on these data, it can be stated that the daily average capacity of a single draft horse mainly depends on the surface relief of the land and the weather conditions.

The mean quantity of timber a draft horse can pull in one turn is 0.81 m³, with 1 m³ of timber per turn in most cases. The timber is usually dragged to the horse with a chain or a rope.

Most of the people who care for the horses gained their knowledge from their family. Using horses for forestry work is a tradition in several families.

3.3 Advantages and disadvantages of animal-powered logging from the aspects of forestry and nature conservation

Skidding with animal power is applied in hilly areas (covered by mixed broadleaved stands) rather than on flat areas. At the time of field observation, 15 of the 17 loggers were working in nature conservation areas, 3 of them being under strict protection. This fact verifies the demand for animal-powered skidding in those forests where the priority is the protection of natural values. It was also reported, however, that the use of horses might be hard in case of selective logging (which is a general practice in continuous cover forestry) due to the high weight of the trunks. According to the most common opinion, loggers use horses for thinning in young stands (10 to 50 years old), because the stand is too dense for machines without causing a lot of extra damage. Horses, however, can maneuver easily in these areas. Borz and Ciobanu (2013) also reported from Romanian areas that horses are mostly applied in very young and dense stands where thinning operations are done.

It was reported in several cases that using animals instead of machines reduces damage to residual trees and seedlings. The Forest Districts favor the natural regeneration of forests, which is better supported by animal logging. Contractors, who work in a national

Table 1 Characteristic factors of animal-powered logging in Hungarian forests

Name of Forest District	Studied area ha	Quantity logged by 1 horse during 1 day m ³	Quantity logged by 1 horse in 1 turn m ³	Used horse breeds	Number of horses	Number of workers	IUCN Category	Forest stand type	Harvesting method	Reach in the area
Eger	23.0	12.5	0.28	Percheron	2+1	3	II	Sessile oak Hornbeam	Group selection	On foot
Eger	5.5	17.5	1.50	Hungarian c.-blooded, cr.-breed	2	4	Ia	Beech	Group selection	Local accommodation
Nagymaros	7.4	20.0	1.00	Cr.-breed	2	5	II	Beech	Thinning	On foot
Telkibánya	0.5	15.0	1.00	Muraközi	2	3	Ia	Beech	Other	On foot
Telkibánya	2.5	10.0	1.00	Nonius, Hungarian c.-blooded	2	3	V	Beech	Single-tree selection	On foot
Pilisszent-kereszt	4.5	15.0	1.00	Belgian and Hungarian c.-blooded	2	3	II	Turkey oak Sessile oak	Single-tree selection	On foot
Királyrét	5.5	25.0	0.50	Belgian c.-blooded	3	5	II	Beech	Single-tree selection	On foot
Sásd	2.5	12.0	0.50	Cr.-breed	2	5	V	Turkey oak Sessile oak	Thinning	Motor-horsebox
Kemence	7.5	8.5	1.00	Cr.-breed	2	2	II	Beech Hornbeam	Thinning	Local accommodation
Bajna	15.9	4.5	0.50	Cr.-breed, Hungarian c.-blooded	2	3	V	Sessile oak Hornbeam	thinning	On foot
Vasvári	5.0	30.0	1.50	Cr.-breed, Muraközi	2	5	--	Hornbeam Black pine	Thinning	On foot
Bakonybél	2.0	10.0	1.00	Percheron	2	3	V	Norway spruce	Other	On foot
Bakonybél	3.0	8.5	1.00	Muraközi	2	2	V	Beech – Hornbeam	Thinning	On foot
Szombathely	6.5	20.0	0.50	Cr.-breed, Muraközi	2	2	V	Black pine	Thinning	On foot
Mátraszőlős	5.0	25.0	0.50	Cr.-breed	2	3	Ia	Turkey oak Sessile oak	Group selection	On foot
Cserépváralfa	0.5	25.0	0.50	Cr.-breed	2	3	--	Black locust	Clearcut	On foot
Pécsi Parkerdő	80.0	14.0	0.25	Cr.-breed	1	2	V	Black pine	Other	Motor-horsebox
Average	6.05	15.5	0.81	Cr.-breed	2	3	II or V	Beech	Thinning	On foot

park (IUCN Cat. II) and in a landscape protection area (IUCN Cat. V), reported that logging in European black pine (*Pinus nigra*) stands is always made by using draft horses (not machines) as this is harmless for the saplings of indigenous species (especially manna ash (*Fraxinus ornus*)) and topsoil. Therefore, horse

skidding might be beneficial for the regeneration of native forests.

Many interviewees highlighted that horse logging is gentle to the soil. In areas with shallow topsoil, skidding with animal power is favorable as it causes less harm to the topsoil than machines. Therefore, native

species continue to be dominant, while invasive species that flourish in damaged and disturbed areas, such as the tree of heaven (*Ailanthus altissima*), are kept out.

Since most of the Forest Districts do not own a horse stock any more, the former stables (maintained by them) also ceased to exist. Thus, it is hard to find accommodation for the contractors and their horses. As a result, contractors then have to reach the area to be logged on foot, which sometimes means a 30 km ride back and forth, and adding up to 3 hours of activity per day.

It is beneficial that the horses are mostly privately owned (not by the Forest District). It is necessary, from a horse's perspective, as the same person always works with it. This makes the teamwork between the two go smoother when completing logging.

