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FORESTS AND FOREST-BASED PRODUCTS FOR A GREENER FUTURE

Natural seed regeneration in chestnut coppices:

a key factor in planning silvicultural management.

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Chestnut (*Castanea sativa*) coppices: ->

- **vegetative origin (resprouts from stool)**
- even aged stands
- short-medium rotation time
- timber production (low-medium sizes)

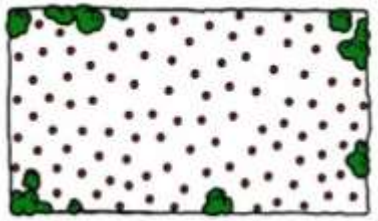
Chestnut (*Castanea sativa*) coppices: ->

- vegetative origin (resprouts from stool)
- even aged stands
- short-medium rotation time
- timber production (low-medium sizes)

Traditional coppicing options:

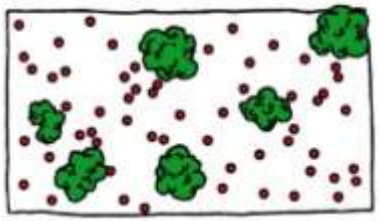
Simple coppice (clearcutting)

all stems are cutted at the same time with no standards.



coppice with standards

selected individuals are retained over 1 or more rotations and the rest is felled.



OPTIONS ON MANAGEMENT OF CHESTNUT COPPICES

- opt.1 – **Short Rotation coppices**:
  - Business as usual (seldom economically sustainable).

- opt.2 – **Medium/Long Rotation coppices**:
  - Improving timber quality
    [extending the rotation period]
    [applying early thinnings]

- opt.3 – **Abandonment:**
  - Abandonment of active silviculture
    [to sporadic and unplanned harvesting activities]
  - Ageing of coppices,
    [spreading of common chestnut-diseases]
    [reduction in density and vitality of the stools]

opt.1: Short Rotation **opt.2: Med/Long Rotation** **opt.3: Abandonement**

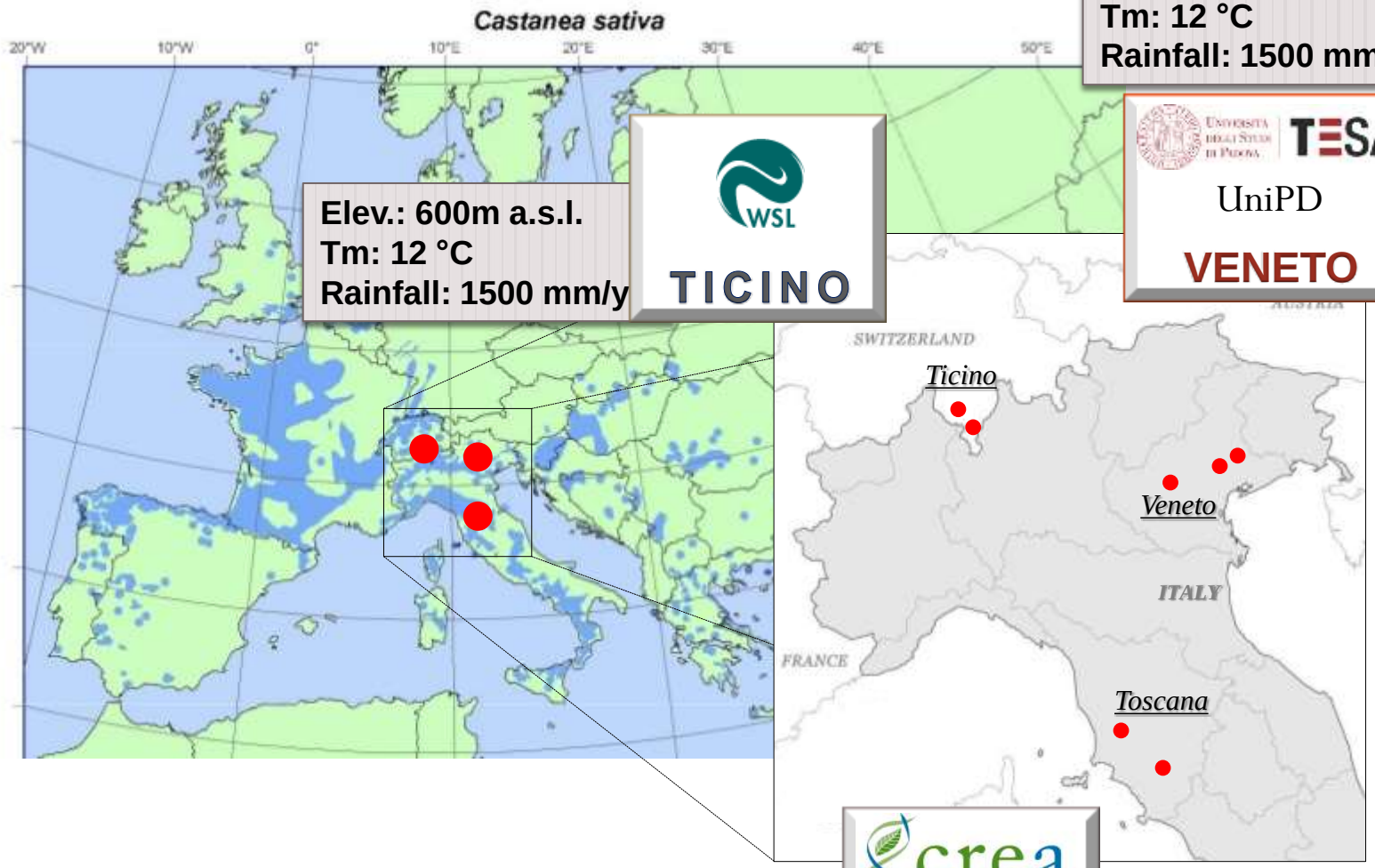
- in case of option 1, 3
- (or from other options to opt. 2)

