

Selected invasive and expansive tree species in conditions of the Botanical garden of P.J. Šafárik University in Košice

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Abstract: Thesis is about invasive and expansive tree species growing in conditions of the Botanical Garden of P.J. Šafárik University in Košice. The aim of this work is to detect the current occurrence of selected species, to map their areas and also to reevaluate their economic value. On the basis of these facts the main goal is to suggest the realisation of the preventive and protective precautions for the selected woody plants. The field research was carried out by the method of monitoring the Botanical Garden and graphical recording of individual species in the map. There were put down these parameters : diameter of a tree trunk at height 1,3 m, number of individuals, height of individuals and area of sprouts. The field research has explicitly shown that the continual control of these locations is necessary. The biggest number of canopy individuals was recorded of species *Robinia pseudoacacia*, *Ailanthus altissima*, *Fraxinus excelsior*, *Acer platanoides* and as to the area of occurrence there are species eg. *Swida sanguinea*. In comparison to invasive species, these expansive species do not push out original ecosystem particles so aggressively; preventative precautions should not be undermined. In terms of prevention either mechanical elimination of seedlings or herbicidal liquidation is suggested, but the control of the individuals is a necessity.

Keywords: invasive tree species, expansive tree species, introduction, original woody plant, control

Introduction

Serious problem in dendrology of park forest became, except for the invasive species, also expansive tree species.

As invasive tree species are considered the introduced (aliens) species, which eliminate original woody plants and their phytocoenose (ELIÁŠ 1994).

Expansion is often interpreted as succession (KRIŽOVÁ 1995) and it has got similar character to invasion, but it is a penetration of native (autochthonous) species of flora from contacting phytocenoses. On the basis of knowledge from literature we can allege, that expansive and invasive tree species have got several common characteristics, for example – high seed quality, hyper resistance against plant pest and abiotic factors, high tolerance for polluted environment and climatic stress, fast growth in initiatory phases and their overgrowing the others tree species, and also overshadowing of others goal tree species, production a large number of seeds (KELBEL 2003). Biological plant associations represent open dynamic systems, where occur flux as well on generic level (genetic structure) as insidegeneric level, depending upon conditions of environment. Unlike natural forest, stability of plant associations directly affected by man is conditioned by continual deposit of additional energy. As soon as, a man stops maintenance of a ground (in our case it is Botanical garden), there occur processes of secondary succesion, which is introducing oneway progress towards climax (GÖMÖRY et al. 2007).

Invasion and expansion can cause the serious influence for man-made plantings as are botanical gardens, arboreta and others. That is why I consider this theme for the very most current.

Material and methods

Field research was done within the area of the Botanical Garden of P.J. Šafárik University in Košice (thereinafter: BG UPJŠ). BG UPJŠ is located in the north – west part of Košice Basin, in locality of Bankov – Red Bank. Geographical coordinates are: 48° 45' of geographic latitude and 21° 19' of g. longitude (MOCHNACKÝ 2001).

The main goal of research was to study the following invasive and expansive tree species:

Invasive species – *Robinia pseudoacacia* L., *Ailanthus altissima* Mill.Swingle, *Negundo aceroides* Moench. and *Amorpha fruticosa* L..

Expansive s.– *Fraxinus excelsior* L., *Swida sanguinea* L., *Acer platanoides* L., *Acer campestre* L., *Rubus fruticosus* L. and *Clematis vitalba* L.

For these species, there was found out the following mensurational data: diameter in height of 1,3 meters, number and height of individuals, and also area of sprouts. Diameter of tree trunk was measured by forest calliper and height of individuals by altimeter Blume-Leisse (type BL - 7). On some locations within the range of BG UPJŠ, the areas with massive natural seeding of seedlings were

registered. Frequency of seedlings, those height is to 1,0 meters, was found out by the help of sample plot. In setting out parts, it was chosen 5 plots with acreage 1 m² (one square meter), then on this a – spot all seedlings by individual tree species were counted. Obtained average number of seedlings from inducted number of a – spots was multiplied by total area of acreage. The field research of individual species was also recorded in the map.

On the basis of findings, a management of preventative and defensive arrangements for individuals areas was carried out.

