Sycamore maple (*Acer pseudoplatanus* L.) potential for coppicing: A case study

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Overview

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2. Objectives
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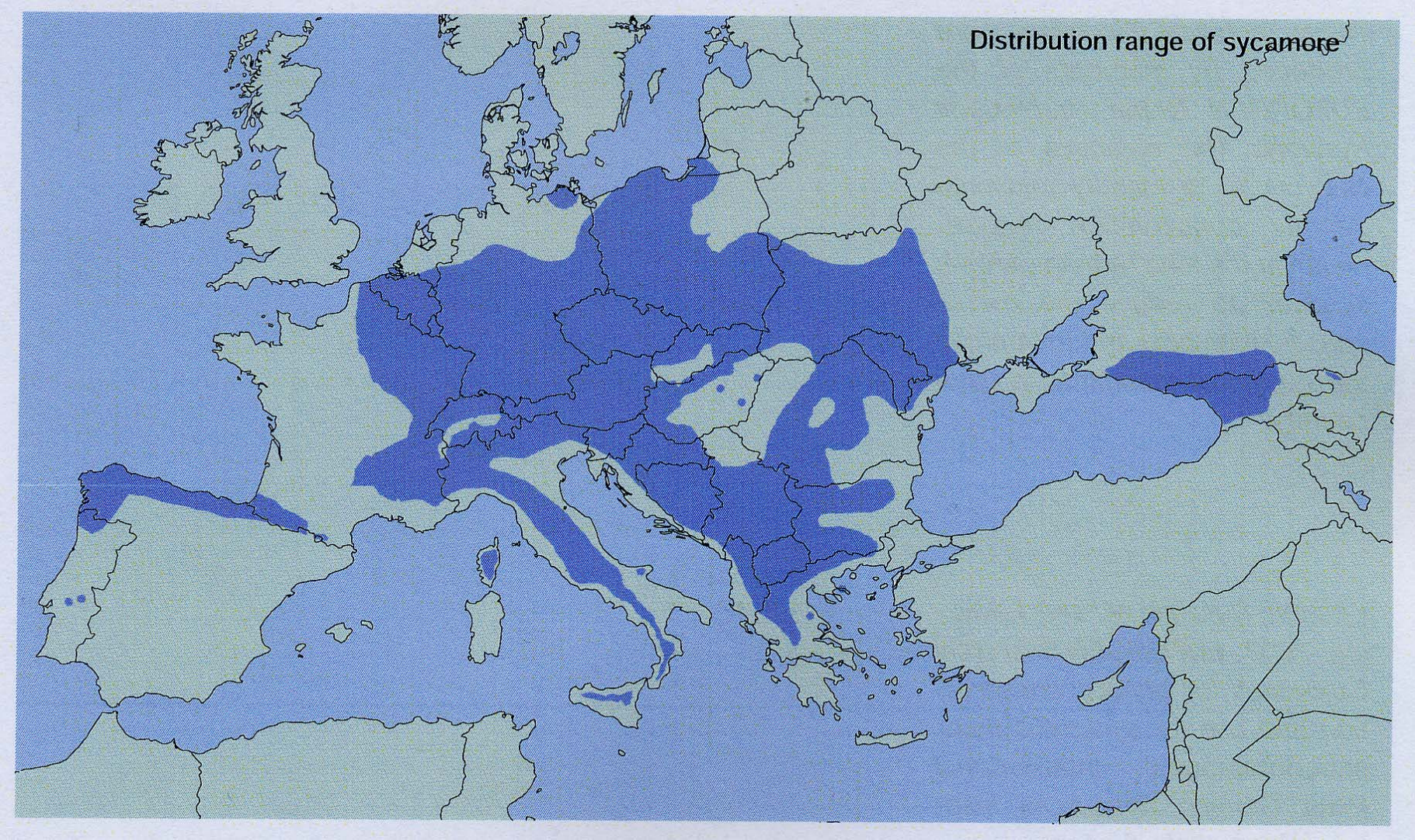
Sycamore (*Acer pseudoplatanus* L.), tree species of high interest in European forestry

(i) Tree species with a vast natural range, covering **1.2%** of European forestland and **1.7%** of annual wood harvest in the European forests (Spiecker *et al*., 2009).

