Seed banks and fire;
A study from heathlands in western Norway

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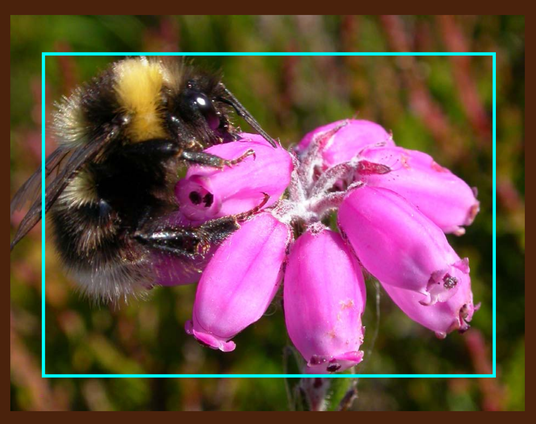
B A C K G R O U N D

Dormant seeds in the soil serve a dual function in plant populations. They are "memories of populations and communities past", and at the same time a potential for future persistence and survival. Hence, the longevity of seeds in the soil affects the resilience of plant communities.

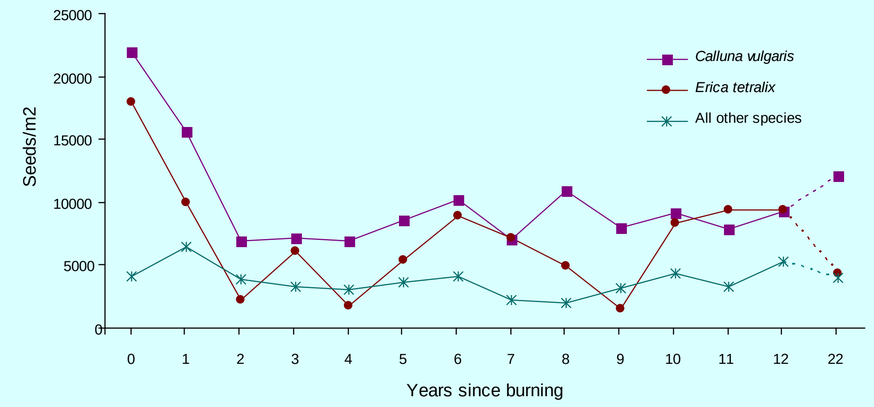
Propagule input is an important and integral part of the successional process where the successful recruitment may be limited either by the availability of seeds, or by the availability of safe sites where the seedlings may germinate and establish. Local seed availability may be affected by e.g. seed-source density, seed production, dispersal strategy and predation, while microsite availability may be affected by e.g. competition, disturbance, and grazing. In the open heathland landscape seed-sources may be sparse, and while the availability of safe sites may be the major limitation in heavily grazed heathland areas, seed limitation may become the most important limiting factor as grazing pressure decreases.

Heathlands are influenced by many factors leading to vegetational change. **Burning and grazing** have been the most commonly employed management practices in west Norwegian heathlands.

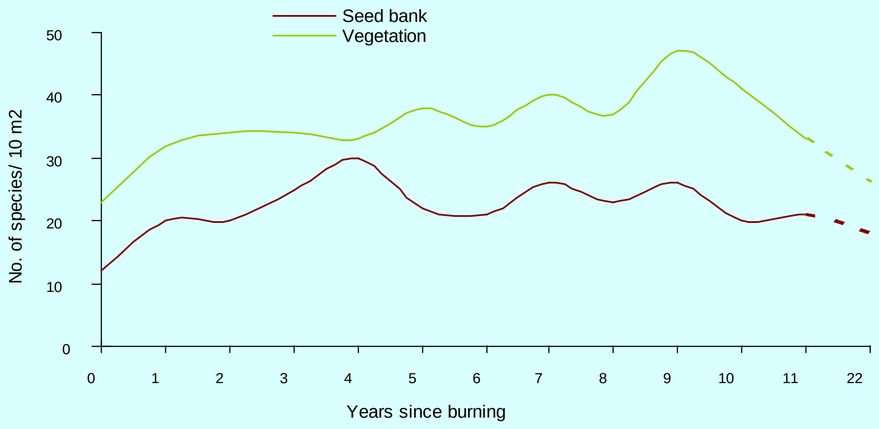


A proper understanding of how heathlands respond to disturbance must take account of seed production-, dispersal-, seed bank- and germinability dynamics. In **cyclic vegetation types** such as heathlands, seed banks are particularly important so that the species can survive locally with time.