improving
QUALITY and SUSTAINABILITY
of long-rotation chestnut coppices:

natural SEED REGENERATION

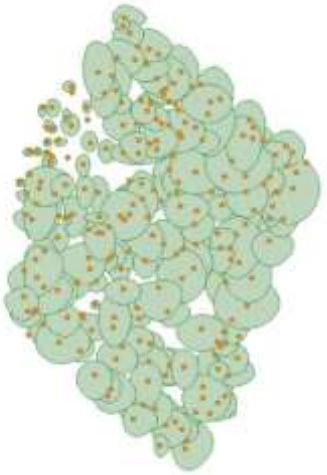
- increasing STOOL DENSITY and substituting old, sick or dead individuals.
- providing news, VIGOROUS, HEALTHY and morphologically well-shaped trees
- providing soil coverage after the coppicing (SOIL PROTECTION and mitigation of the water erosion risk)
- promoting DIVERSITY of the stand and increasing the RESILIENCE to diseases

Study area: stand locations and map



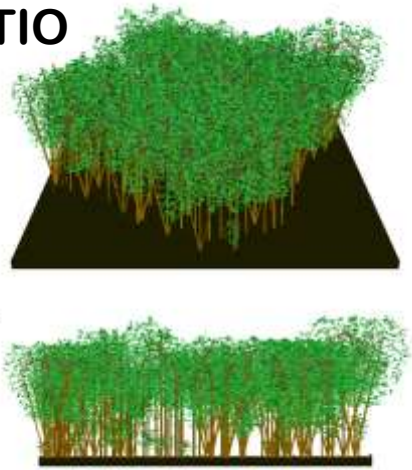
COPPICING plays on:

CANOPY COVER
(strictly related to **BASAL AREA**)



STAND VARIABLES affecting availability of resources for NATURAL REGENERATION from seed