Results and discussion

Field research was made in the years 2008 (invasive tree species) and 2009 (expansive tree species). In conditions of Botanical garden, the biggest problems were related to the following invasive and expansive species.

Invasive tree species

1. ***Robinia pseudoacacia* L.** : with number of solitaires 249, the highest individual was 21,5 m high and the burliest individual had diameter in height 1,3 m only to 100 cm.

The most problematical locations were:

- A) Locality of ravine – there were found out the largest number of individuals - 144. The biggest ones had diameter in height 1,3 m - 44 cm and the smallest ones had 3 cm. Heights were in interval from 12 to 18 m. Acacias were planted in the area of ravine on purpose of holding erosion of soil. However, after the time, at the end of the function of ravine, acacias began to band about intensively with sprouting capacity to next locations.
- B) Historical dewpond – on the edge of dewpond there was found out 28 canopy individuals in stretch 38 m and height was in interval 5 - 14,5 m. Predominant one was solitaire with diameter in height 1,3 m - 100 cm and height 15 m. Area of sprouts was 1691 m².

Tab.1. Diameter structure of *Robinia pseudoacacia* L.

Diameter intervals (cm)	Number of individuals	Percentage (%)
0 - 10	49	19,8
11 - 20	81	32,5
21 - 30	86	34,5
31 - 40	28	11,2
41 - 50	3	1,2
51 - 60	0	0,0
61 - 70	0	0,0
71 - 80	1	0,4
81 - 90	0	0,0
91 - 100	1	0,4
total	249	100,0



Fig. 1. *Robinia pseudoacacia* L. – Locality of ravine (A)

Robinia is big rival for others woody species, because of intensive and effective stump sprouting, root suckering and also for fast growth in the first 10 - 20 years. According to Novák (verbal presentation), ample rooty system of acacia draw off soil nutritive very effective and *Robinia* poisons soil by secretion of colin.

2. *Negundo aceroides* L. : with number of solitaires 57, and the burliest individual with $d_{1,3} = 67$ cm.

The most problematical locations were:

C) Locality of SAS – there were found 55 canopy individuals. The biggest c. individual was with $d_{1,3} = 21$ cm and the tiniest with $d_{1,3} = 2$ cm.

D) Locality of Mánesova – there were found out only 2 c. individuals with $d_{1,3} - 67$ and 58 cm.

The biggest problem of that species is his very early procreation ability. Winged double achenes of *Negundo* are staying up a tree very long time until spring. So they can be windblown by autumnal winds and winter blizzard to broad surroundings. Probably from locality Mánesova (s. D) to locality SAS (s. C) there occurred just that anemochory extension.



Fig. 2. *Negundo aceroides* L. – Locality of SAS (C)

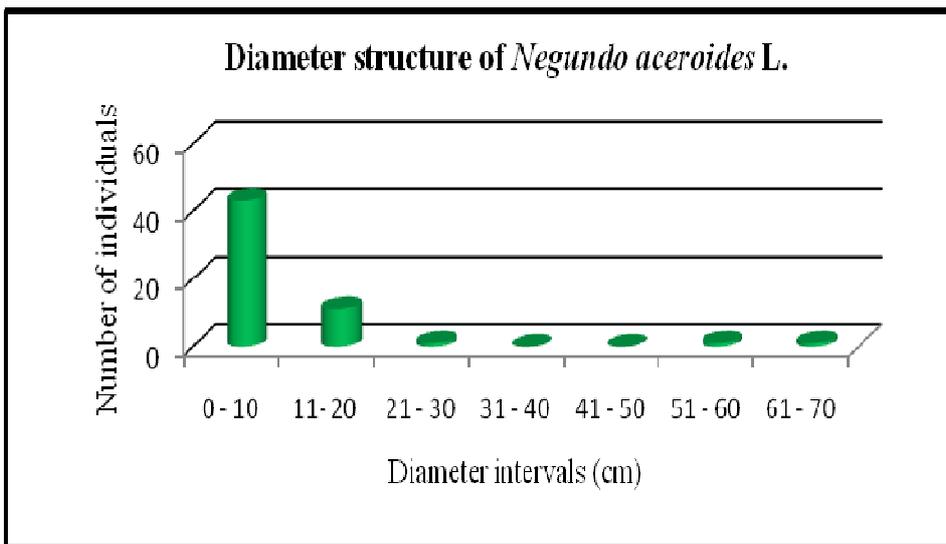


Fig. 3. Diameter structure of *Negundo aceroides* L.