Sycamore



Rusanen and Myking, 2003

Sycamore (*Acer pseudoplatanus* L.), tree species of high interest in European forestry

(ii) *One of the most valuable broadleaved tree species in Europe*, whose wood is used for the production of solid furniture, decorative veneer, musical instruments as well as sawntimber, pulp and paper, firewood, etc. (Hein *et al*., 2010).

What about the coppicing potential of sycamore?

- it coppices only at low elevations and the life-span of shoots is short (Negulescu and Savulescu, 1957, 1965).

- it coppices well but the longevity of shoots is short and stumps can rot easily (Stanescu, 1979; Stanescu *et al*., 1997; Sofletea and Curtu, 2000, 2007).

- the stump shoots are not numerous but quite vigorous when young. After 40-50 years, the coppicing potential decreases sharply (Haralamb, 1967).

- sycamore trees up to 80-100 years old coppice and normally self-prune well (Savill, 2013).

Objectives

1. Evaluation of the coppicing potential of sycamore.

2. Assessment of the effects of reducing the stocking (no. of shoots/stump) on diameter and height increment of individual sycamore shoots.

Material and Methods

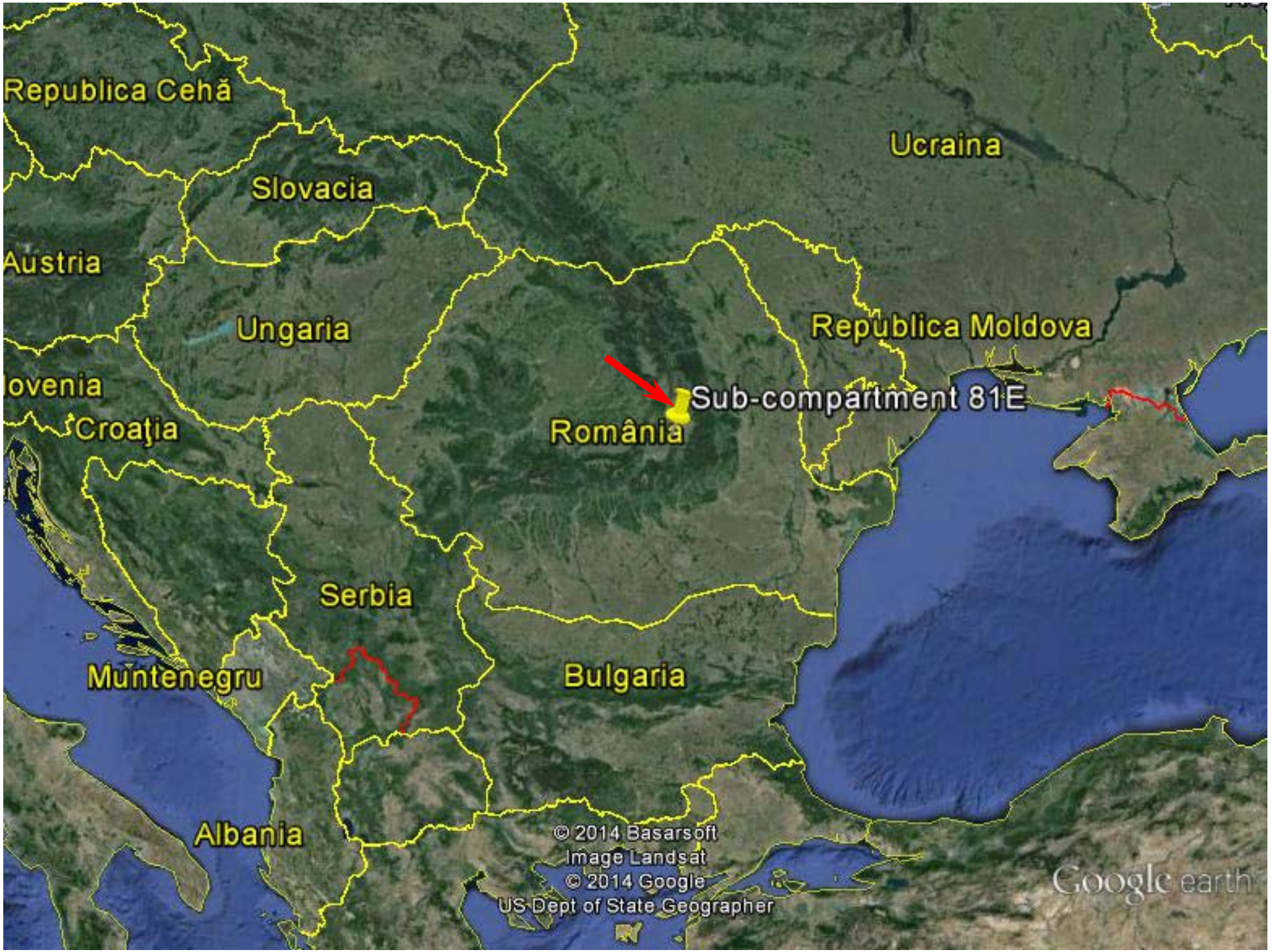
Sub-compartment 81E (45°54’19’’ N. lat., 25°54’98’’ E long., elevation 780 m asl):