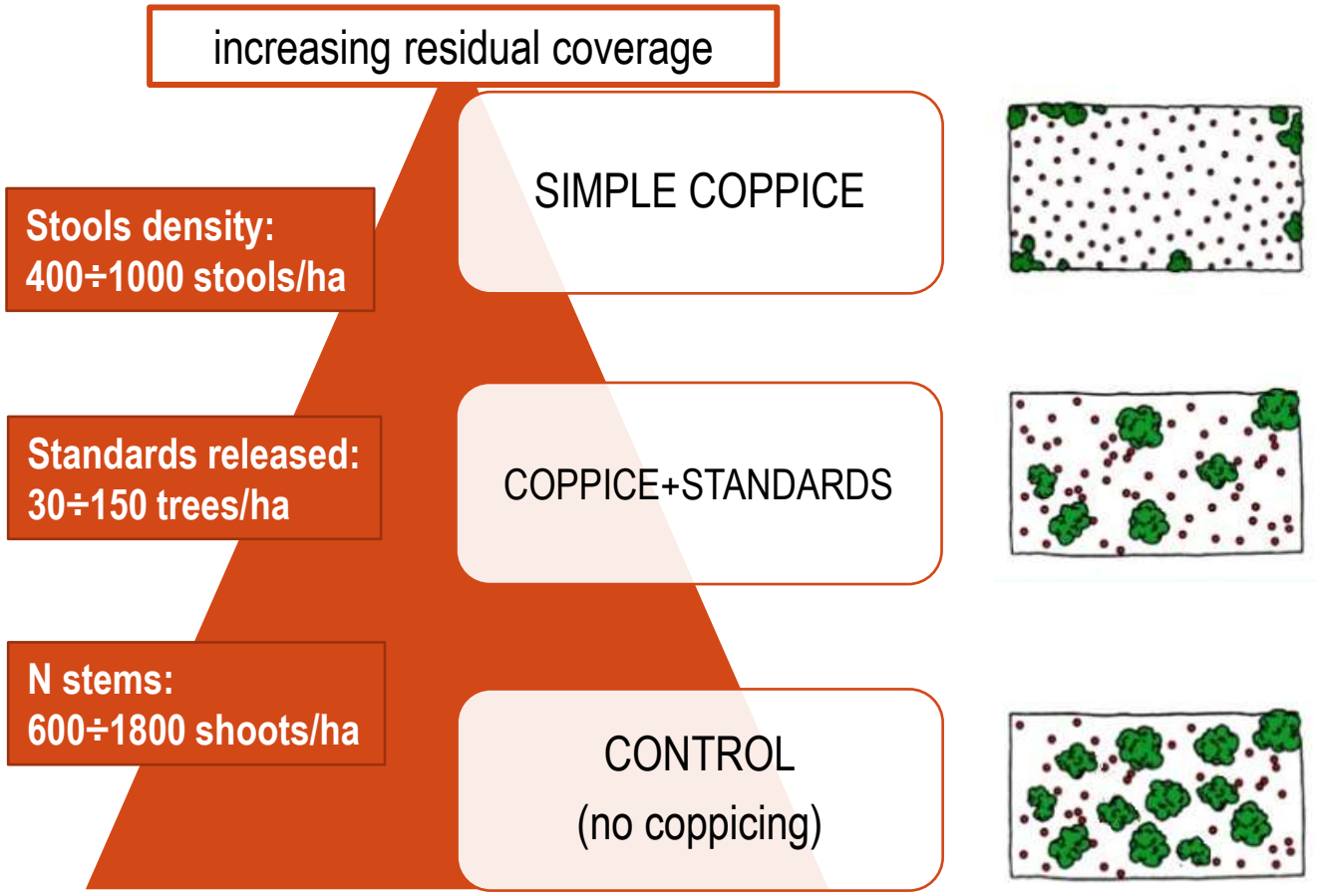
STEMS/STOOL RATIO



STOOL DENSITY

HYPOTHESIS:
- STAND COVER IMPEDING NATURAL REGENERATION

COPPICING OPTIONS



HYPOTHESIS:
- STAND COVER IMPEDING NATURAL REGENERATION

TIME DIAGRAM with contributions of 3 groups (independent studies)

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time -1 0

Forest Inventory - PRE
Trees mapping (x,y) [GIS]
N stools (n/ha)
N shoots (n/stool)
Tree height$_{dom}$ (m)
DBH (cm)
Species composition

TIME DIAGRAM with contributions of 3 groups (independent studies)

