The impact of mechanized cutting on coppice mortality, re-sprouting vigor and physiology

N. Magagnotti, L. Pari, R. Spinelli G. Aminti, A. Giovannelli

Session 82 a/b - IUFRO 125th Anniversary Congress, Freiburg, Germany
Traditional coppice: ecology, silviculture & socio-economic aspects
Tuesday Sept. 19th, 2017

EuroCoppice

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Introduction

- Coppice management to be modernized
- Modern industrial business
- Mechanization
  - Multiple stems on the same stump
  - Prevent stump damage
  - Re-sprouting vigor
  - Safety
  - Right technology & skilled operator

Goals

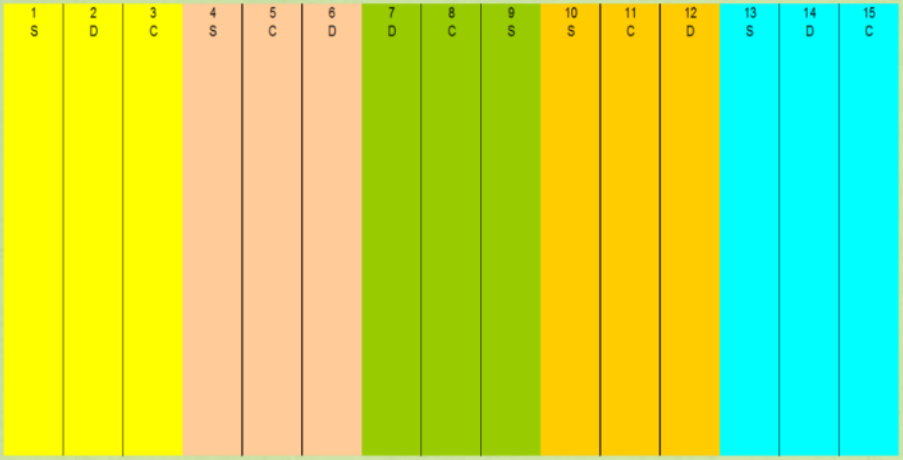
- To determine ***if*** mechanized cutting can effect the mortality and re-sprouting of coppiced stumps.
- To gauge the magnitude of these effects
- To analyze the effect of mechanized cutting on the carbon and nitrogen reserves of the stumps

Materials and methods

- Central Italy
- Oak dominated coppice stand (20y old)
  - Turkey oak 36%
  - Field maple 24%
  - Narrow-leaf ash 16%
  - Downy oak 7%
  - Manna ash 4%
  - Mock privet, cornelian cherry

- Slope gradient 20%
- DBH: 15 cm (5-30 cm)
- Clearcut with reserve (100 standards/ha)
- Harvest 150 fresh t/ha (including tops and branches)