- currently under private ownership after the restitution of forest land in 2000.

Climate: temperate continental; mean annual temperature: 7.6 °C; mean annual rainfall: 584 mm; aridity (de Martonne) index: 33.2

Soil type: brown argillic, of moderate fertility to sessile oak-dominated stands

Natural vegetation type: mixed broadleaved woodland, sessile oak-dominated, of moderate productivity


Republica Cehă
Slovacia
Ucraina
Austria
Ungaria
Republica Moldova
lovenia
Croaţia
Sub-compartment 81E
România
Serbia
Muntenegru
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- plantation of 3.3 ha, established with 1-year old plants (1.8x1.1 m - 5.000 plants/ha) in April 2003.

- species composition when planting: 52% northern red oak (*Quercus rubra*) 24% European beech (*Fagus sylvatica*) **15% sycamore** 9% European larch (*Larix europaea*) + (subsequent filling of the gaps with sessile oak (*Quercus petraea*), small-leaved linden (*Tilia cordata*), wild cherry (*Prunus avium*), common walnut (*Juglans regia*), Norway spruce (*Picea abies*), wild pear (*Pirus pyraster*), silver birch (*Betula pendula*), horse chestnut (*Aesculus hippocastanum*), etc.)

- use of ***agroforestry system*** (inter-planting with strawberries) between 2003 and 2008.

Plantation of scpt. 81E in 28 April 2007 (left) and 17 June 2007 (right)

- **December 2005**: owing to their quick height growth and ***over shading of strawberries***, pure lines of sycamore trees were cut 5-10 cm above the collar and stumps coppiced freely afterwards