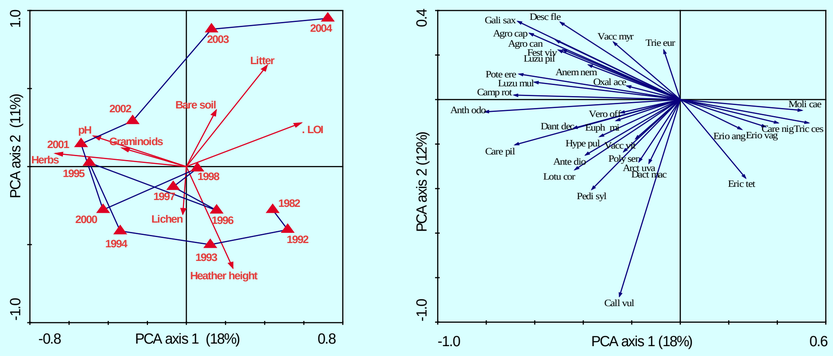
Few studies have focused on the temporal changes in **seed banks** during cyclic heathland succession. Very few studies deal with the role of the seed bank in post-fire recovery, and particularly in heathlands. In **this study** we investigated the relationship between vegetational composition and seed bank in burnt heath of varying age using a chronosequence. It is part of a larger heathland project focusing on the different effects of management and abandonment on heathland succession.



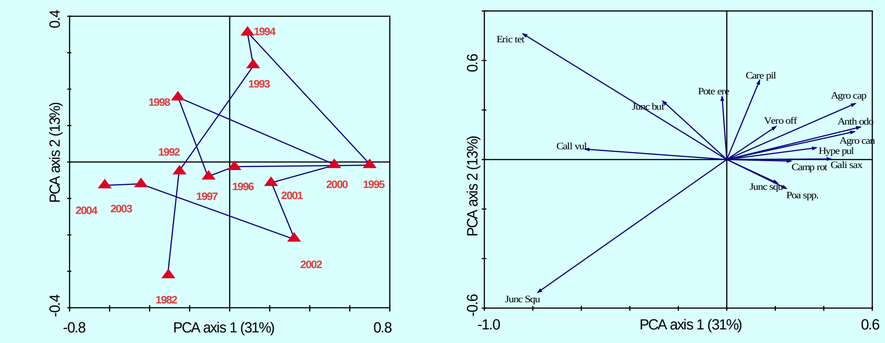
DENSITY OF THE SEED BANK OVER SUCCESSION. The 10 most commonly occurring species of the seed bank contributed 98 % of the germinated seeds. Emergence from the seed bank of the two dominant dwarf-shrubs *Calluna vulgaris* (48%) and *Erica tetralix* (34%) peaked in the first two years after fire.



DIVERSITY OF SEED BANK AND VEGETATION OVER SUCCESSION. A total of 115 species of higher plants were encountered in the heathlands, where of 15 species (13 %) occurred in the seed bank only, 68 species (59 %) were found in both seed bank and vegetation, and 32 species (29 %) occurred in the vegetation only. Both vegetation and seed bank diversity peak during the first 10 years after fire.



COMPOSITION OF THE HEATHLAND VEGETATION OVER SUCCESSION. During the first 22 years after fire, the heathland vegetation progresses from open newly-burnt ground via species rich grass- and herb-dominated vegetation to *Calluna*-dominated heathland.



COMPOSITION OF THE HEATHLAND SEED BANK OVER SUCCESSION. The post-fire succession is less clearly reflected in the seed bank. This is because the seed banks are dominated by a few very abundant species.

The island Lygra is situated at 60° 42' N, and 5° 5' E, in the Lurefjorden fjord basin, approximately 20 km inland from the Norwegian west coast, 40 km north-west of Bergen. The area has a characteristic oceanic climate with relatively small differences between June and January mean temperatures; 2°C and 12°C respectively (Aune 1993), a long growing season of ca. 220 days above 5°C, abundant precipitation at 1600 mm (Førland 1993) that is relatively evenly distributed throughout the year, and strong winds. The area seldom experiences snow cover or periods of frost.

The size and the quality of the viable seed bank may both be determinants for successful heathland management and restoration. These findings emphasize the need for continued management measures in order to maintain the dynamic heterogeneity characterising the heathlands of western Norway.

QUESTIONS WE WILL EXPLORE IN THE FUTURE

- What causes the high Calluna germination in the first two years following burning? Does it reflect increased seed input? Or could it be due to changed chemical properties of the soil? Do charcoal particles deposited on the surface absorb germination inhibitors and allelophathic chemicals?

- What is the relationship between seed bank and vegetation along a successional gradient following fire? To what extent does the seed bank contribute to the diversity and composition of the vegetation in the course of succession?

- How important is a buried seed bank of desirable species to heathland management and restoration? What conditions facilitate germination and establishment of these species?

- What is the relative importance of dispersal, in space and in time, for successional dynamics?

- How does the seed bank density and composition change with climate?

PREVIOUS PUBLICATIONS:

Vandvik V, Heegaard E., Måren I.E. & Aarrestad P.A. 2005. Managing heterogeneity: the importance of grazing and environmental variation on post-fire succession in heathlands. Journal of Applied Ecology 42: 139-149.

Aarrestad, P.A. & Vandvik, V. 1997. Leptodontiun flexifolium (Dicks.) Hampe new to Norway from a burnt Calluna heath. Lindbergia 22: 31-32.

Aarrestad P.A. & Vandvik V. 2000. Vegetasjonsendringer i vestnorsk kystlynghei-effekter av skjøtselsformene brann og sauebeite ved rehabilitering av gammel lynghei på Lurekalven, Hordaland. NINA rapp. 044:1-60

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