3. *Ailanthus altissima* L. : with number of solitaires 56 and the burliest individual with $d_{1,3} = 43$ cm.

The most problematical locations were:

E) Locality opposite to garages – there were found 26 c. individuals, with diameter of tree trunk ranging from 2 to 19 cm and with average height ranging from 88 to 93 cm. Sprouts and c. individuals were burgeoned out on the area 81 m².

F) Locality of arable area – there were found out 2 c. individuals with $d_{1,3} = 36$ cm and 42 cm and height 14,5 m. There were also sprouts of these individuals on the area 40 m² and with average height of 7 m.

G) In the forest above meadow Čerešňovka – there was found one big c. individual with $d_{1,3} = 23$ cm and height 17 m.

There were also occurrence of sprouts on the area 286 m² from that c. individual.

Ailanthus is generating a lot of seeds and it is a large adventure in comparison with others tree species.



Fig. 4. *Ailanthus altissima* L. - Locality of arable area (F)

The sprouts of *Ailanthus* can grown out and cause persecution of others trees very quickly by making light conditions for adjacent stands worse and. That's why preventive precautions should not be underestimated.

4. *Amorpha fruticosa* L. : with number of solitaires 57.

The most problematical locality was:

H) Locality of fruit grove – there were found sprouts on the area only to 106 m².

Amorpha fruticosa has got a very strong root suckering and also all pieces of shoots put into soil form roots. It was argued also on locality H, there were found out sprouts on a large area for a very short time interval.



Fig. 5. *Amorpha fruticosa* L. - Locality of fruit grove (H)

Expansive tree species

5. *Fraxinus excelsior* L. :

The most problematical locations were:

CH) Man-made crop area of ash – there were found total number of 145 pieces of c. individuals, from that number 65 pieces of c. individuals were worked out. Then intensive stump sprouting has begun in consequence of felling. For the reason of conservation of original structure of outplantings it will be necessary to do changes in the future.

The measured heights were in interval 16 – 19,5 m.

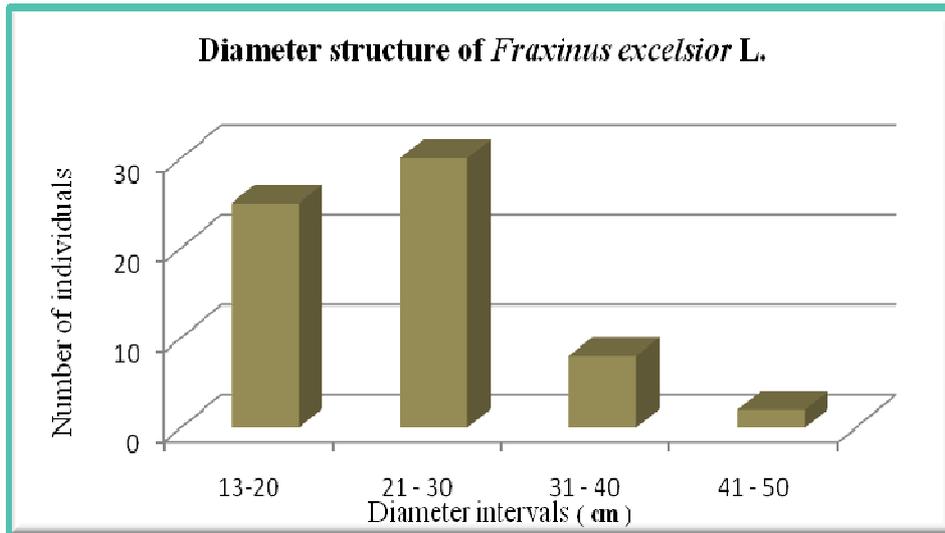


Fig. 6. Diameter structure of *Fraxinus excelsior* L.

l) Locality of the north parts of Botanical garden and area over the groove – there were found c. individuals of *Fraxinus* with total number – 386 in forest stand.

Tab.2 Diameter structure of *Fraxinus excelsior* L.