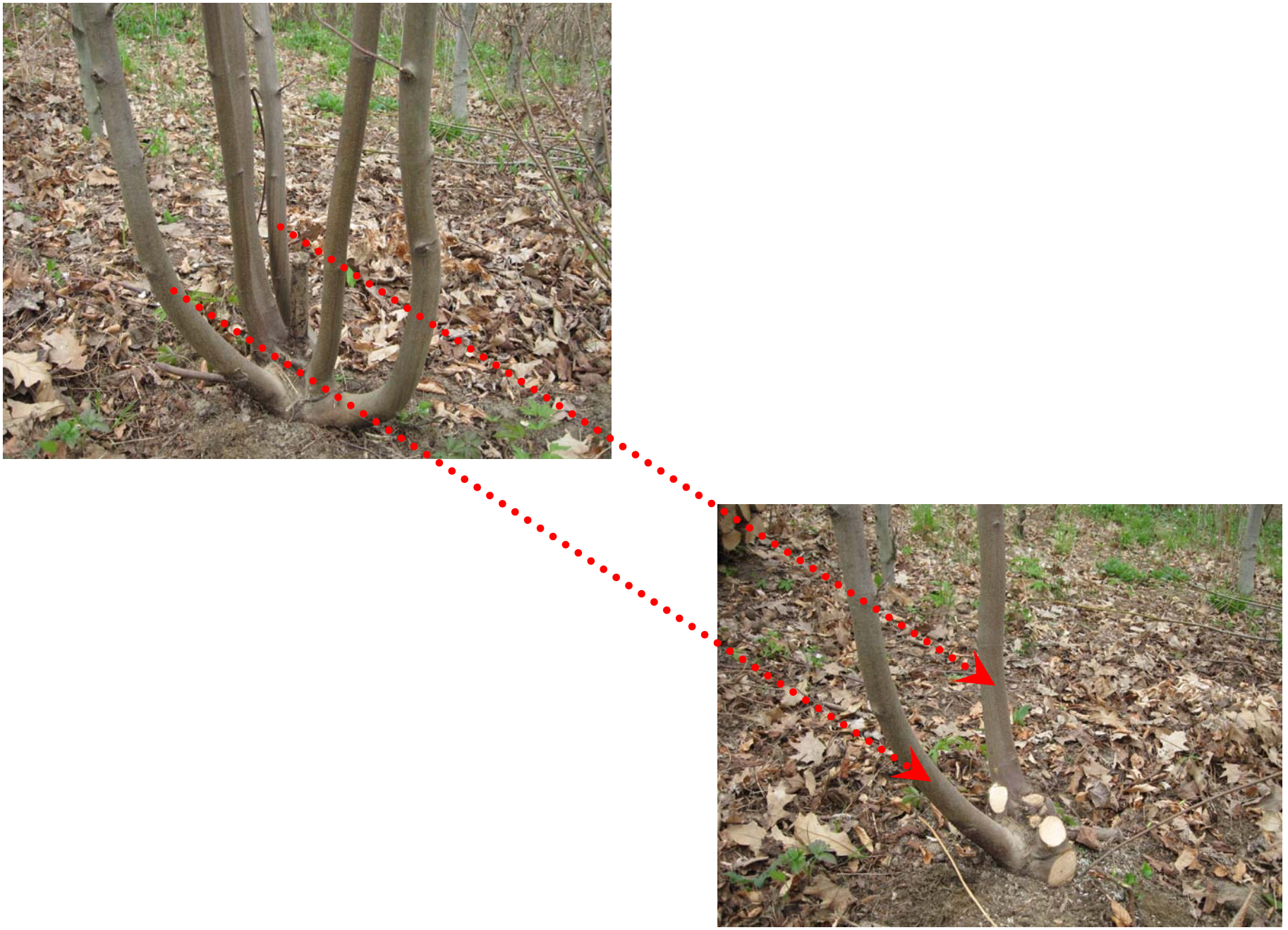
- **end of April-beginning of May 2011**: **45** sycamore stumps located along the same row (A) were treated as follows:

a. **15** stumps were cut keeping only 1 shoot/stump (the most vigorous and with good form)

b. **15** stumps were cut keeping 2 shoots/stump (in general the most vigorous and located face-to-face if possible)

c. **10** stumps, with 47 shoots (between 4 and 7 shoots/stump) were kept as control (no cut).

c. **5** stumps were ground cut (no stumps left)



