The effects of fire on carabid beetle diversity on a western Norwegian heathland

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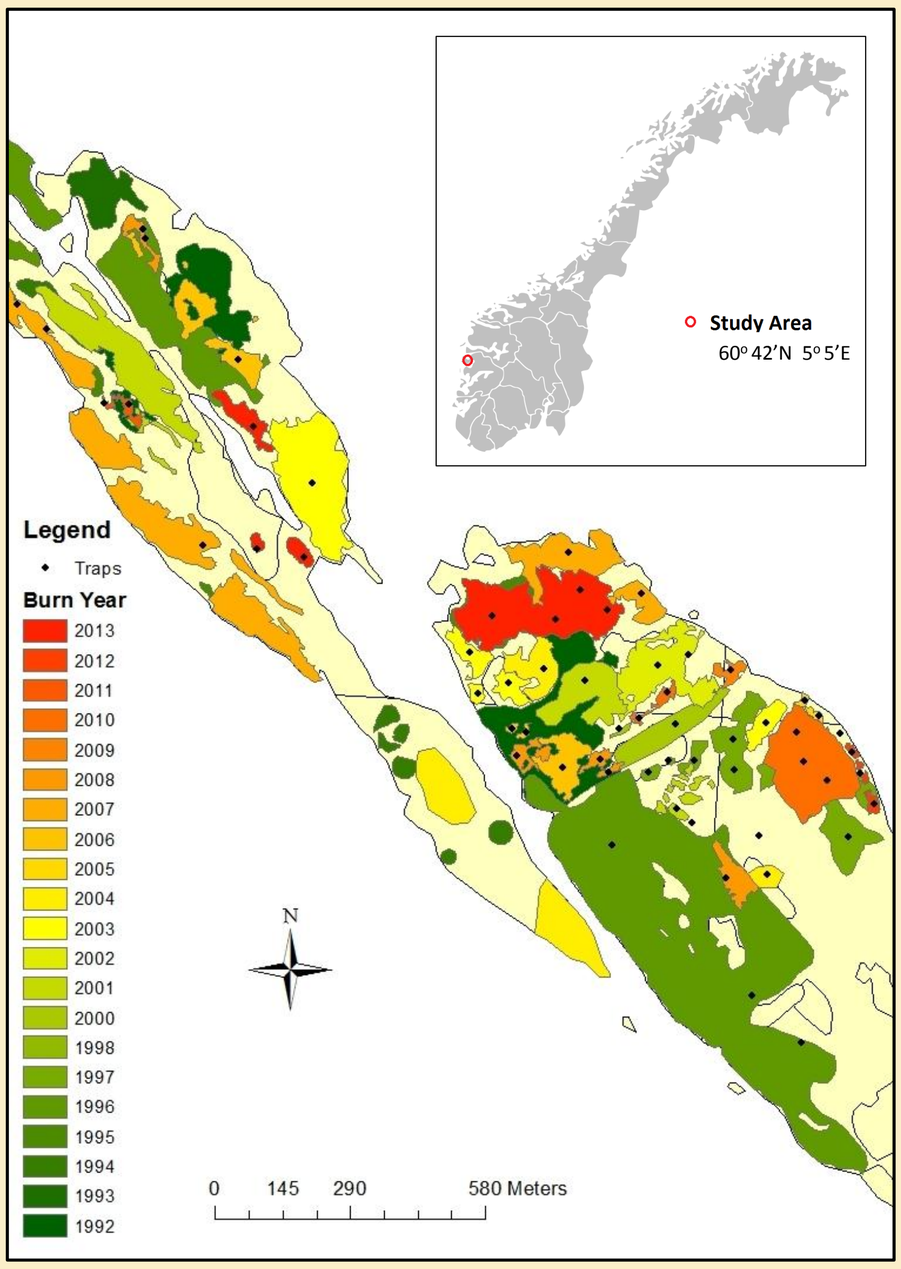

Background: Heathland is a cultural landscape spanning 3600 kilometers of the western coast of Europe, and Norway is home to roughly one third of this latitudinal range. As prescribed burning is an effective and widespread management method in this threatened nature type, it is important to understand the effects of fire on every part of the heathland landscape. This study focusses on carabids in different stages of *Calluna* heathland.

Aims: We are interested in the species composition and diversity of carabids in relation to the time since the last burning event, and aim to identify species that are characteristic of heathland in Norway.

Methods: Pitfall traps with saturated saline solution were set up in 60 groups of 3 traps in the centre of plots burned between 1992 and 2012. Trapping commenced in April 2012 and finished in September 2012, and traps were emptied monthly.