COPPICING

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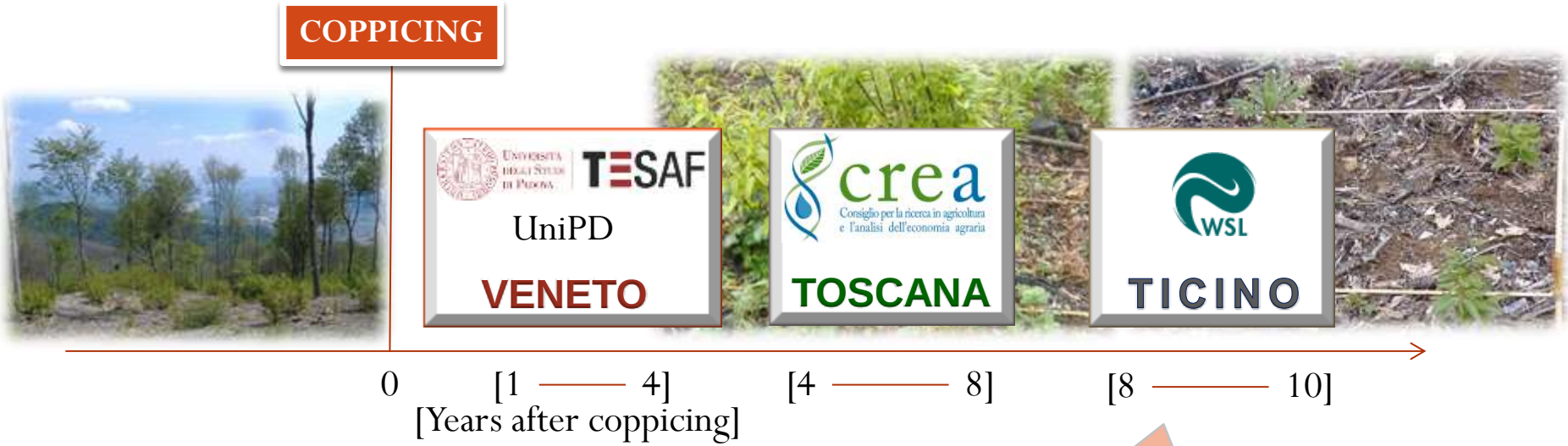
Forest Inventory–POST
Coppice standards
Residual Trees (updating) (x,y) [GIS]
Residual N stools (n/ha)
Residual N shoots (n/stool)
Tree height$_{dom}$ (m)
DBH (cm) --> Residual Basal Area(cm^2)

Time diagram with contributions from the groups (independent studies)



Coppice standards	Sprouting regeneration	Seed regeneration
N trees (n/ha)	N stools (n/ha)	N seedlings (n/ha)
D_mBH (cm)	N shoots (n/ha) , (n/stool)	H seedling (cm)
H_m (m)	H_{dom} stool (m)	species composition
Canopy cover (m^2)	Canopy cover (m^2)	[Sampling plots]
[Sampling plots]	[Sampling plots]	Surveying methods

Natural seed regeneration in chestnut coppices

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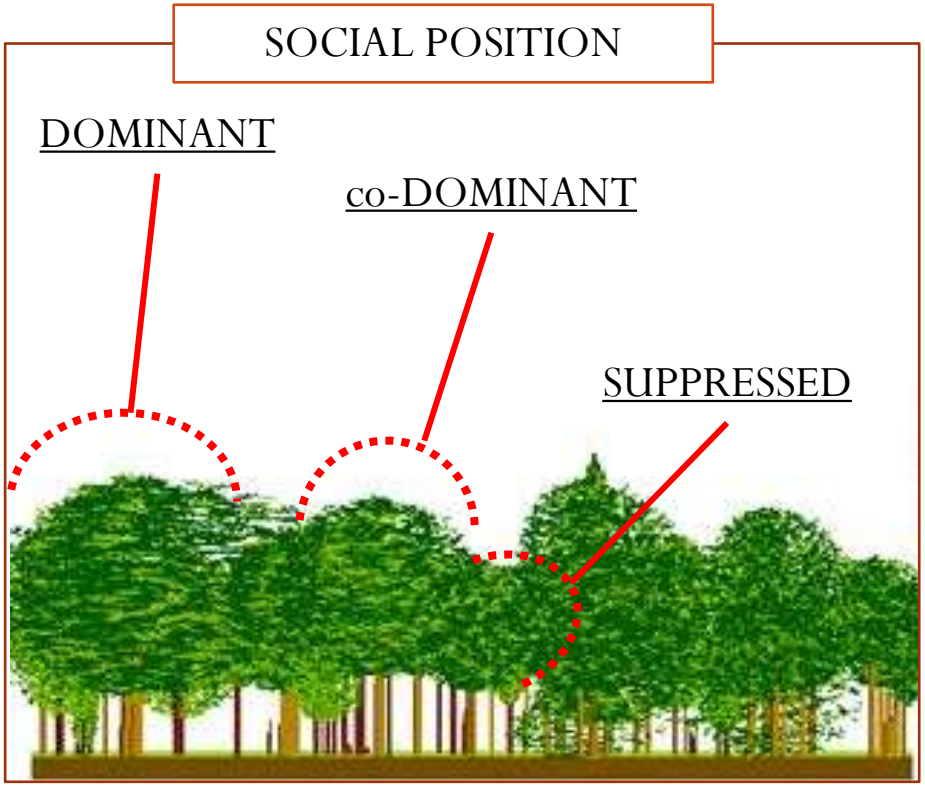
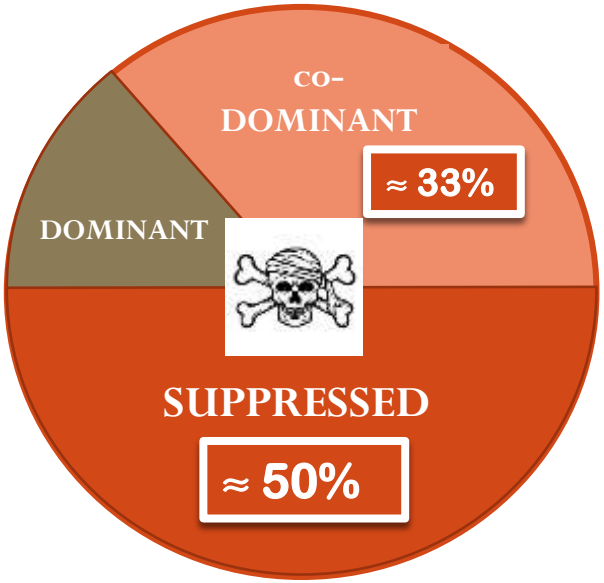
…4 years after coppicing