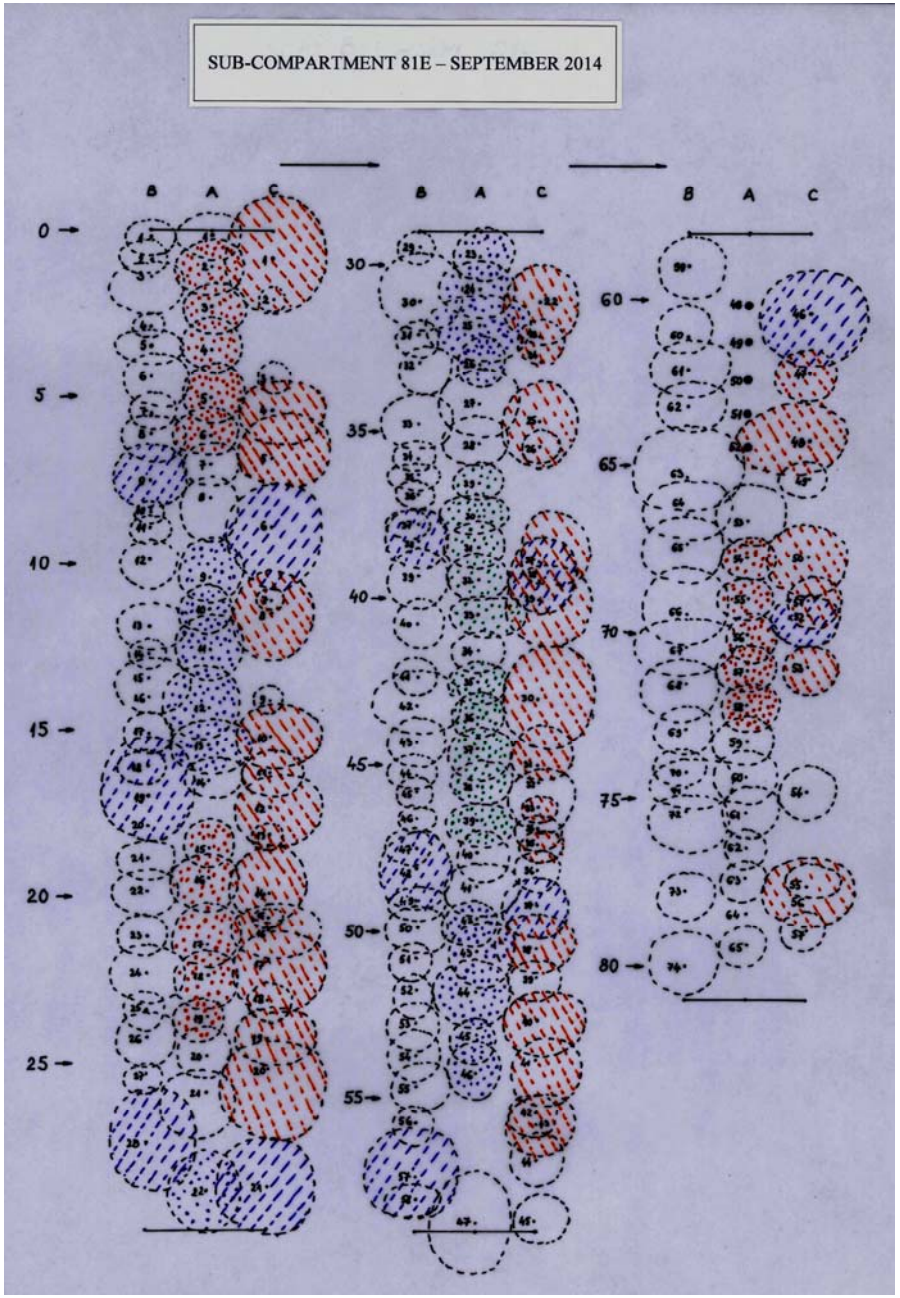
2011…2014: measurement of dbh and height of all shoots in the three treatments.

2011: selection of 60 individual high forest sycamore trees along three rows of plantation; 2011-2014: measurement of their dbh, height, 4 crown radii.

2014: measurement of location, dbh, height and 4 crown radii of all trees regardless species and size located along the row A as well as the two adjacent rows B and C.

2011…2014: calculation of main biometrical performances (mean diameter, mean height, mean slenderness index SI = (h/dbh) * 100) of sycamore shoots.

