Recreational load as a driving variable for urban forests

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ABSTRACT: Green areas and urban forests represent important factors of urbanized environment which attracts more and more attention of forest management and silviculture. Recreational load and its types are the most important driving variable for the management framework in which basic silvicultural methods should be applied. The problem of the required combination of natural and social limits is resolved by a matrix which takes into account forest ecosystem quality and recreation. The matrix defines 9 or 27 units (their number depends on the fact if we take into account the age of stand or not) for which basic management rules could be prepared. The basic rules concerning biological aspects are described in a general way in the article.

Keywords: urban forests; recreation; silvicultural method; management in forests

Urban forests are paid more and more attention from a research perspective as an environmental service playing an important role in the urban life quality. The roles of forests are even more emphasized in the urban areas, being the most prominent in large cities and industrial agglomerations (Poleno 1985). The city of Prague, capital of the Czech Republic, is surrounded by forests, which represents a treasure for their inhabitants.

The Ministry of Environment of the Czech Republic granted a project aimed at delimitation, location and optimization of the area of Prague urban forests (Podrázský et al. 2005). The project was managed by the Faculty of Forestry and Environment, Czech University of Agriculture in Prague.

The main targets of the project can be described in the following items:
– objective quantification of the social recreational demands on the area of urban forests of Prague, especially of their socio-economic importance, their spatial distribution, determination of modes and loads of the recreational use of the representative forest parts,
– definition of management rules for the target area,
– identification of the zones differentiated by the type and intensity of recreational load.

This paper is focused only on one target of the project, i.e. management rules for urban forests.

Urban forests of Prague

The historical centre has large green areas lying mainly on gentle slopes oriented towards the Vltava River valley even though the city lost large areas of its forests in the Middle Ages. The existing green areas serve as openings enabling the effective ventilation of the central part of Prague. The "Petřín Park" is a typical example of a large green area lying on the eastern slope of the left bank of Vltava River, which is very close to the Prague Castle at Hradčany and according to experimental studies it brings fresh air from western suburbs into the historical centre including Charles bridge – the most frequently visited spot for tourists. Historical gardens around the Prague Castle and green yards inside the old blocks of apartments

are other green areas which offer a refreshing oasis to Prague inhabitants.

Prague urban forests nowadays cover about 8,500 ha as a scattered ring around the city (KUPKA 2005a). These forests are under a heavy pressure of visitors who arrive daily for short walks, biking or jogging. As the result of the strong recreational load the forests are losing their ability to offer their environmental services and become deteriorated and no more attractive to their visitors.

METHODS

The load of recreational pressure and its types are the driving variables for management of urban forests. These variables are more important than natural conditions (climatic and soil ones) which usually represent the limits for management systems. On the other hand, natural conditions should be taken into account as well. The problem was resolved by the matrix where the first axis was defined by recreational load and the second axis was defined by ecosystem quality in terms of nature fragility and/or nature conservation. We realized soon that the matrix should be more precise to incorporate the age of stands. That is why the third auxiliary axis was used for the stand age stage. This auxiliary axis was particularly useful for the decision if and when the stand could be influenced by silvicultural methods. We created only three broad age stages of forest stands:
– young (from 0 to about 40 years),
– middle (from 40 to 70 years),
– mature (> 70 years old).

Middle and mature stands could and should be changed effectively by silvicultural methods including changes in the species composition where needed while young stands cannot be changed radically through silvicultural treatments.

The details how the management type units are defined are given in Table 1.

There are theoretically 27 units based on forest ecosystem quality (natural conditions), recreational load and type where L denotes light load, H denotes heavy load, S denotes short recreation and L denotes

long recreation. Once we got these basic management units, we could prepare general management rules for those units.

