

Phytomass structure of abandoned and managed mesic meadows in the forest zone: a case study from NW Russia

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Introduction

Along with other functional traits, specific leaf area (SLA) is a crucial tool to assess the response of meadow plants to the type of management. However, the variability of leaf traits across habitats is poorly studied. Meadows of Central Forest Reserve represent a long-term experiment as their management was ceased under protection regime. Our study was aimed to reveal the difference between SLA of herbaceous plants at abandoned and managed sites.

Methods

We measured leaf area and SLA of 24 herbaceous plant species on abandoned and managed upland meadows with similar floristic composition. Fully water-saturated leaves were scanned at 300 dpi, then dried in the oven and weighed to the nearest of 0,1 mg. Leaf area was measured in ImageJ software. Specific leaf area was calculated as a ratio between leaf area and leaf dry mass. The statistical analysis was conducted in R environment. Based on the data for each species at managed sites the coefficients of the regression equation were determined and further used to calculate expected SLA at abandoned sites. To compare the observed and the expected SLA at abandoned sites the Mann-Whitney U-test was applied.

Studied species

<i>Achillea millefolium</i>	<i>Leucanthemum vulgare</i>
<i>Agrostis tenuis</i>	<i>Melampyrum</i>
<i>Anthoxanthum odoratum</i>	<i>nemorosum</i>
<i>Centaurea jacea</i>	<i>Phleum pratense</i>
<i>Centaurea phrygia</i>	<i>Plantago lanceolata</i>
<i>Dactylis glomerata</i>	<i>Poa angustifolia</i>
<i>Deschampsia caespitosa</i>	<i>Potentilla erecta</i>
<i>Festuca pratensis</i>	<i>Ranunculus acris</i>
<i>Galeopsis tetrahit</i>	<i>Rumex acetosa</i>
<i>Galium mollugo</i>	<i>Stellaria graminea</i>
<i>Geranium palustre</i>	<i>Succisa pratensis</i>
<i>Hypericum maculatum</i>	<i>Trifolium medium</i>

Objects of study



Main Formulas

$$M = \alpha \cdot A^\beta$$

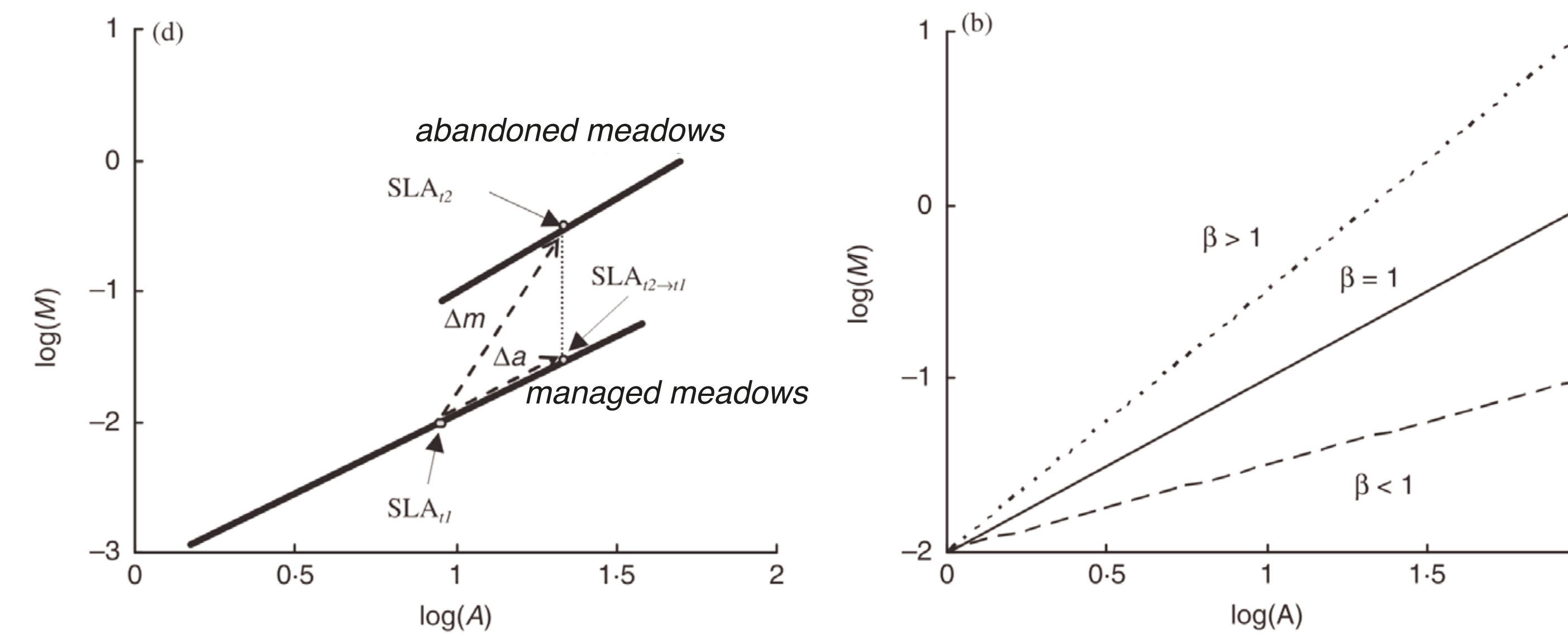
$$\log(M) = \log \alpha + \beta \cdot \log A$$