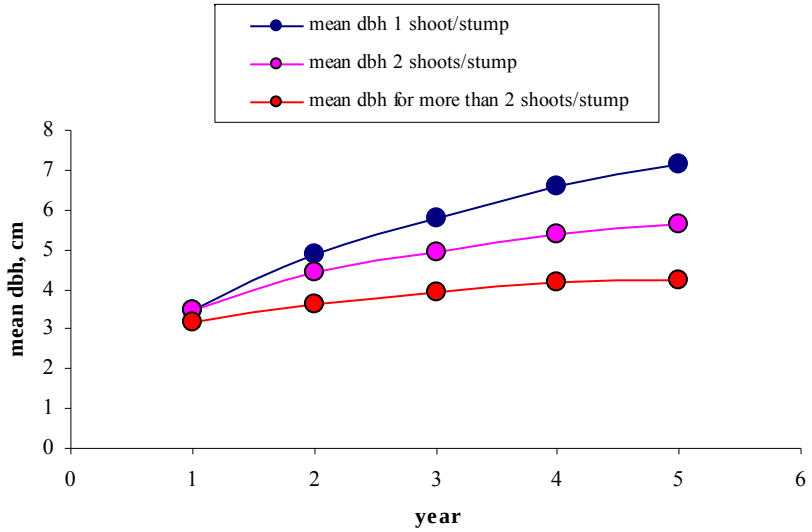
- blue dots: 1 shoot/stump
- orange dots: 2 shoots/stump
- green dots: control
- no. 48-52, row A: no shoots/stump
- blue hatching: European larch
- orange hatching: northern red oak



Results and Discussion

Mean diameter and individual diameter increments of sycamore shoots in the three treatments

	Mean diameter in... (cm)					Increase of mean diameter between 2011 and 2014		Range of increase of individual diameter increment between 2011 and 2014 (cm)/coeff.of variation, %
	2011	2012	2013a	2013b	2014	cm	%	
1 shoot/stump	***3.48***	4.86	5.77	6.61	***7.14***	***3.66***	***105.17***	1.2-5.4/30.28
2 shoots/stump	***3.50***	4.41	4.92	5.37	***5.66***	2.16	61.71	0.2-3.8/34.14
Control	***3.16***	3.61	3.90	4.18	***4.24***	1.08	34.18	0.1-2.6/66.61



Variation of diameter of individual sycamore shoots in the three treatments

	Variation of diameter of individual sycamore shoots in 2011 (age: 5 years), cm/coefficient of variation (%)	Variation of diameter of individual sycamore shoots in 2014 (age: 8 years), cm/coefficient of variation (%)
1 shoot/stump	2.6-4.8/17.77	**4.1-10.2/21.80**
2 shoots/stump	2.4-4.7/17.80	3.7-8.4/19.77
Control	1.7-5.0/21.04	2.0-6.6/27.34

Relevant values of diameter increment of sycamore shoots in the three treatments

	Sycamore shoots with individual diameter increments of **minimum 6 mm/yr** between 2011 and 2014		Sycamore shoots with individual diameter increments of **minimum 10 mm/yr** between 2011 and 2014	
	No.	%	No.	%
1 shoot/stump	13	**87**	7	**47**
2 shoots/stump	12	40	0	0
Control	1	2	0	0

Mean height and individual height increments of sycamore shoots in the three treatments

	Mean height in... , m				Increase of mean height between 2011 and 2014		Range of increase of individual height increment between 2011 and 2014, m/coefficient of variation, %
	2011	2012	2013	2014	m	%	
1 shoot/stump	***4.86***	5.90	6.41	***7.48***	**2.62**	**53.91**	1.79-3.27/18.80
2 shoots/stump	***4.76***	5.62	6.13	***6.90***	2.14	44.96	1.26-2.88/18.83
Control	***4.96***	5.61	6.07	***6.69***	1.73	34.78	0.14-3.21/41.28

Variation of heights of individual sycamore shoots in the three treatments

	Variation of heights of individual sycamore shoots in 2011 (age: 5 years), m/coefficient of variation, %	Variation of height of individual sycamore shoots in 2014 (age: 8 years), m/coefficient of variation, %
1 shoot/stump	3.99-5.80/11.31	**6.59-8.35/6.93**
2 shoots/stump	4.05-5.68/8.68	5,55-7,93/8.66
Control	3.51-6.03/12.01	4,35-8,45/15.10