Diameter intervals (cm)	Number of individuals	Percentage (%)
0 - 11	151	39
12 - 20	164	42
21 - 30	65	17
31 - 40	6	2
total	386	100

Fraxinus belongs to fast growing tree species and also individuals from self-seeding are very abundant. Young seedlings can vegetate in strong shade, there they have more humidity and they are protected to frost in several years. It has got 75 % three – year germinating capacity. *Fraxinus* doesn't generate pure stands, but second – growth stand with annual fruiting, dense and fast growing individuals from natural regeneration, it has also ability of big stump sprouting. Ash is effective competitor for other tree species which are not able to counteract its strategies. It was acknowledged on locality I. where ash wasn't autochthonous tree species but allochthonous species. There were found 386 c. individuals. They were found totally on 16 locations in form of canopy individuals and also sprouts. That's why this one species (*Fraxinus excelsior*) should be monitored with increased attention.

6. *Acer platanoides* L. :

J) Locality of the north parts of B. garden and area over the line – there were found c. individuals and also their sprouts in forest stand.

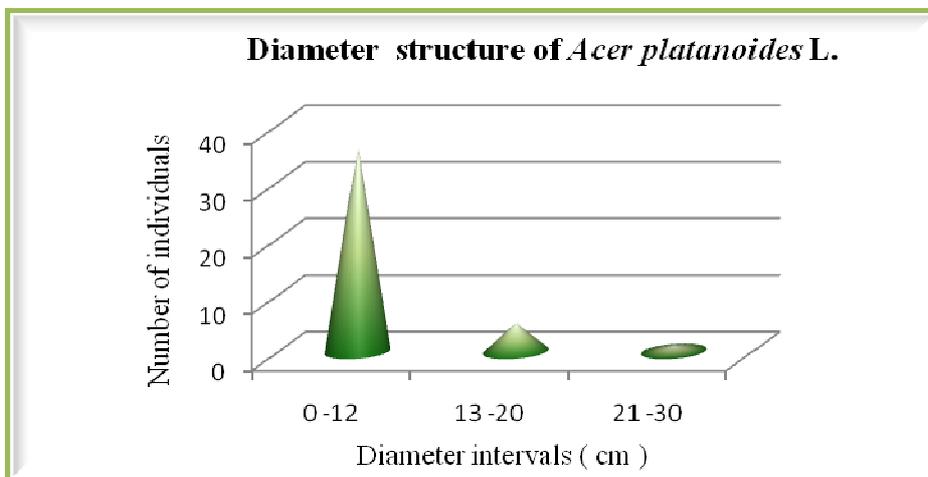


Fig. 7. Diameter structure of *Acer platanoides* L.

7. *Acer campestre* L. :

The most problematical locality was:

K) Terraces – it occupied a total area of 795 m², there were found 9540 pieces of sprouts.

A big problem with these maples lays in their very good stump sprouting. They can occupy a large area very quickly and then they deteriorate aesthetic and functional appearance of others tree species.

8. *Swida sanguinea* L. :

K) Terraces – there were found inherence of 8745 pieces of sprouts

Swida sanguinea has got a very intensive root suckering. It was acknowledged also by this research. In this regard, there should be done increased monitoring, especially on locality of this (K). There were found out a large number of sprouts which can cover primary outplantings in the area (for example a part assigned for experimental purposes).

9. *Rubus fruticosus* L. :

The most problematical locations were:

L) The meadow at apiary – with total area of sprouts 32 m²

M) Locality of the north parts of B. garden and area over the road. There were found sprouts on area 68 m² on clearing at fence.

10. *Clematis vitalba* L.:

The most problematical locality was:

N) Along the paved road from off greenhouses (opposite to cypresses)

On locality of outplanting conifers, at high building of SAS, *Clematis* and also *Rosa canina* L. were encrusted pine trees and arbovitaes.

Clematis vitalba belongs to aggressive – expansive species and needs to stay of fence, columns or the another tree species. This is a big problem. *Clematis* was invaded very intensively and disvalued aesthetic and also functional aspects of *Thuja occidentalis* in lower exposure part of BG UPJŠ. That is why control for this area is very important.