$$SLA = A^{1-\beta} / \alpha$$

$$SLA_{\Delta m} = \frac{(SLA_{t1} - SLA_{t2})}{SLA_{t1}} \times 100$$

$$SLA_{\Delta \alpha} = \frac{(SLA_{t1} - SLA_{t2 \rightarrow t1})}{SLA_{t1}} \times 100$$

$$SLA_{\Delta t} = SLA_{\Delta m} - SLA_{\Delta \alpha}$$

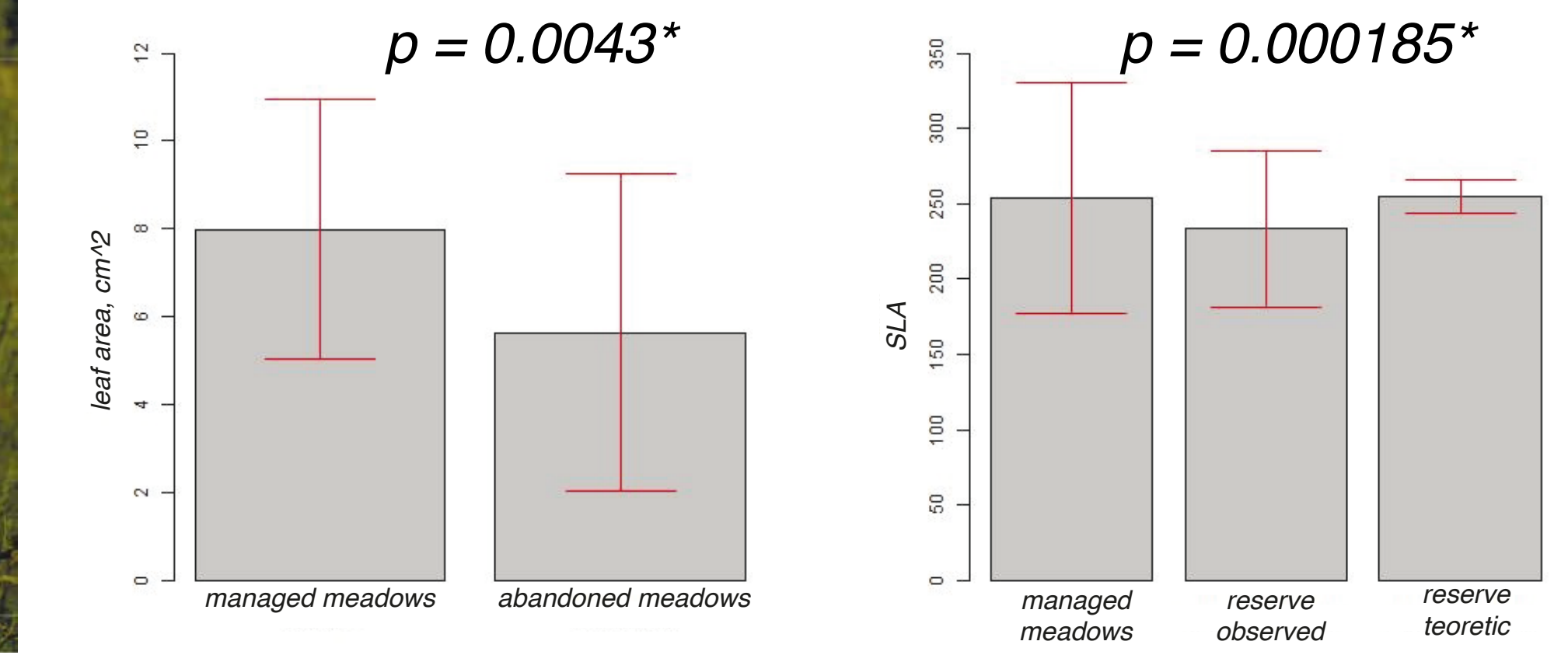


Conclusions

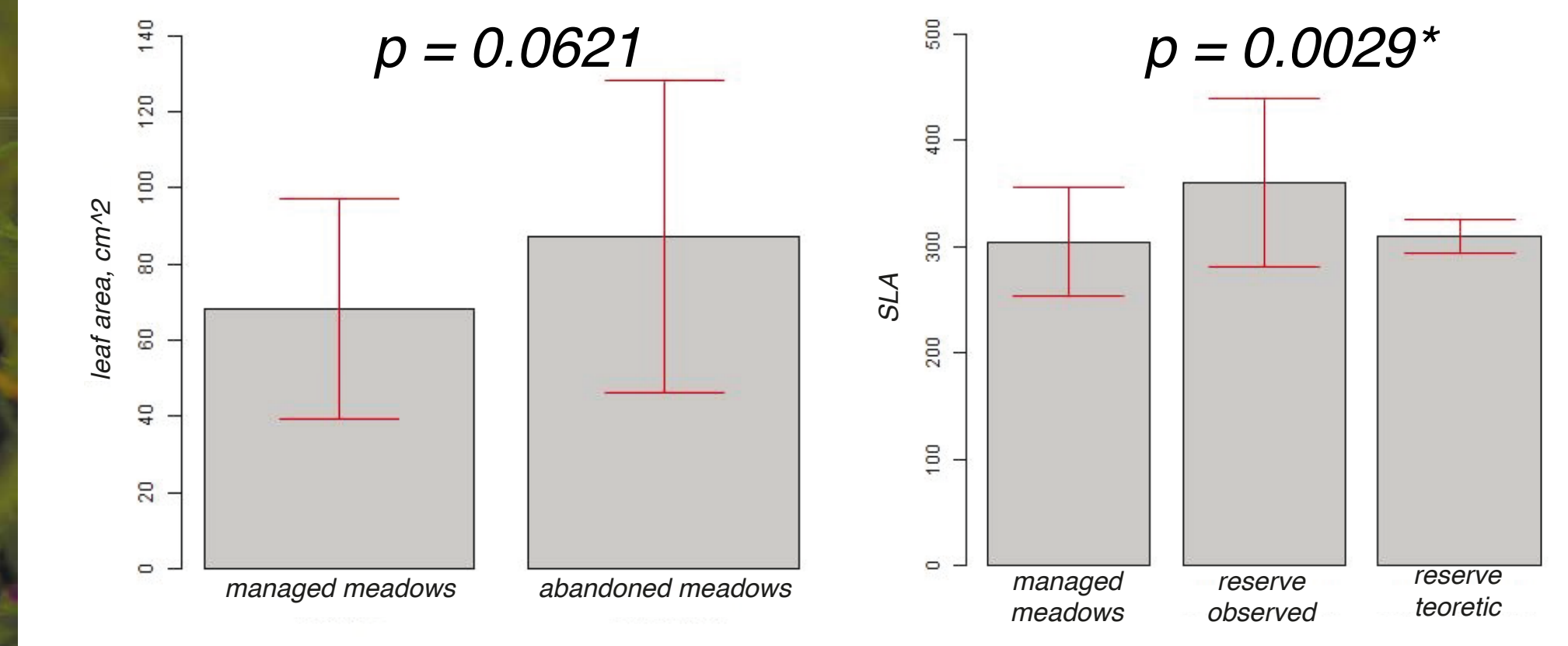
1. Meadow plants differently react to the conservation regimen or changes in environmental conditions associated with it;
2. Half of the studied species did not show any differences in the SLA and leaf area depending on the management regimen (12 of 24);
3. For the remaining 12 species, significant differences of SLA and leaf area associated with differences in management regimen were revealed;
4. Species composition of meadow communities includes species with different variability of leaf functional traits which allows them to adapt to changing environmental conditions.