STOOL MORTALITY: 13÷18%





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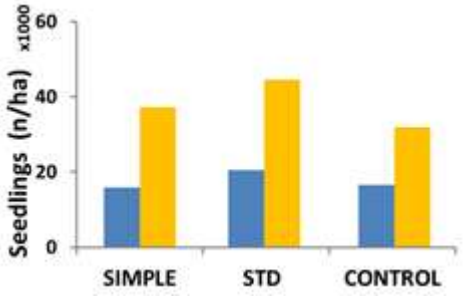
1° stage:
focus on
seedling settlement

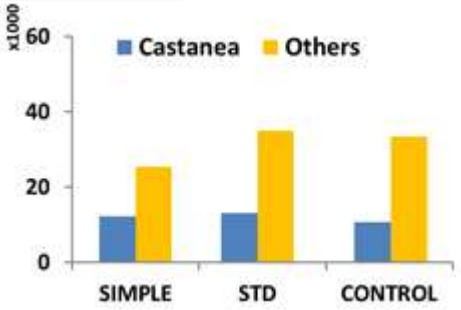
Seedling occurences

1 y



• Total 45.000-60.000 n/ha
(*Castanea* 15.000-20.000 n/ha)

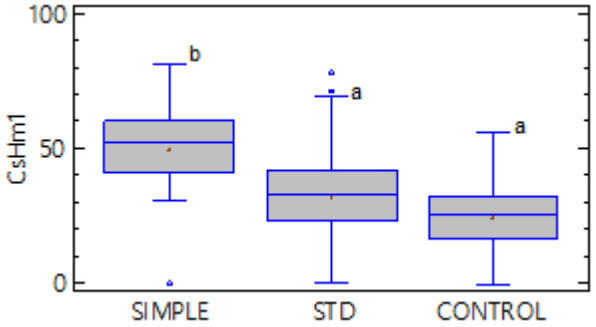
4 ys



• Total 30.000-50.000 n/ha
(*Castanea* 10.000-15.000 n/ha)

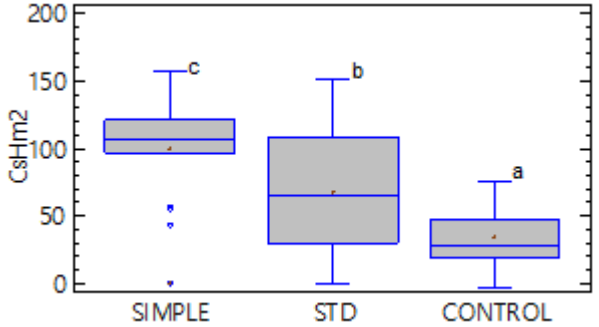
mean Height of *Castanea* seedling

1 y



H_{mean}	SIMPLE	STD	CONTROL
	49^{b} ±16	31^{a} ±20	24^{a} ±14

4 ys



SIMPLE	STD	CONTROL
99^{c} ±43	67^{b} ±46	36^{a} ±23

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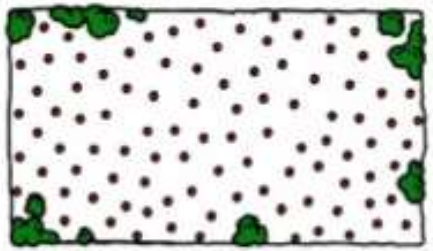
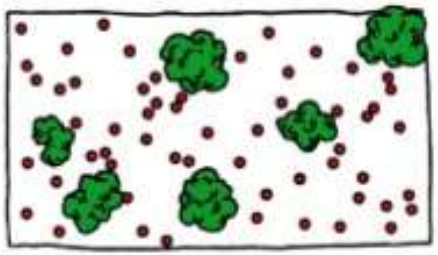
2° stage: focus on *sapling* growth