Materials and methods



Materials and methods

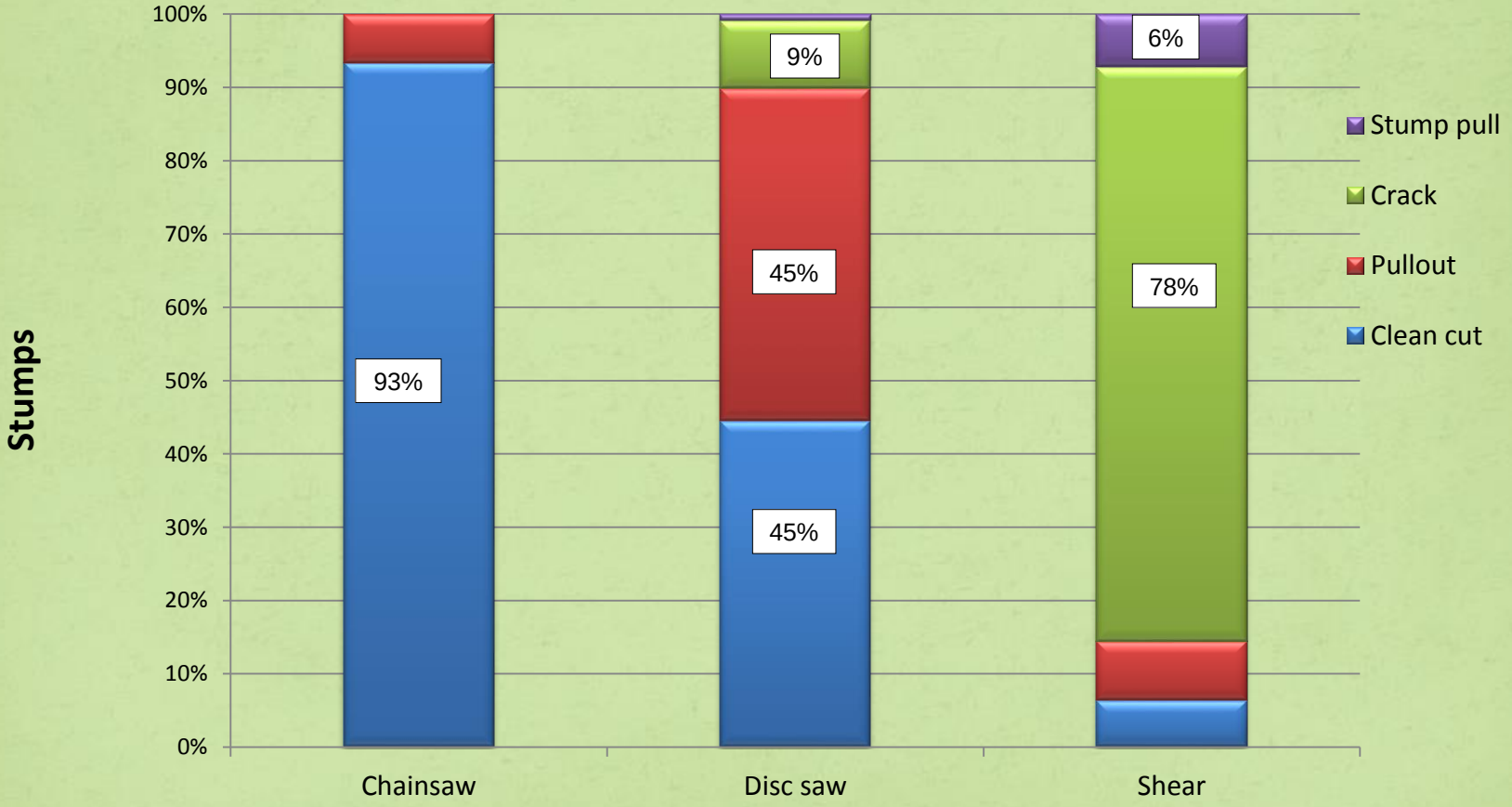
- Individual stump=observational unit
- Btw 13-34 stumps per each subplot
- After cutting: stump characteristic & cut quality
    - Clean cut
    - Pullout
    - Crack
    - Stump pull
- Re-sprouting:
    - No shoots taller than 30 cm
    - 5 tallest shoots: diameter, height, insertion
    - browsing
- C/N ratio & sugar type (5 stumps/subplot)
    - 4 times - phenological phase: after felling, exponential growth, offset, dormancy
    - 5 cm long helical core

Materials and methods

Results

	Mean	SD	Min	Max
Maximum height (cm)				
Chainsaw	9.4[a]	3.9	2	27
Disc saw	10.4[a]	6.2	0	33
Shear	15.2[b]	7.1	3	40
Minimum height (cm)				
Chainsaw	4.2[a]	2.0	0	10
Disc saw	4.9[a]	4.3	0	29
Shear	7.8[b]	4.6	1	24
Circumference at cut level (cm)				
Chainsaw	210[a]	75	70	410
Disc saw	213[a]	88	65	415
Shear	207[a]	86	40	460

Results


Stumps
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
93%
45%
45%
9%
6%
78%
Chainsaw
Disc saw
Shear
Stump pull
Crack
Pullout
Clean cut