RESULTS AND DISCUSSION

Urban forest area

The total Metropolitan Forest Area for Prague with the buffer zone is about 23,000 ha of forest area. This figure represents the scattered ring along the Prague administration boundaries of around 20 km with two large strips in the southern suburb of Prague containing cottages and weekend houses along the Berounka and Sázava Rivers. We believe that this area size should satisfy the present situation of the capital as well as for the near future. Formally the total area is divided into two zones: (*i*) nucleus and (*ii*) buffer zone. The buffer zone, which is supposed to be legislatively equal to the nucleus zone, got the status of Prague urban forests as well. It could be used and converted step by step as a nucleolus zone when needed. Nowadays these forests are proposed to be managed in the same way as unit type 1 LS, 4 LS or 7 LS depending on ecosystem quality (Table 1).

Management rules

The intention of the article is not to give the details on management rules for all units specified in Table 1 but we would like to mention some specific points dealing with silviculture and management of urban forests (KUPKA 2005b).

Fragile ecosystem areas (Unit 2 HS) should be managed so as to convert them to Unit 1 LS, i.e. to diminish their recreational load. We suppose that only a low number of visitors explicitly want to visit conservation areas to experience nature (ARNBERGER, BRANDENBURG 2002). It is not an easy task and it cannot be done just by putting up the notice "No entrance" in these areas. Gentle guidance is recommended instead of strict orders (PEKNY, LEDITZNIG 2002). General, short but well-balanced information on the uniqueness of the site could be put on wooden panels at the boundary of the area. The pathways

Table 1. The matrix defining nine management units within the given recreational load and forest ecosystem quality. Each of these basic units is subdivided into three age stages

Forest ecosystem quality	Short recreation		Long recreation (more than 1 day)
	light load	heavy load	
Fragile	1 LS	2 HS	3L
Stable	4 LS	5 HS	6L
Nature conservation	7 LS	8 HS	9L

should not lead through the area (the existing paths should be destroyed) and we do not propose any biological or technical infrastructure to be prepared in the vicinity of the area. These precautions might decrease the short recreation load as visitors who are looking just for body exercise and sport activities should be attracted to different areas of urban forests where the biological and technical equipments are concentrated. Those who are interested in the knowledge of nature do not destroy the place as their behaviour is wise and knowledgeable.

Management methods for forests belonging to Unit 1 LS will transform the stands either into selective or multilayer stands or into coppice stands in the long run. It means their rotation period should be more than 200 years or even more, clear cutting should be avoided and the species composition will be diversified.

The interior structure of uniform young stands should be altered by small clearings and openings made on purpose. The natural regeneration will start later on these openings contributing to a rich stand structure.

The silvicultural system as a good option for forests belonging to Unit 1 LS is a coppice or coppice with standard especially on rocky ridges with shallow soil horizons. This form of forest stand creates a rich vertical structure, increasing the recreational attractiveness for its visitors.

The artificial regeneration could also be used in case the natural regeneration is not sufficient. The chance to modify the species composition towards a more appropriate form for recreation is viable in that case.

The stands belonging to Unit 5 HS are typical urban forests where basically no limits are set from the ecosystem point of view. A questionnaire enquiry gave rather contradictory statements on what type of forest stand was preferred by different social groups. However, we learned that the selective forests were not the best option as visitors liked open stands where they could see open countryside and they could walk off the roads through the stands. They did not mind large openings with sunshine as the contrast to shades and glooms of the closed crown canopy of mature stand. The clear-cutting silvicultural system definitely forms forest stands into the structure just described above and therefore this system will be used and recommended for stands belonging to management Unit 5 HS. The limit for a clear-cut area in this country is 1 ha according to Czech forest law and there is no reason not to apply the rule to urban forests. An exception could be asked for the obligation of reforestation of bare ground within a 2-year time span after final cutting as laid down by Forest Act No. 289/1995. At least a part of the clear cuts could be left without reforestation serving as playgrounds for a while. The rotation period could remain the same as for productive (commercial) forests, i.e. between 100 and 130 years and without any dramatic changes in the species composition.

An important aspect of urban forests is stand edges where special attention should be paid to aesthetic requirements. It means not only alleys along large roads but also the decoration of most forest margins with colourful broadleaved species and bushes.

The path system in Unit 5 HS should be dense (more than 300 m of roads per ha) but pathways should be narrow to give visitors a chance to be alone and have a feeling of privacy in the forests. Rich technical equipment could be built along the main roads.