4÷9 YEARS AFTER COPPICING



SIMPLE

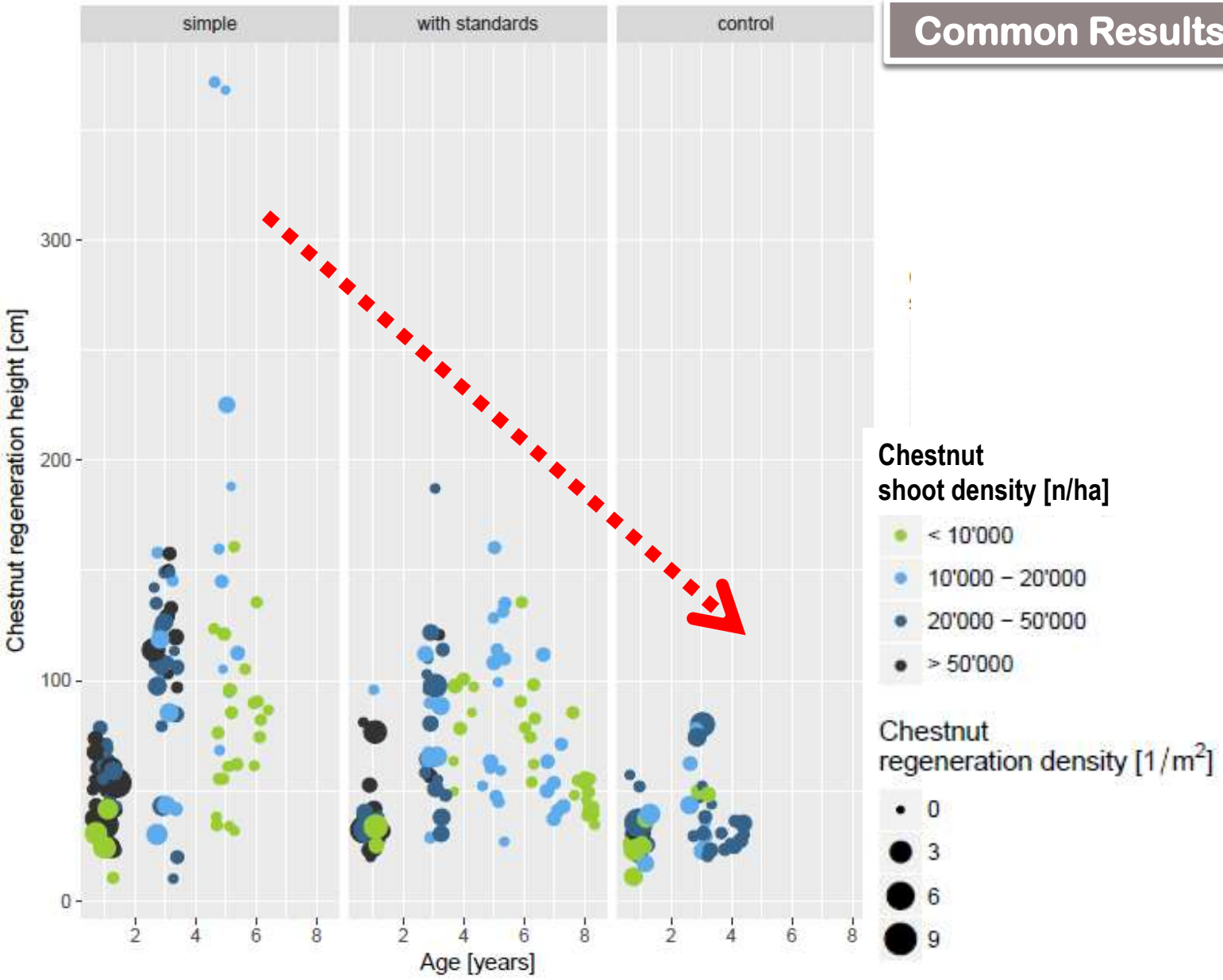


+STANDARDS

SIMPLE	+STANDARDS	
360÷10000	200÷5500	Chestnut seedlings [min÷max] (n/ha)
124÷630	30÷110	Hm [min÷max] (cm)