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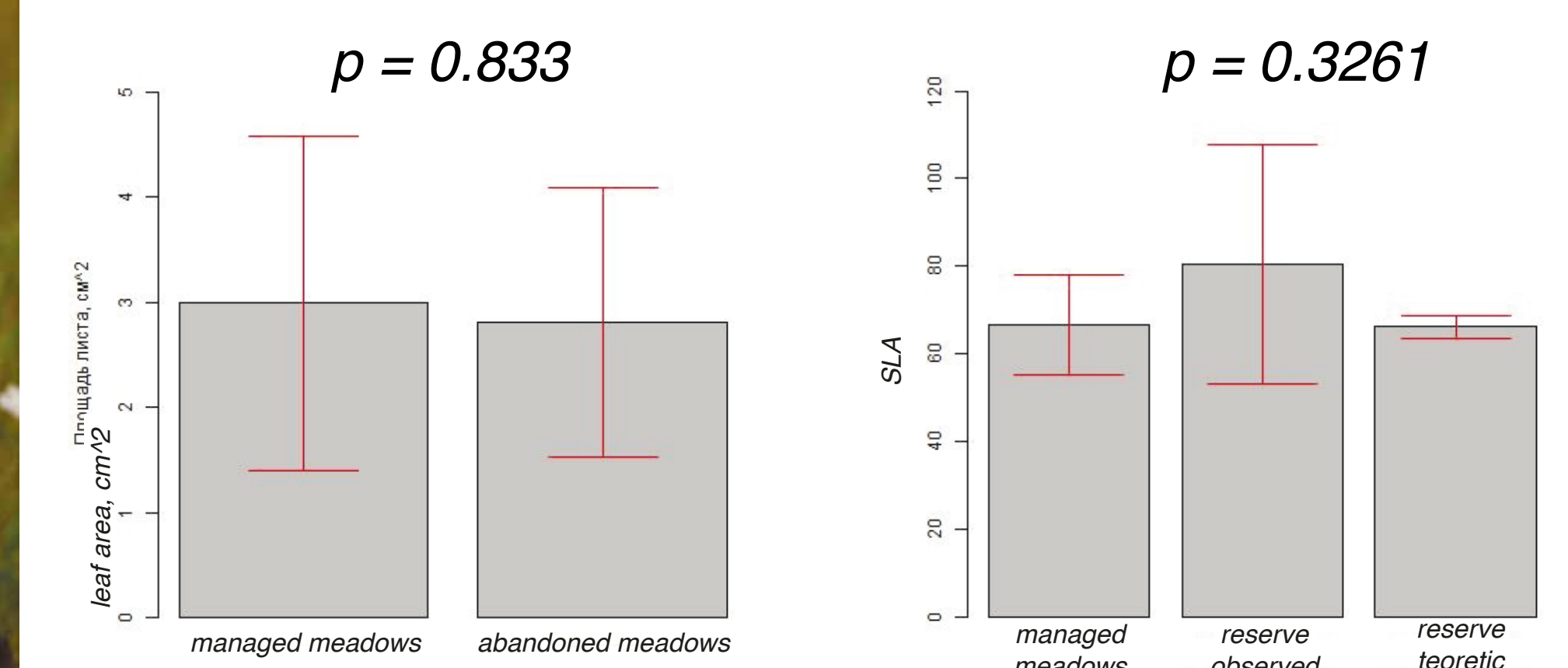
Phleum pratense leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)