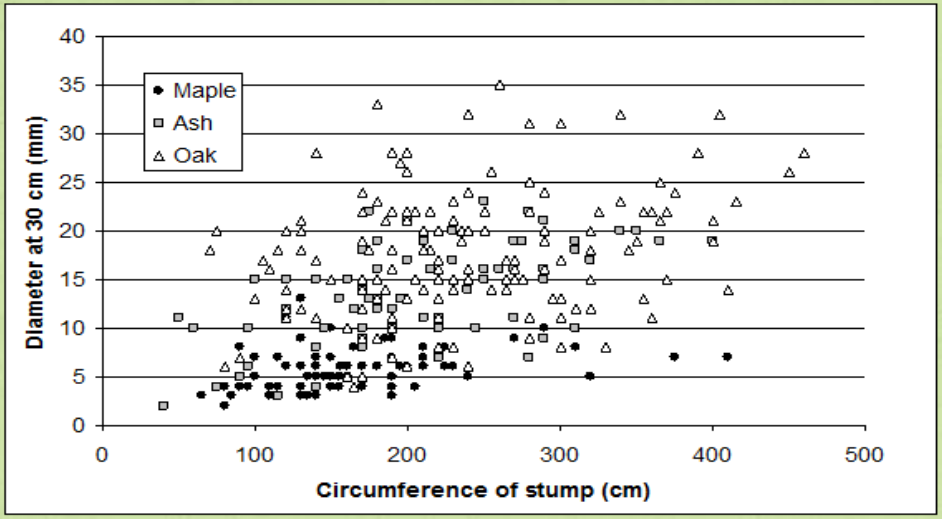
Results

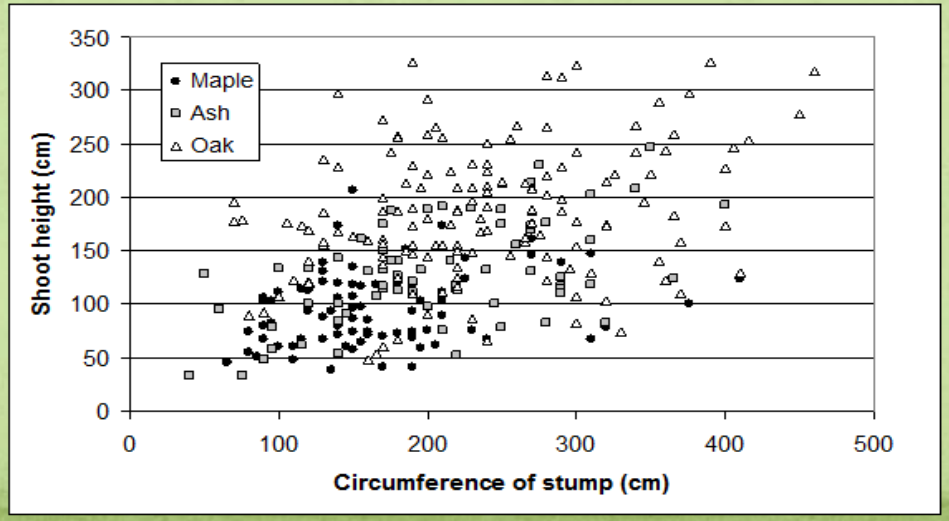
- Re-sprouting vigor - species

	Oak		Maple		Ash	
	Mean	SD	Mean	SD	Mean	SD
Number of shoots						
Chainsaw	13.7[a]	7.7	37.5[a]	19.6	18.0[ab]	12.6
Disc saw	15.8[ab]	9.4	23.4[b]	19.3	13.1[a]	8.2
Shear	18.7[b]	10.3	28.6[ab]	15.8	25.6[b]	21.3
Mean shoot diameter at 30 cm from the ground (mm)						
Chainsaw	17.6	6.7	6.3	1.9	12.4	5.7
Disc saw	17.3	6.2	5.3	1.9	13.9	4.8
Shear	18.0	6.1	6.1	2.1	14.0	5.5
Mean shoot height (cm)						
Chainsaw	184	63	101	27	114	44
Disc saw	180	59	83	34	136	48
Shear	197	63	100	36	136	46

Results

- Re-sprouting vigor (size of stumps)