Natural seed regeneration in chestnut coppices

Common Results



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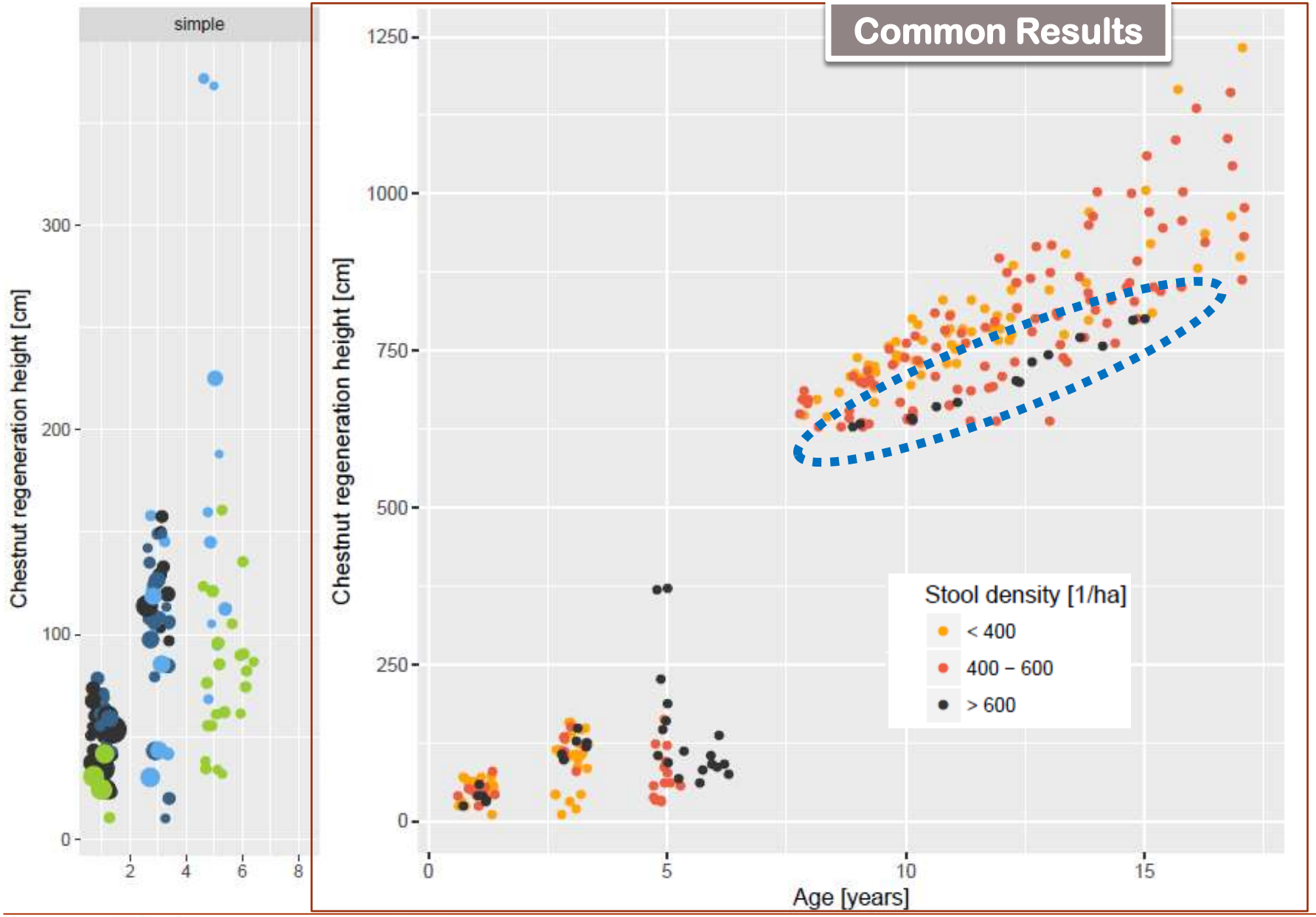
Common Results



Common Results

Successful settlement of (seed) natural regeneration depends from:

STAND AGE BEFORE COPPICING
(reduction of stools and shoots/stool ratio)
(increasing of seed production)

STOOL DENSITY → physical space
(higher density of stools reduces potential area for seedlings establishment)

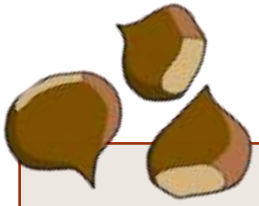
RESIDUAL COVER from released standards
(none or little is better)

