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Alley Cropping – A promising multifunctional form of land use for reclaimed lignite mining sites in Germany

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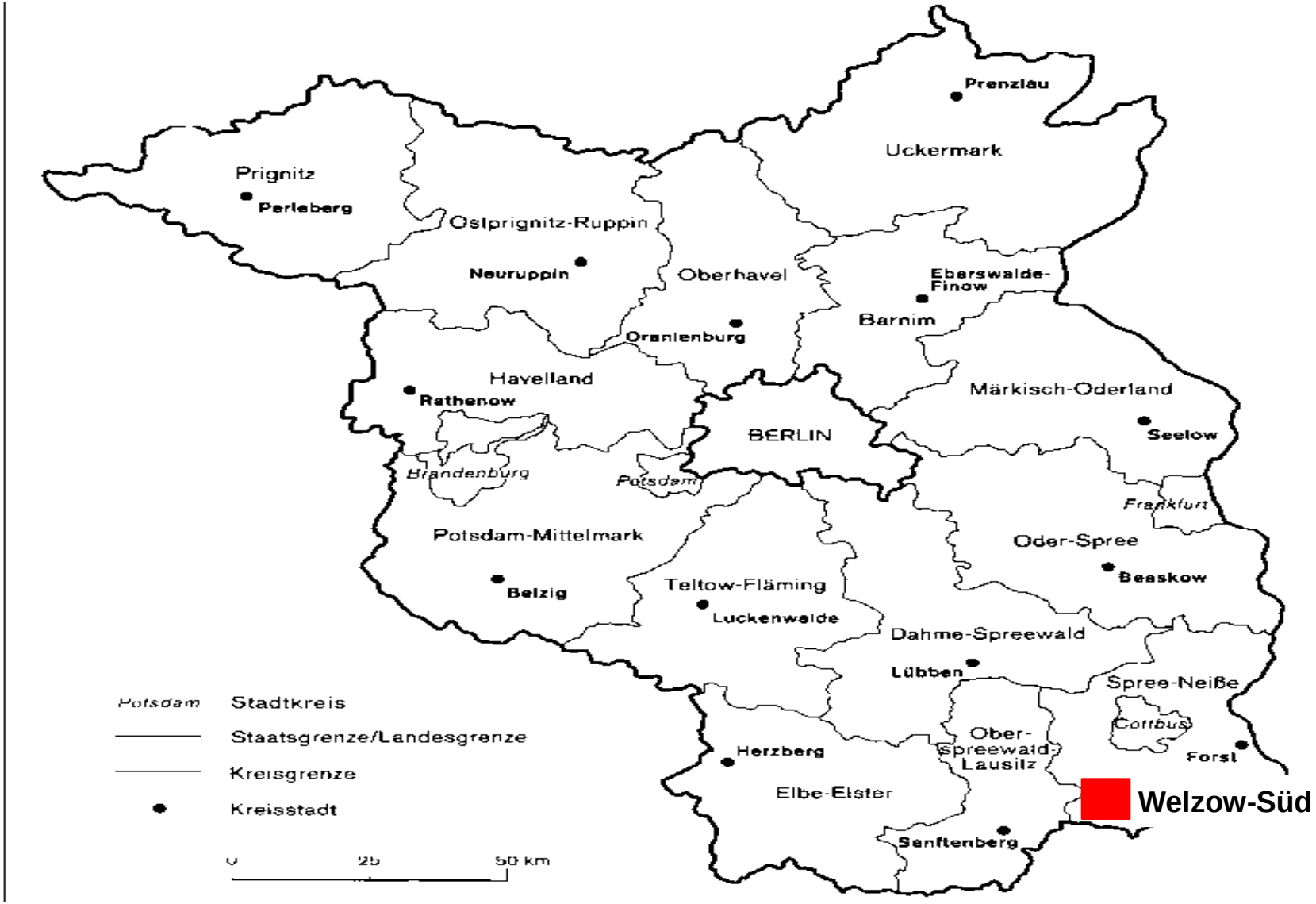
I. Introduction

- lignite mining >80,000 ha affected
- large post-mining landscapes evolved
- conventional crop production restricted
- increasing demand for woody biomass for bioenergy → fast growing trees

I. Introduction

- sustainable supply of bioenergy wood with black locust trees is possible
  - short rotation coppice, alley cropping
  - Positive impacts on agricultural crop productivity, soil fertility and protection ?