Using horses for logging is possible in any kind of weather conditions, except for deep mud, heavy rain-storm, and thick snow cover. In the case of snow, however, interviewed loggers reported deep snow to be problematic from about 20 to 50 cm or more. If the snow is not too deep for horses, then they should be used, as it is more economical than machines. In deep-snow conditions, machines need to be chained, thus increasing fuel consumption.

The revenue for horse logging per cubic meter is usually the same price as for using machines (in some exceptional cases, however, horse loggers earn more). This is disadvantageous for those who use horses. Therefore, the benefits for nature conservation and forest regeneration aspects that result from using animal-power over machines should be made more known.

Nature conservation areas can be logged only during winter. Therefore, the horses and the people working with them have to find another job for the vegetation period. This usually means operating a carriage or a chariot for tourism.

4. Discussion and conclusions

It has been proven that the main advantage of horse logging is that it causes less logging damage to the wood stand and saplings, due to its low pressure impact to the ground. Furthermore, draft horses are able to maneuver easier than machines in dense young forest stands and thus cause less harm to the wood.

The environmental significance of animal-powered logging was also highlighted by several interviewees as being an almost »zero emission« method, as there is no direct use of any fossil fuels (see also Rydberg and Jansén 2002) and, therefore, has the lowest green-

house gas emissions (Engel et al. 2012). While animal traction is inherently environmentally friendly, properly managed mechanized operations can also offer good environmental performances (Spinelli et al. 2013).

As it is a labor-intensive operation (Rodriguez and Fellow 1986) and through ensuring forage supply for the horses and caring for them, animal-powered logging may create jobs in distant rural areas, which is beneficial for achieving the aims of rural development policies and the principles of sustainability.

It has already been mentioned that animal logging is especially recommended for deployment in conservation areas with strict environmental constraints (McCabe and Tiner 1992). The new Hungarian Forest Act (adopted in 2009) prescribes conversion of forest management towards continuous cover forestry (CCF) in state forest areas, which means harvests that use selective thinnings. These low-intensity cuts reduce the performance and the profit margins expected from highly mechanized timber harvesting (Mason et al. 1999), therefore, they claim for a switch towards slighter methods (not mentioning reduced impact logging (*RIL*) in the Hungarian legislation), creating space for traditional small-scale harvesting alternatives (such as animal-powered skidding) leading to a new flourish of draft horse logging. Assessment of ecological and economic impacts of different forest management methods are among top priority research questions for the conservation of biodiversity in Hungary, as compiled during a recent participatory process (Mihók et al. 2015).

Another aspect is the high cost of mechanized harvesting on small woodlots. This makes animal-powered logging more cost effective, especially when pre-existing skidding trails are not available (Magagnotti and Spinelli 2011b), even if it contains more non-productive time elements (Shrestha et al. 2005). Several loggers reported that the use of horses is an especially efficient tool for log extraction on steep terrain, which was also stated by Magagnotti and Spinelli (2011b).

Although several authors report that the main reason for using horses for timber logging is the lack of capital for modern technology (Toms et al. 2001, Jourgholami et al. 2010, Magagnotti and Spinelli 2011a), our interviews showed that it is much more the terrain conditions of the area and the constraints by nature conservation authorities that determines the use of horses instead of skidders (Wang (1997) strengthens this argument).

Only a few people intend and are actually able to work with draft horses, or have knowledge and experience in this field, as it is a strict and hard way of life. They must find another job for the vegetation period,

a time when logging is prohibited by the Forest Act. There is also a strong need to find a role with a reasonable income for the horses during the vegetation period. 6 Forest Districts have so far not been able to implement horse skidding due to the lack of people with in-depth knowledge on how to work with the animals and horse care.

Meanwhile, we strongly recommend further development of the equipment of animal-powered skidding in Hungary, as most loggers use almost century-old tools and devices. This process would increase the efficiency of skidding and reduce the gap of output values between machines and horses.

The fact that even distant sites can be reached and logged by draft horses without excessive damage might be considered either an advantage or a disadvantage, as it might be undesirable for strictly protected natural areas (IUCN Category Ia) to harvest timber at all. Horse skidding can, however, still be advisable for both national park directorates and for small-scale timber producers. It is a viable and sustainable method with relatively small investments and operating costs, and it also carries benefits for rural development.

In conclusion, it can be stated that this historical way of logging started to disappear from the Hungarian forests 1 to 4 decades ago. Currently 26% of Hungarian Forest Districts apply animal logging regularly and 7.76% occasionally (but only 2.59% among them own their own horses); all operate at least partially on nature conservation areas and in every case draft horses are used. All animal loggers work on tracts with low timber volumes, do thinning and selections in young stands (10 to 50 years old), and the use of animals is almost exclusive in steep areas with strict environmental constraints. Using animals instead of machines reduces damage to the topsoil, the residual trees and seedlings, and supports the natural regeneration of forests. Furthermore, it is more economical than machines in thick snow. Usually two horses (14 cases out of 17) and three people (9 cases out of 17) work together: one worker performs tree felling, another performs tree processing, and a third one is engaged in leading the horses. The daily logging capacity of a single draft horse ranges from 4.5 m³ to 30 m³, depending on the surface relief of the land and the weather conditions. Loggers and horses sometimes spend up to 3 hours per day to reach the area to be logged. Horse logging should play a crucial role in the preservation of native horse breeds such as the Hungarian cold-blooded and Muraközi, which are especially suitable for work as they are characterized as being resistant and calm.

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