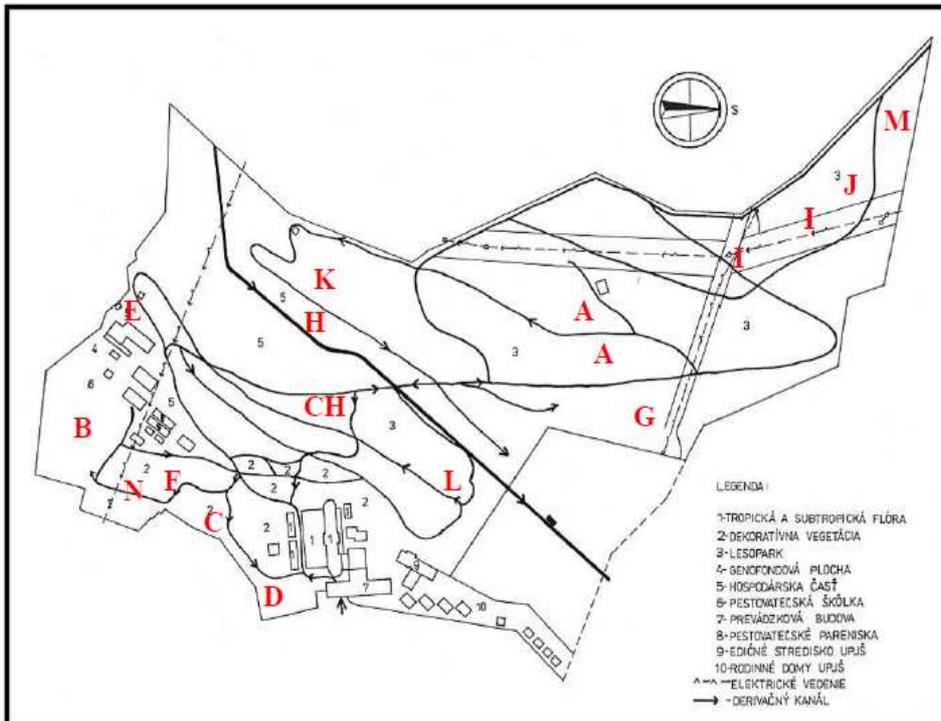


Fig. 8: Roadmap of BG UPJŠ in Košice

Preventive and defensive measures

Invasive tree species

We can use combined, defensive crackdown

a) *Mechanical crackdown*

If we have sprout with diameter of trunk of about 10 cm, we will abolish it by brush cutter or herbivora (*Capra hircus*). However c. individuals with diameter more than 10 cm will be eliminated by power-saw.

b) Chemical crackdown

- After the mechanical crackdown, we can use system herbicide (for example Roundup H).
- Optimal season is from April to May, when green shoot absorbs nutrients by leaves to shoots but important is killing of root system (mainly – *Robinia*, *Ailanthus* and *Amorpha*).
- After the period of 2 – 3 weeks, we should check through and, if it is necessary, we will use chemical measure again. If individuals are sapless, we can scythe area by brush cutter.
- Despite of it, we shouldn't underestimate the prevention. We should make a control for individual locations. Because of change of f.e. local climate, natural regeneration should be checked repeatedly in next years.

Expansive tree species

Mechanical crackdown

We can use cutter or herbivora (f.e. *Capra hircus*) for stump sprouts and also for root suckering individuals with $d_{1,3}$ of about 10 cm. We should eliminate these species by hand, on locations where expansive tree species (f.e. *Clematis v.*) are climbing up goal tree species because it could damage these goal t. species (s. locality N).

However c. individuals with diameter more than 10 cm, we will eliminate by power-saw.

On locality I I suggest manual felling of unhealthy c. individuals and reducing every second or every third healthy c. individuals. This will lead to opening a canopy layer. Especially, we should eliminate individuals closely at fence.

I suggest similar working on locality J. (on locality K) to eliminate sprouts individually (by hand) because of the genepool area.

On locality L, we should eliminate *Rubus fruticosus* by hand, because of, for example, meadow sweets (*Spiraea*) or apple trees (*Malus*).

On locality M, as there are some valuable species of *Rubus fruticosus*, we won't make mechanical or chemical crackdown. In opposite case we can use brush-cutter and then we can make chemical crackdowns (s. chemical crackdown for invasive species).

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