II. Materials and Methods



Picture source: Materna/Ribbe (1995)

II. Materials and Methods

- 25 km south-west of Cottbus
- dominant substrat: sandy loam
- humus- and nutrient-poor
- Ø annual precipitation sum of 560 mm
- mean annual temperature of 9.3 °C

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- approx. 7 ha Alley Cropping (2007)
- alleys 24 m (width)
- alfalfa, spring barley, oat and winter rye
- hedgerows 10 m (width), black locust
- double row system (~ 9,227 plants ha^{-1})

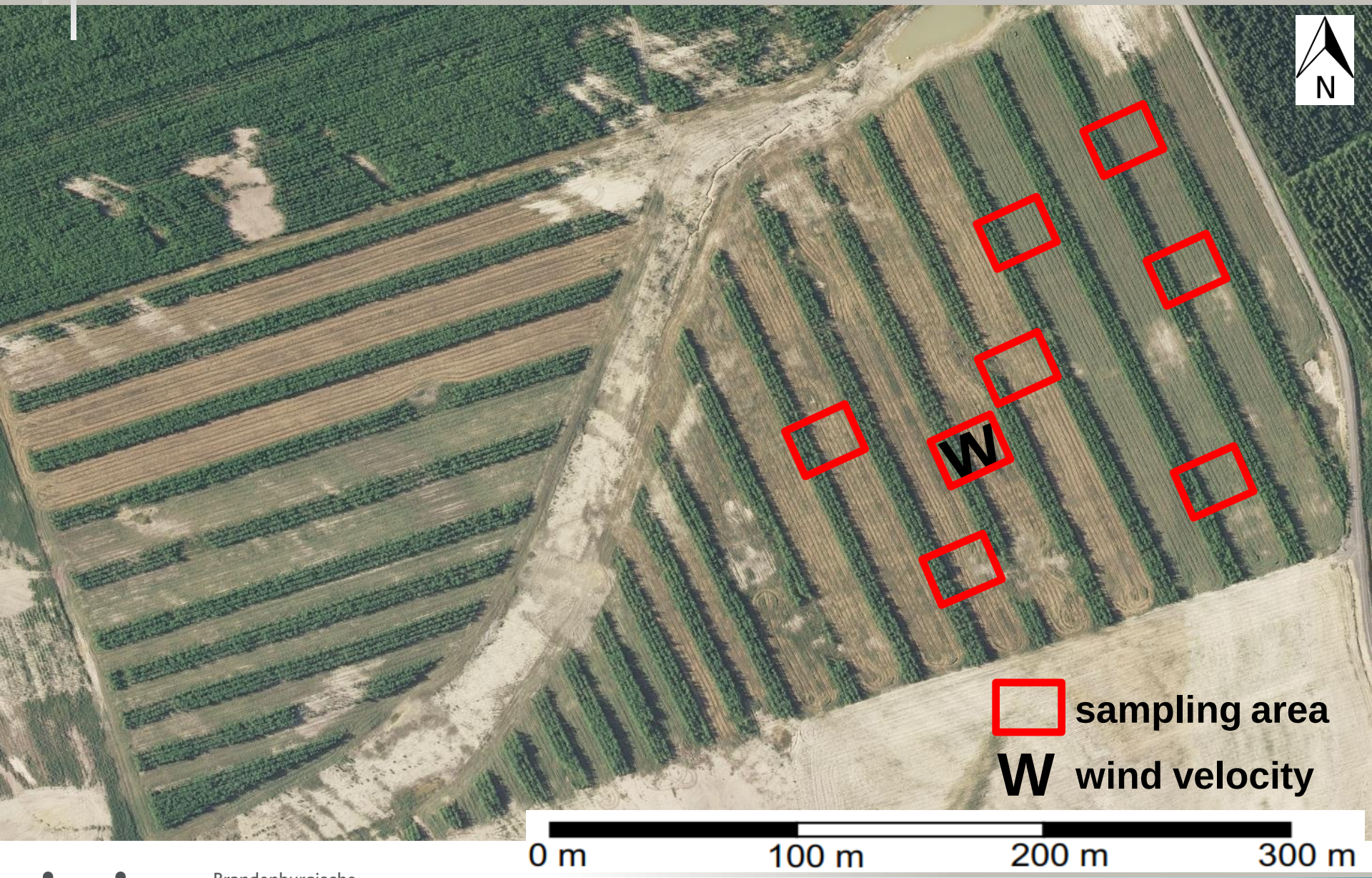
II. Materials and Methods

- aboveground biomass crop yields
- soil samples (0 - 30 cm depth), spring
- hot water extractable organic carbon (HWC_{org}) and nitrogen (HWN_{org})