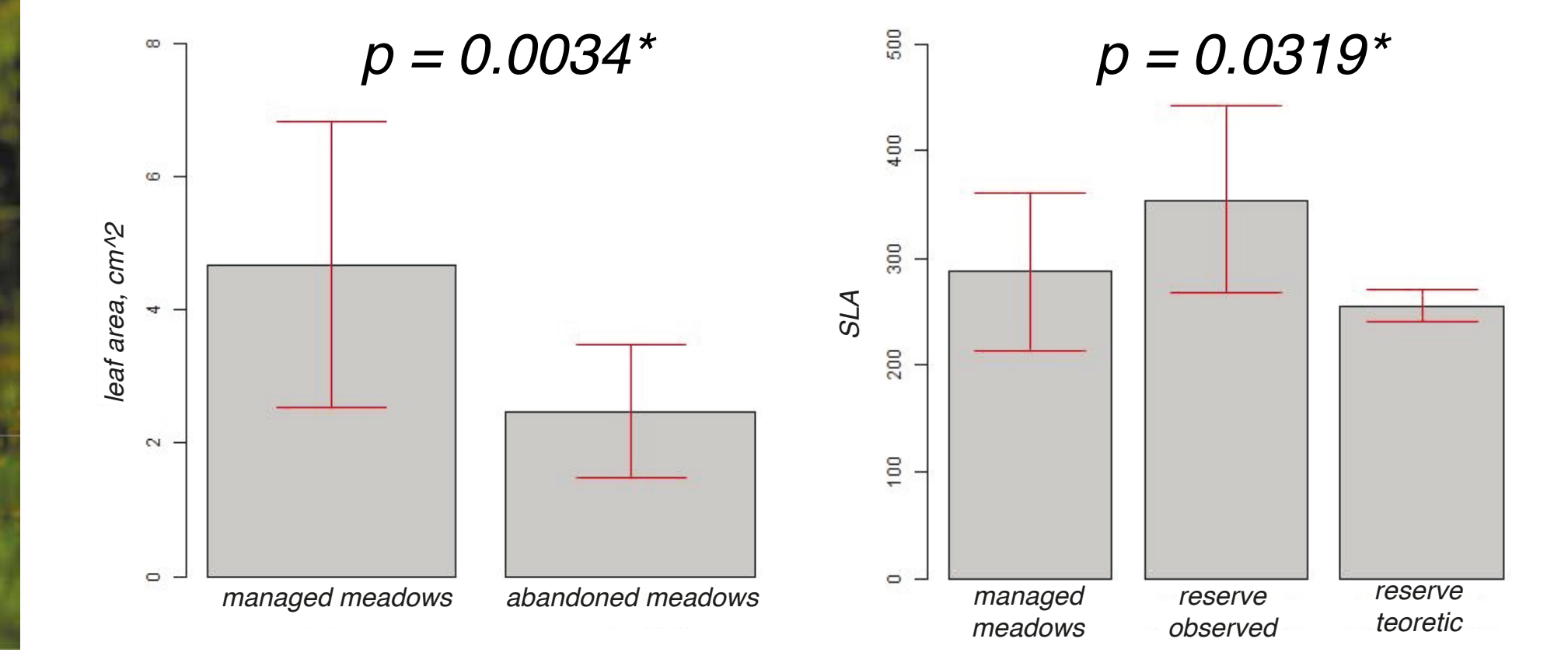
Centaurea phrygia leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)