Results: In total, 1968 individuals of 32 species were trapped. Preliminary results suggest that:

- Burning promotes the presence of more rarely occurring species, as well as improves diversity (some species only occurred in recently burnt heath).
- Carabids return quickly to burnt areas after fire. While most of the common species have a high dispersal ability, species with low dispersal abilities were also recorded in newly burnt areas.
- Year since the last burn seems to be a good predictor of carabid beetle composition.

Table 1: Species abundances, wing dimorphisms, dispersal abilities, and presence in stage of *Calluna vulgaris* development of trapped carabid beetles. M=macropterous, B=brachypterous, D=dimorphic, P=pioneer phase (0-5 years), B=building phase (6-12 years), M=mature phase (13-18 years), D=degenerate phase (18+ years).

Species	Abundance	Wings	Dispersal	Presence
Pterostichus niger	587	M	High	P-D
Poecilus cupreus	503	M		P-D
Pterostichus melanarius	253	D		P-D
Nebria salina	188	M		P-D
Carabus problematicus	89	B	High	P-D
Carabus violaceus	83	B	High	P-D
Carabus nemoralis	62	B	High	P-D
Harpalus latus	27	M	High	P-M
Poecilus lepidus	20	D/B		P-B
Pterostichus diligens	19	D/B	Low	P-D
Poecilus versicolor	19	M		P-B
Calathus fuscipes	15	B		P-D
Pterostichus nigrita	14	D/M	High	P-D
Cicindela campestris	13	M		P-B
Notiophilus aquaticus	11	D	Low	P-B
Dyschirius globosus	9	D	Low	P-B
Cychrus caraboides	9	B		P-D
Trechus secalis	7	B		P-D
Bembidion lampros	7	D		P
Amara lunicollis	7	M	Low	P
Synuchus vivalis	6	D/M		P-M
Loricera pilicornis	6	M	High	P
Cymindis vaporarioum	2	D		P&M
Amara communis	2	M	High	P
Carabus coriaceus	2	B		M
Pterostichus strenuus	2	D/M		B
Agonum fuliginosum	1	D/M		D
Bradycellus caucasicus	1	D/B		P
Bradycellus ruficollis	1	D/M	Low	B
Nebria brevicollis	1	M	High	P
Notiophilus biguttatus	1	D/B	Low	P
Patrobus assimilis	1	B		B

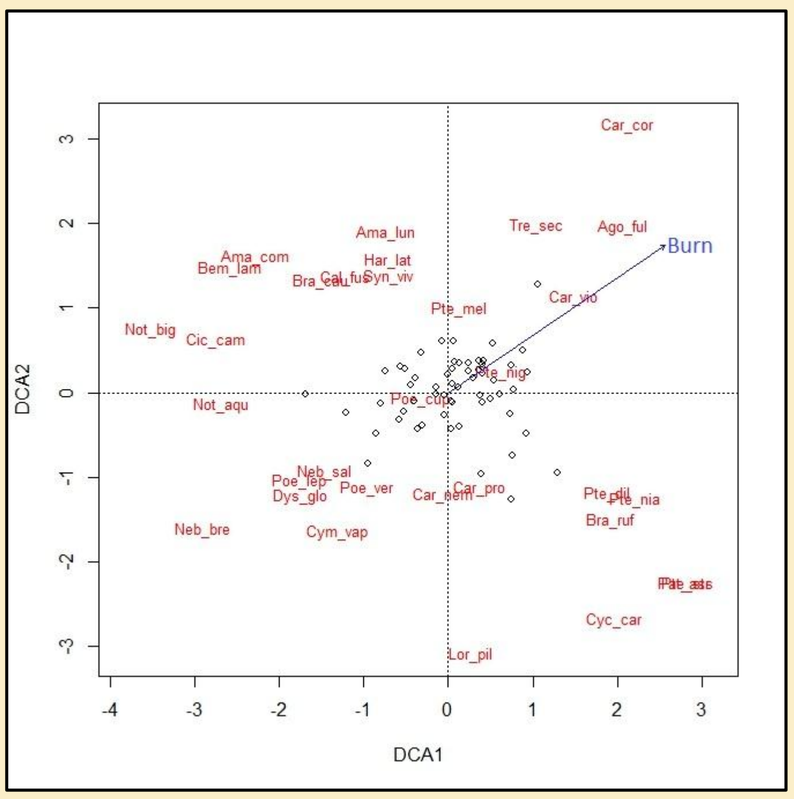

Figure 1: Detrended correspondence analysis (DCA) of all species caught in our 2012 study. Open circles represent sites, and the vector in blue shows the direction of the variable years since last burn. The correlation between the variable burn and the first DCA axis is 0.46 (p value 0.00), and the correlation between the variable burn and the second axis is 0.26 (p value 0.05).