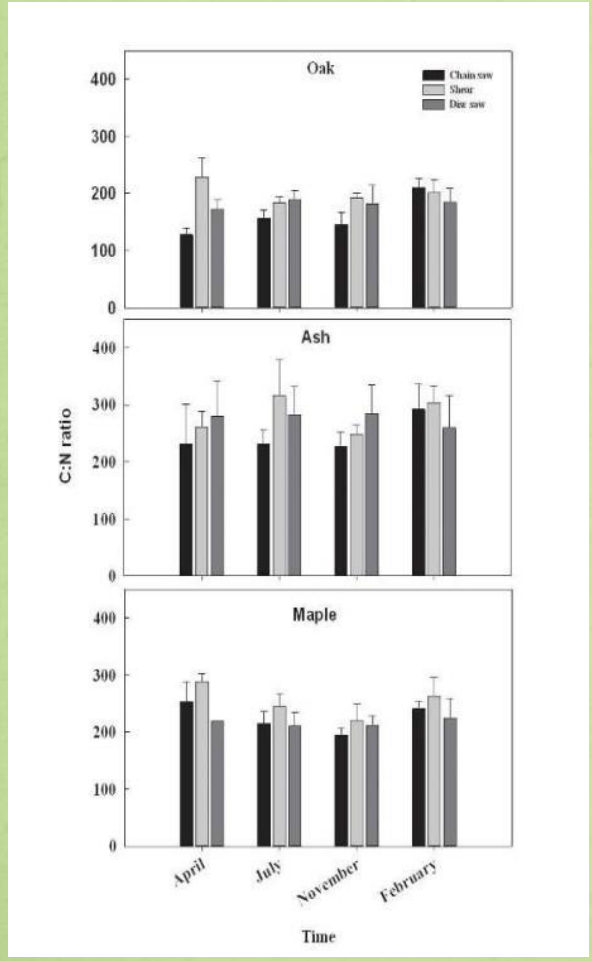


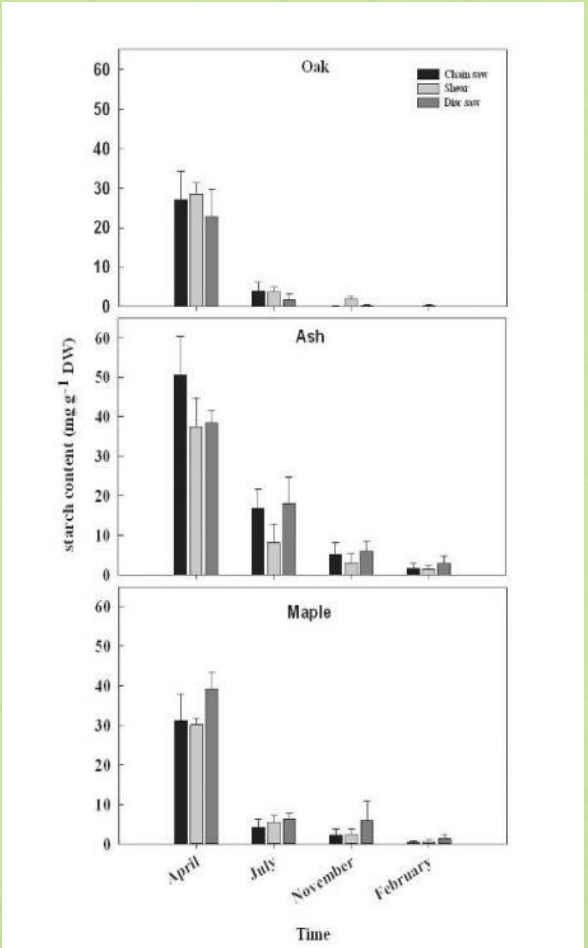
Results

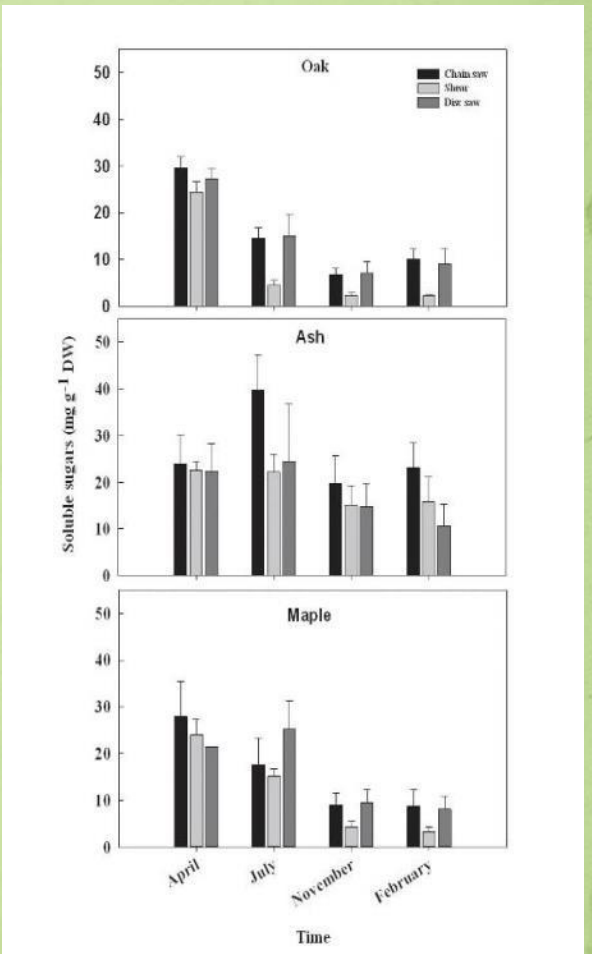
- % distribution of different shoot types