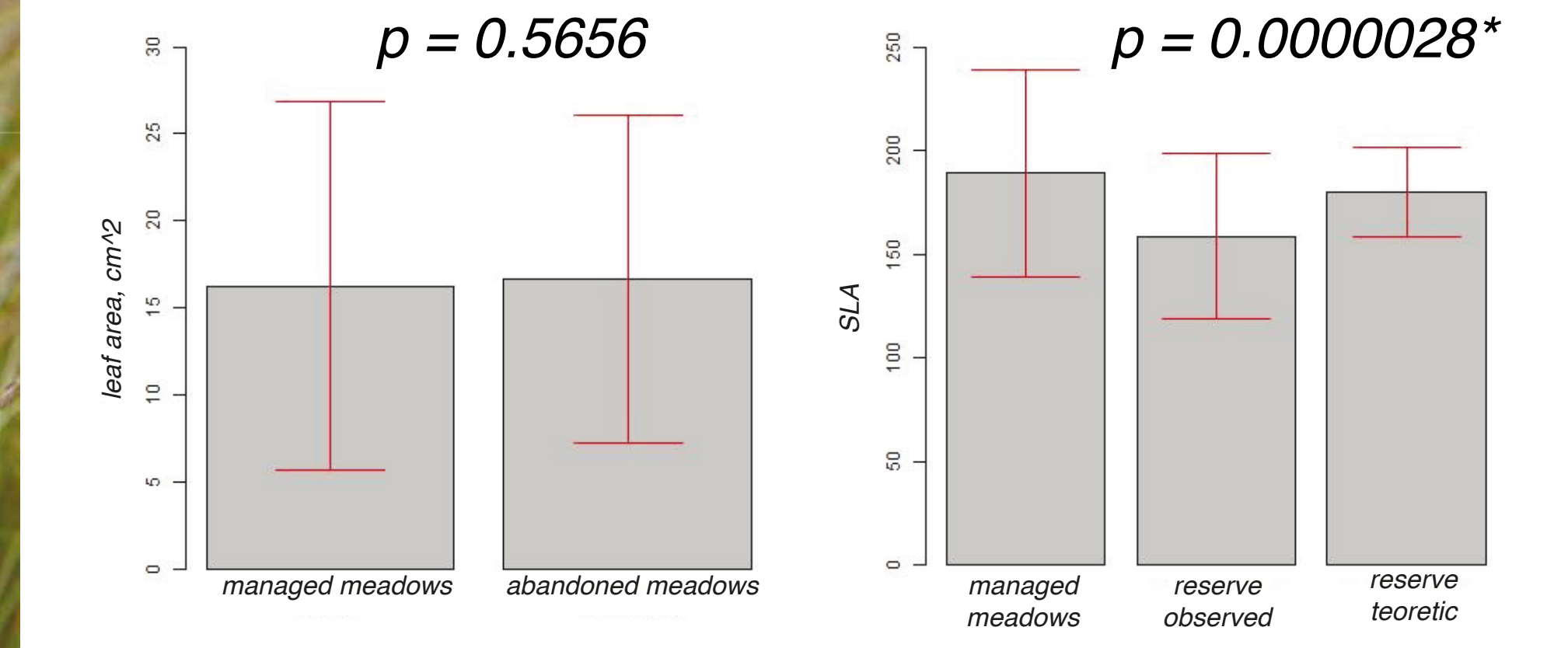
Centaurea jacea leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)



Agrostis tenuis leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)



Achillea millefolium leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)



Anthoxanthum odoratum leaf area and SLA on managed and abandoned meadows (mean \pm s.d.)