Relevant values of heights of sycamore shoots
in the three treatments

	Shoots **at least 5 m tall** in 2011 (age: 5 years)		Shoots **at least 8 m tall** in 2014 (age: 8 years)	
	No.	%	No.	%
1 shoot/stump	7	**46.7**	3	**20.0**
2 shoots/stump	8	26.7	0	0
Control	23	48.9	5	11.6

Mean slenderness index and modification of slenderness index of sycamore shoots in the three treatments

	Mean slenderness index in... (cm)				Increase/decrease of mean slenderness index between 2011 and 2014		Modification of slenderness index in individual shoots	
	2011	2012	2013	2014	+	-	Decrease, no./%	Increase, no./%
1 shoot/stump	**140**	121	111	**109**		31	15/100	0/0
2 shoots/stump	**136**	128	125	**125**		11	23/77	7/23
Control	**162**	161	161	**167**	5		19/44	24/56

Variation of slenderness index of individual sycamore shoots in the three treatments

	Variation of slenderness index of individual sycamore shoots in 2011 (age: 5 years)/coefficient of variation, %	Variation of slenderness index of individual sycamore shoots in 2014 (age: 8 years)/coefficient of variation, %
1 shoot/stump	113-163/13.77	**77-161/19.74**
2 shoots/stump	106-188/14.94	86-178/15.69
Control	102-232/15.96	98-218/17.26

Planted (high forest) sycamore trees

Coppiced sycamore – 1 shoot/stump

	High forest sycamore trees (**8-years old** in 2011)	**Coppice** sycamore trees (1 shoot/stump) (**5-years old** in 2011)
Mean diameter, diameter variation + coefficient of variation of d in 2011, cm/%	5.67 (3.9...8.1/14.66)	3.48 (2.6...4.8/17.77)
Mean diameter, diameter variation + coefficient of variation of d in 2014, cm/%	**8.39** (5.8...11.5/14.54)	**7.14** (4.1...10.2/21.80)
Increase of mean diameter (2011-2014), cm/%	**2.72/47.2**	**3.66/105.17**
Mean diameter increment in 2014, cm/yr	**0.70**	**0.79**
Mean height, height variation + coefficient of variation of h in 2011, m/%	5.34 (4.07...6.45/9.79)	4.86 (3.99...5.80/11.31)
Mean height, height variation + coefficient of variation of h in 2014, m/%	**6.69** (5.40...7.81/8.93)	**7.48** (6.59...8.35/6.93)
Increase of mean height (2011-2014), m/%	**1.35/25.28**	**2.62/53.91**
Mean height increment in 2014, m/yr	**0.56**	**0.83**

Other planted tree species in rows B and C

	Row B		Row C	
	Mean diameter, cm	Mean height, m	Mean diameter, cm	Mean height, m
European larch	**12.9**	**10.06**	**13.45**	**10.49**
Northern red oak			**7.60**	**8.20**
European beech	5.46	5.82		
Small-leaved linden	5.72	6.08		

Preliminary Conclusions

1. Sycamore has a high coppicing potential and fast growth at young ages, therefore the species can be used in short rotation coppices (maximum 10-12 years).

2. Sycamore shoots, especially when grown as individuals, have higher diameter and height increments than planted sycamore trees. However, they are less fast growers than European larch and northern red oak planted trees under the local conditions.

3. The reduction of stocking had a positive effect on both diameter and height increment. However, the diameter increment was more responsive to stocking reduction than the height increment; consequently the slenderness index was positively influenced (reduced) by the heavier reduction of number of shoots/stump.

What is next?

1. Research (using extra individual stumps and variable shoot densities/stump) on the effects of stocking on growth and yield of sycamore coppice.

2. Research on the effects of reducing stocking on wound closure and presence of discolourations/decay in wood. Testing the impacts of different antiseptic substances in the dynamics of this process.


Thank you for your attention!