Silvicultural recommendations for Unit 4 LS are very similar; it differs from Unit 5 HS only in the load of recreational pressure. The difference results in a road-network system which should not be so dense (less than 250 m of pathways per ha) and less technical equipment should be build there.

Units 7 LS and 8 HS are forests under the nature conservation regimes and the management plans of those stands have to observe the requirements of nature protection. There is no reason to interfere recreational demands with the conservation instructions, only the heavy recreational pressure should be diminished in forests belonging to management Unit 8 HS. The successful attempt at so called "soft recreation" should be proposed for these stands.

CONCLUSIONS

Urban forests of Prague are determined by two basic criteria: (*i*) type of recreation and its intensity as an expression of public demands and (*ii*) forest ecosystem conditions which show natural limits for the forest management.

Other important variables for these forests such as age, stand structure, species composition, etc. are auxiliary indicators which influence the management rules for these forests. For example if the species composition does not match our expectations and requirements, we have to transform it. The scale of the changes and time horizon are dependent on stand characteristics.

These two basic criteria made a matrix (Table 1) with 9 or 27 different management units (the number depends on the fact if we take into account the age of stand or not) which could be applied to Prague urban

forests. The typical urban forests are those belonging to management units 4 LS, 5 HS and 6L where all biological and technical equipments facilitate recreational services of the forests. A clear-cutting silvicultural system is recommended for these management units, which is a little contradictory to modern silviculture (compare with Pro Silva movement in Europe or Continuous Cover Forestry, etc.). The clear-cutting silvicultural system brings to forest stands large openings which are welcome by visitors.

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Rekreační zátěž jako určující veličina pro městské lesy

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ABSTRAKT: Zeleň a městské lesy, představující důležitou součást městského prostředí, se stávají předmětem zájmu lesního hospodářství a pěstování lesa. Typ a intenzita rekreační zátěže představuje přitom hlavní určující veličinu pro zásady hospodaření v těchto lesích. Nutnost vzít v úvahu jak rekreační zátěž, tak i přírodní podmínky lesního ekosystému je řešena vytvořením matice, která tyto určující podmínky uvažuje zároveň. Vzniká tak matice o 9 nebo 27 polích (počet závisí na tom, zda bereme v úvahu i věk porostů či nikoliv), pro která lze připravit rámcové směrnice hospodaření. V článku jsou stručně popsána jen některá opatření biologického charakteru.

Klíčová slova: městské lesy; rekreace; pěstování lesa; hospodaření v lesích

Hospodaření v pražských městských a příměstských lesích je limitováno dvěma hlavními podmínkami. Je to v první řadě rekreace, její typ a intenzita, a v druhé řadě přírodní podmínky. Další parametry, které je ovšem třeba brát v úvahu, je věk porostů, jejich struktura, druhové složení atd. – např. pokud druhové složení porostu neodpovídá rekreačním potřebám, měl by být tento porost přeměněn. Rychlost a charakter přeměny však závisí na dalších porostních charakteristikách.

Obě uvedené základní podmínky tvoří matici, ve které se vyskytuje 9 nebo 27 jednotek. Jejich počet závisí na tom, zda bereme v úvahu ještě věk porostu či nikoliv (tab. 1). Zůstaneme-li u základní matice s devíti jednotkami (poli), pak pro městské lesy jsou nejcharakterističtější jednotky 4 LS, 5 HS

a 6L, pro které jsou vytvořeny rámce hospodaření. Pro tyto „typické" městské lesy navrhujeme jako základní hospodářský způsob holosečný, což je svým způsobem v rozporu s moderními trendy v pěstování lesů, které prosazují přírodě blízké způsoby hospodaření s vyloučením či výrazným omezením ho-

losečí (srovnej např. s hnutím Pro Silva). Holosečný způsob hospodaření, který samozřejmě respektuje zákonné omezení maximální velikosti holoseče na 1 ha, však vytváří zajímavou a často se proměňující strukturu lesa, kterou by se – podle našeho názoru – měly městské lesy vyznačovat.

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