→ CN-analyzer (Shimadzu)

- wind velocity data: 4 anemometers

II. Materials and Methods



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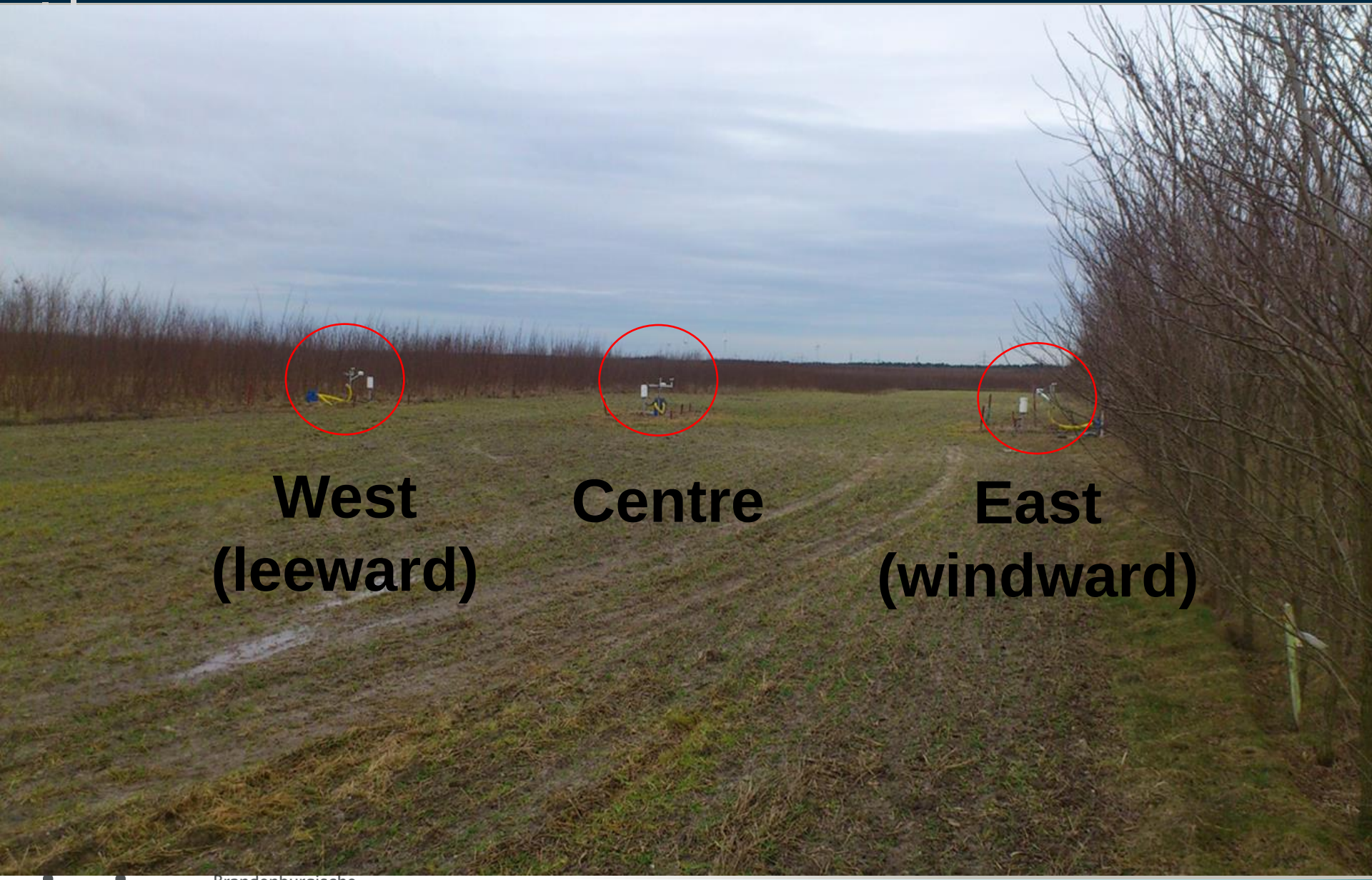