Basal Area ~ Seedling Hm (**r= - 0,5 p<0.01**)

Increasing competition for resources with **GROWING SHOOTS**
(frequent and repeated thinnings)

N Stems ~ Seedling Hm (**r= -0,3 p<0.01**)

Management to promote natural regeneration



ACTION PLAN

✓ **COPPICING to:**

❑ favour SEED AVAILABILITY (standards of good quality as seeders)

✓ **THINNING to:**

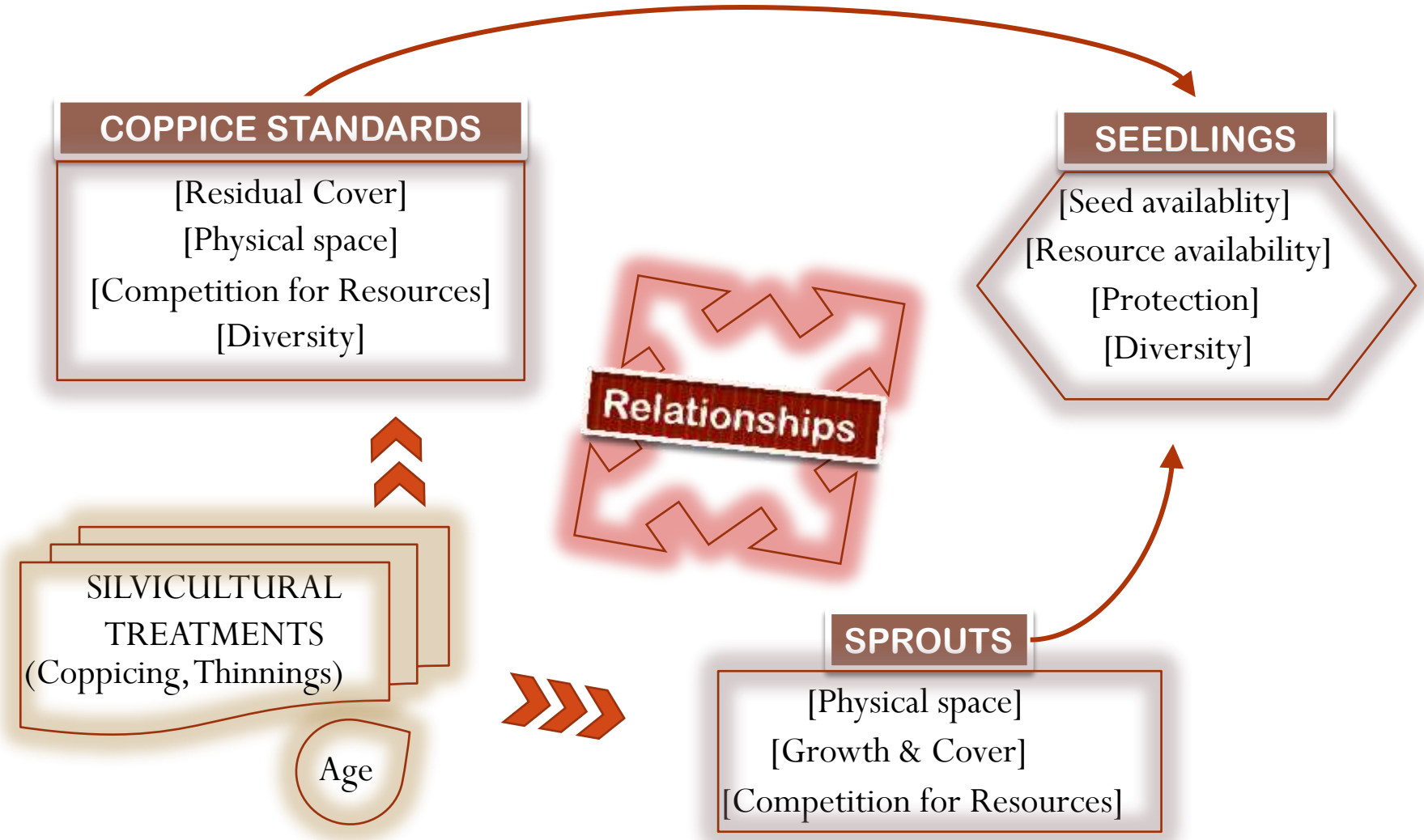
❑ reduce COVER from released standards

❑ promote GROWTH of selected saplings

select and MINIMIZE the release of standards

Framework of Variables involved in the model

Regeneration output, environmental and explanatory parameters



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Thanks for your kind attention

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