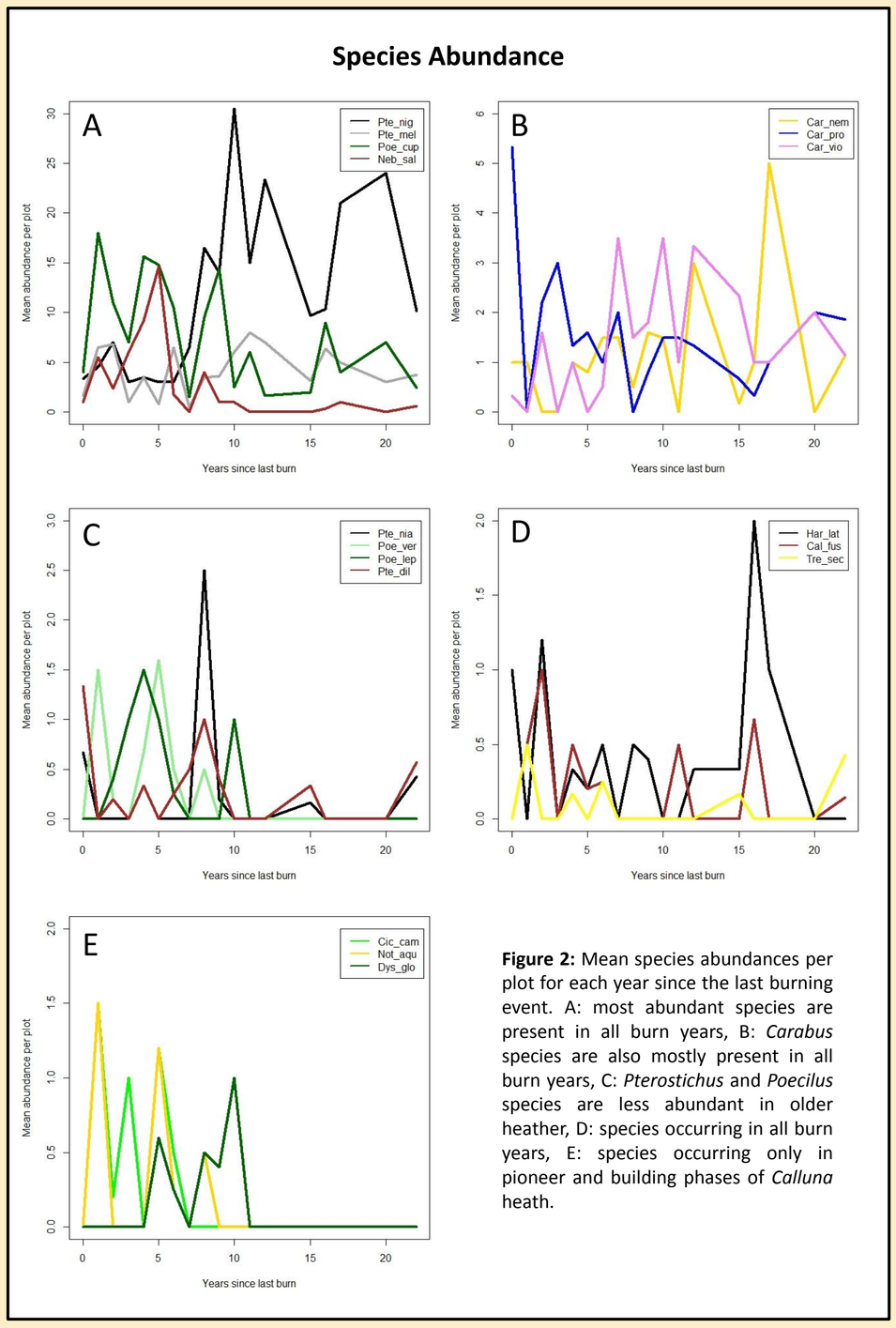

Figure 2: Mean species abundances per plot for each year since the last burning event. A: most abundant species are present in all burn years, B: *Carabus* species are also mostly present in all burn years, C: *Pterostichus* and *Poecilus* species are less abundant in older heather, D: species occurring in all burn years, E: species occurring only in pioneer and building phases of *Calluna* heath.

Implications: Results suggest that heathland management strategies using rotational burning enhance total carabid diversity in heathland. This is mainly due to the dependence of some species on newly burnt areas.

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