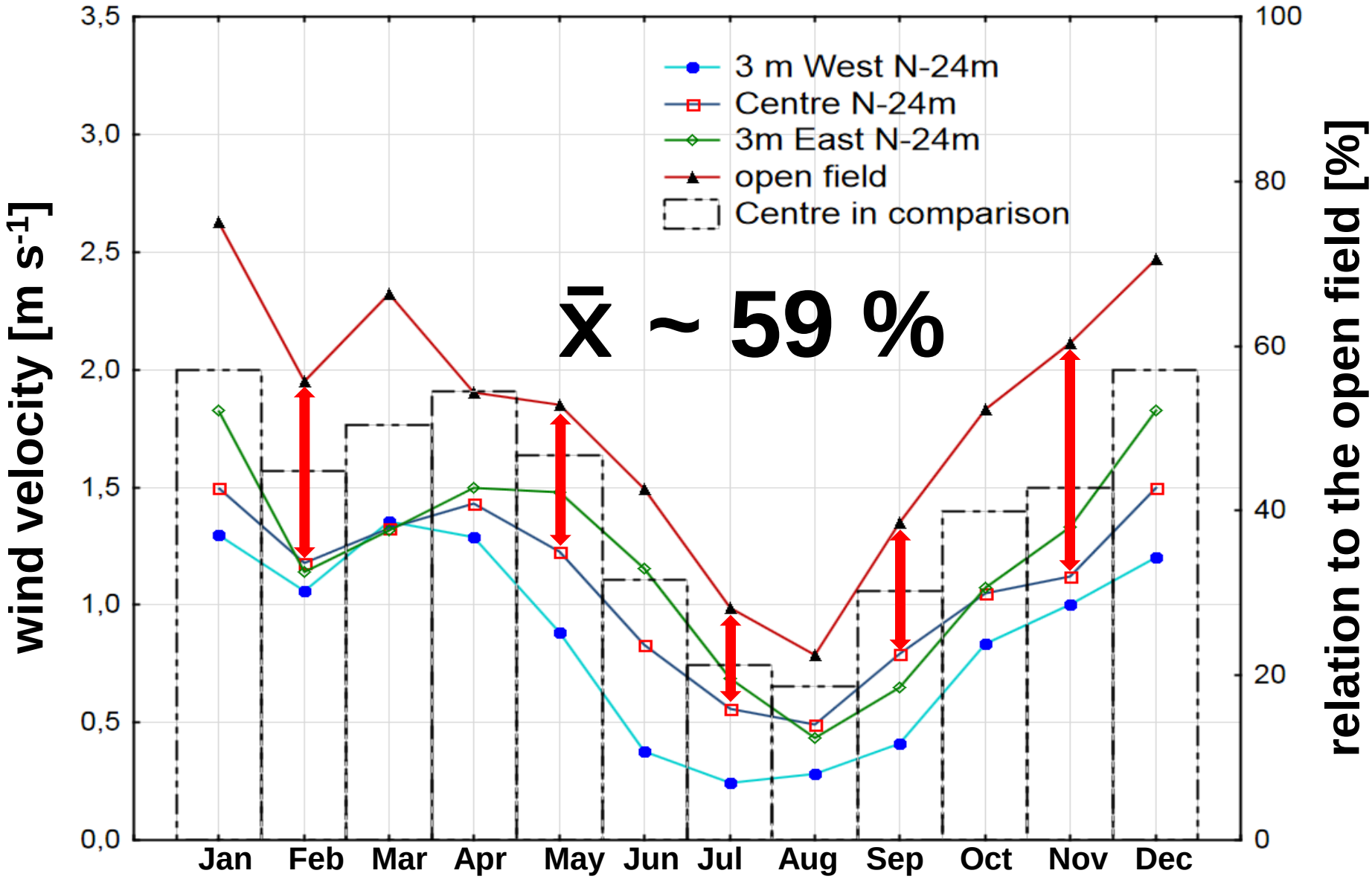
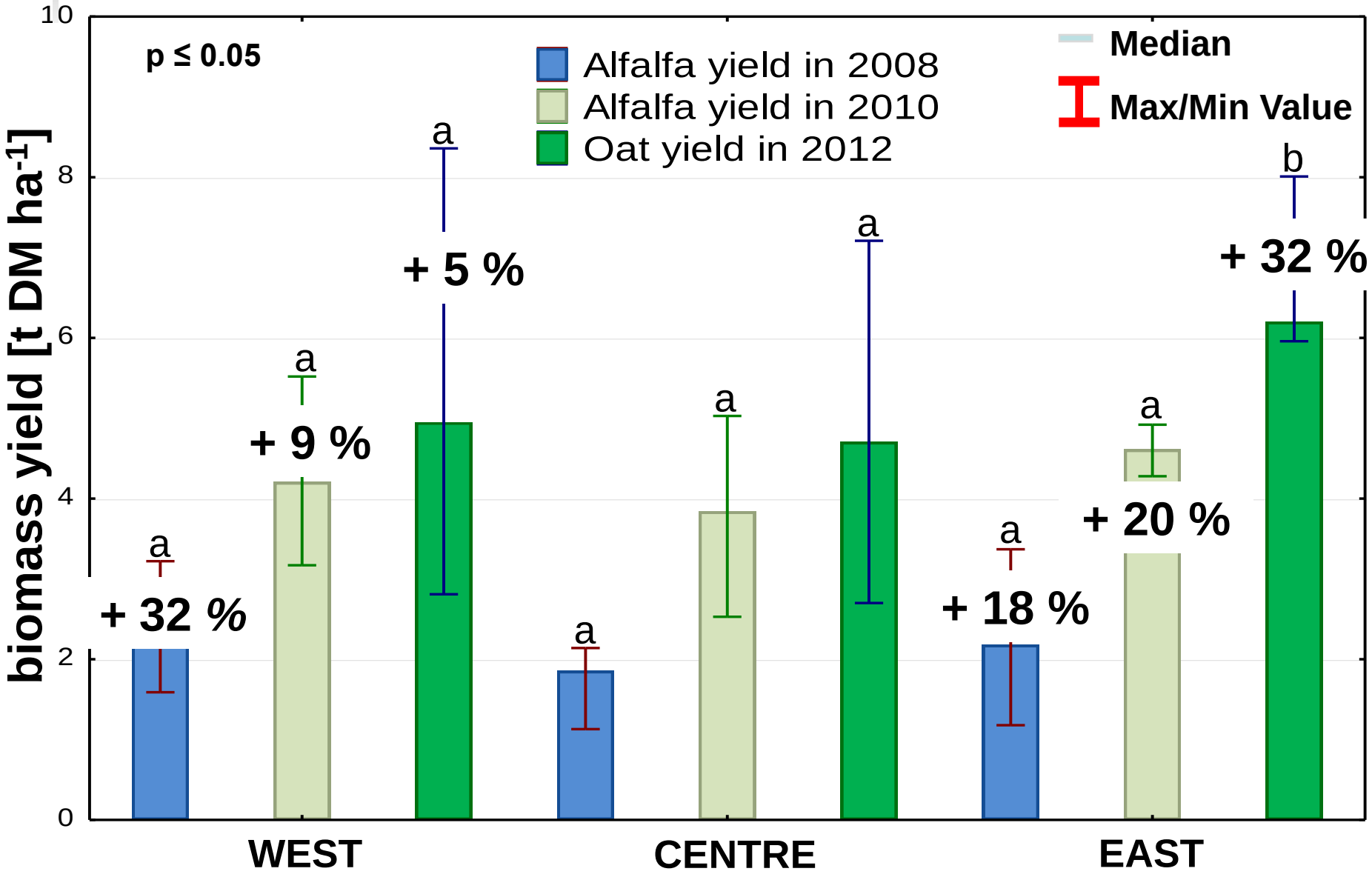