	Adventitious shoots	Basal shoots	Root suckers
All treatments together – by species			
Species - χ^2 = 10.491; p-Value = 0.033			
Oak	11.0	80.9	8.0
Maple	12.3	82.9	4.8
Ash	**16.0**	78.7	5.2
Oak only – by treatment			
Treatments - χ^2 = 17.008; p-Value = 0.002			
Chainsaw	**16.8**	73.5	9.7
Disc	9.5	82.1	8.4
Shear	**6.5**	88.1	5.5
Maple only – by treatment			
Treatments - χ^2 = 9.571; p-Value = 0.048			
Chainsaw	**17.8**	74.8	7.4
Disc	9.4	87.7	2.8
Shear	9.7	86.3	4.0
Ash only – by treatment			
Treatments - χ^2 = 31.671; p-Value = 0.000			
Chainsaw	23.7	69.1	7.2
Disc	23.3	69.8	7.0
Shear	**3.6**	94.2	**2.2**

Results


Oak
Ash
Maple
Chain saw
Shear
Disc saw
C:N ratio
April
July
November
February
Time


Oak
Ash
Maple
Chain saw
Shear
Disc saw
starch content (mg g-1 DW)
April
July
November
February
Time


Oak
Ash
Maple
Chain saw
Shear
Disc saw
Soluble sugars (mg g-1 DW)
April
July
November
February
Time

Conclusions

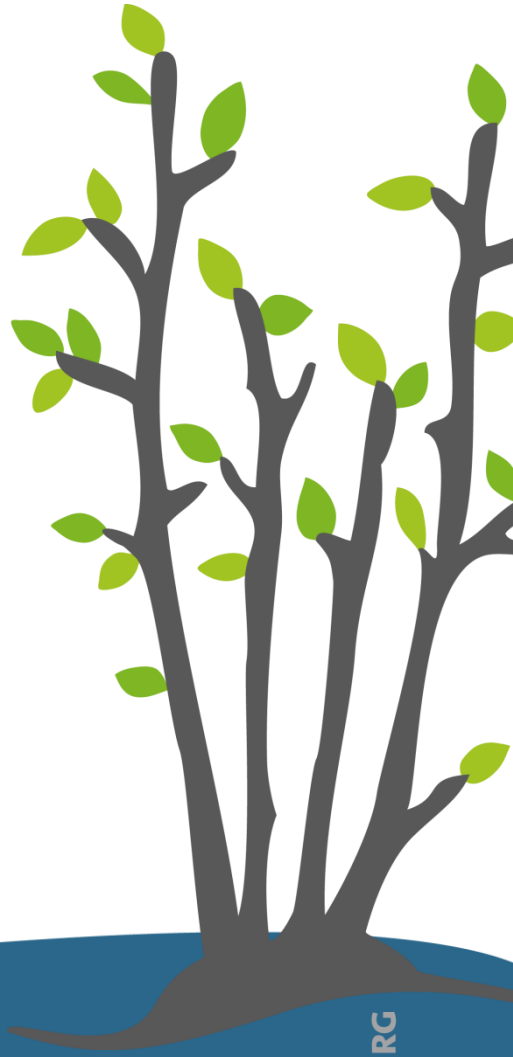
- Limited mortality: 4-8%
- Dominant shoots: exceeded 1,5 m
- Cutting technology:
  - Effect on cutting height & damage
  - No effect on mortality, re-sprouting vigor, nutrient balance
- Regeneration vigor: species
- Largest shoots: oaks

☞To be continued in the following years

COST Action FP1301 EuroCoppice

Innovative management and multifunctional utilisation of traditional coppice forests – an answer to future ecological, economic and social challenges in the European forestry sector

… Thank you!



Corresponding author contact information:

magagnotti@ivalsa.cnr.it

www.eurocoppice.uni-freiburg.de

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