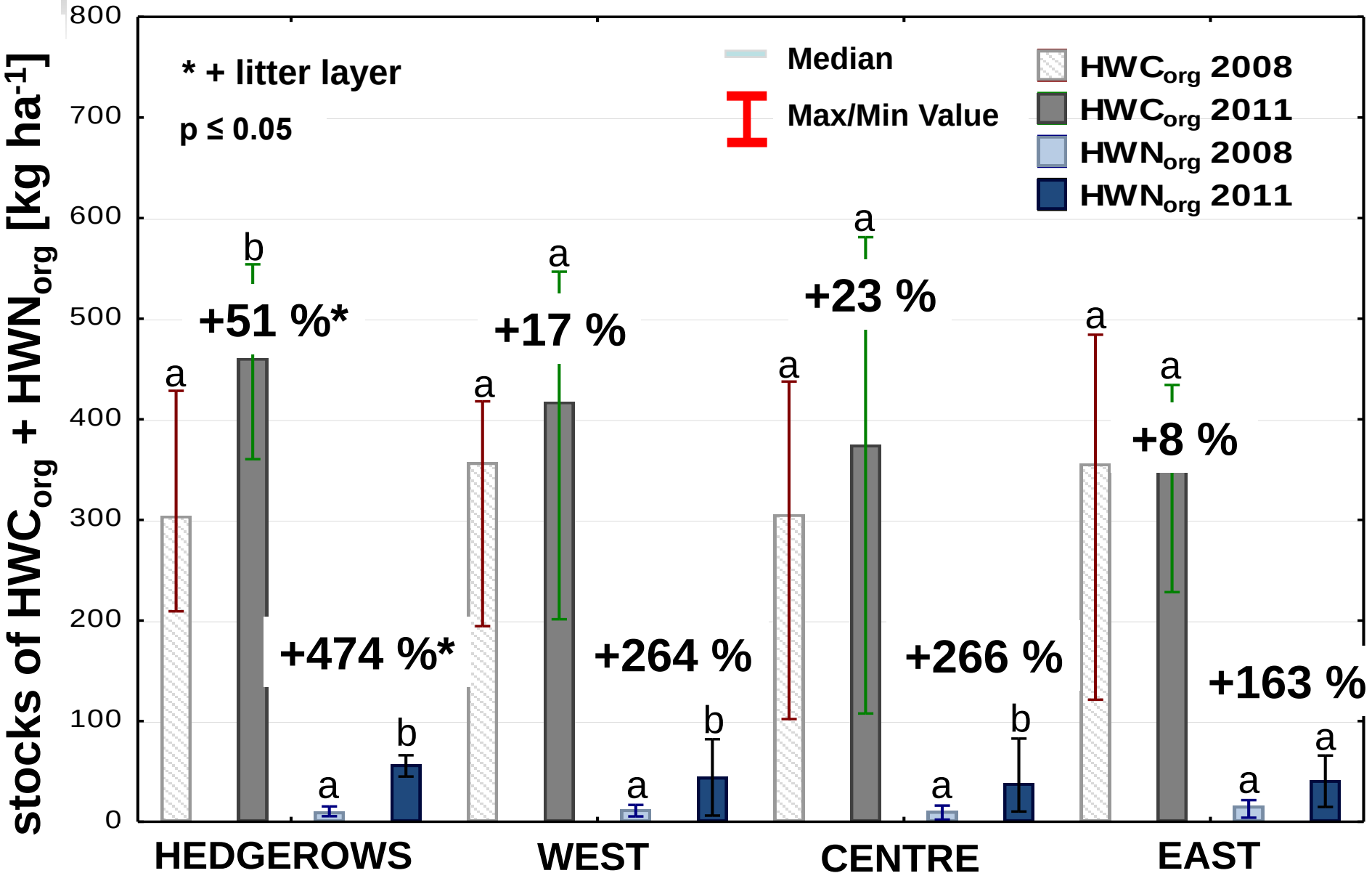
III. Results


3 m West N-24m
Centre N-24m
3m East N-24m
open field
Centre in comparison
x̄ ~ 59 %
wind velocity [m s-1]
relation to the open field [%]
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0,0
100
80
60
40
20
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

III. Results


p ≤ 0.05
Alfalfa yield in 2008
Alfalfa yield in 2010
Oat yield in 2012
Median
Max/Min Value
biomass yield [t DM ha-1]
10
8
6
4
2
0
a
+ 32 %
a
+ 9 %
a
+ 5 %
a
a
a
a
a
+ 18 %
a
+ 20 %
b
+ 32 %
WEST
CENTRE
EAST

III. Results



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IV. Discussion

- black locust trees ≥ alfalfa
- humus accumulation
- wind erosion control
- enhanced site protection and fertility

IV. Discussion

- higher crop productivity (peripheral areas)
  - site heterogeneity → lower crop yield

    compared to undisturbed sites
- sustainable management of marginal sites

V. Conclusions

✓support soil protection and fertility

✓woody biomass and crop production

✓intercrop productivity

✓rehabilitation and agricultural reuse of marginal sites


Thank you for your attention

VI. Acknowledgements

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