Plant dispersal in a changing climate.

A seed-rain study along climate gradients in Southern Norway

Marta Ramírez Boixaderas

Master of Science in Biology

Biodiversity, Evolution and Ecology

University of Bergen

Department of Biology

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[**Front page:** *Viola palustris* capsule with 38 seeds. Høgsete, Aurland, Norway. 18/07/2011.
Photo: Marta Ramírez Boixaderas]

Acknowledgements

"Tusen takk" is not only one of the first things I learned, but also one of the most used words while working on this thesis.

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Bergen, October 2012

Abstract

Seed dispersal is a key event in a plant's life, affecting the outcomes of many ecological processes ranging from species reproduction to population and community dynamics. It is influenced by various environmental and ecological variables and is therefore expected to vary among and within communities. Understanding how dispersal varies in space and time is important, as the effectiveness of dispersal may modify abundance and diversity patterns observed in nature.

This work explores seed rain patterns in grasslands in western Norway and how they are influenced by climate. Seed rain was examined during one year throughout twelve grassland sites (ca 4°50' - 8°45' E; 60°20' - 61°50' N) arranged in a "climate grid" design where the effects of temperature and precipitation can be decoupled. Mean summer temperature ranges from 5.9°C to 10.8°C primarily driven by elevation and continentality, while annual mean precipitation ranges from 596 mm in the east to 3029 mm in the west. I hypothesized that seed rain, being the primary reflection of dispersal, might: show differences at species, community and landscape scales; be highly influenced by adult vegetation; be constrained by the distance of the dispersal source.

About 15 800 seeds from 122 species fell into the seed traps. Temperature appears to be the most important factor limiting seed rain density through the grid, with fewer seeds recorded in colder-climate sites. The results also show that temperature affects correlations between seed and plant abundance within species and restricts dispersal distances through an interaction with precipitation. 98% of the seeds came from the vegetation; the remainder has been assigned to long distance dispersal between communities and this process appears to be regulated by climatic variables. Adult plant abundance and deposited seeds at species level were correlated. Seed rain and vegetation diversity followed broadly the same patterns along the grid while inter and intra-specific variability is more strongly linked to environmental variables and different vegetation composition driven by altitude In general, found relationships appeared to be stronger when zooming up from community-site to landscape-gradient scale.

Thus, climate seems to play a role in seed rain variability, affecting dispersal processes on the scale of this study. These results provide a trigger for more detailed, longer-term studies of the effect of climate on seed dispersal.

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1. Introduction

Dispersal of organisms has played a key role since the start of life on the planet when new fertile spots were invaded and the globe was gradually provided with life (Givnish and Renner, 2004, Cook and Crisp, 2005). The biosphere is a dynamic mosaic of species resulting from a constant movement of genes driven by dispersal processes. Evidence suggests that dispersal processes are key factors in controlling community patterns such as structure and composition, that they may drive population dynamics, that they shape biomes in the different biogeographical regions, and that they regulate evolutionary rates through affecting the genetic isolation of local populations as well as rates of extinction (Hubbell et al., 1999, Wehncke et al., 2003). Dispersal is a universal phenomenon. However, its properties under different conditions in natural communities are still far from being well understood (Zobel and Kalamees, 2005, Vandvik and Goldberg, 2005).

Dispersal refers to the movement of individuals from their source location to another location where they might establish and reproduce (Bullock et al., 2002, Clobert et al., 2001). Terrestrial plants are excellent subjects for the study of dispersal. In general, plant dispersal is confined to a short phase in the life cycle during which the individual reproduces. Dispersal of reproductive propagules is an important motile process in the otherwise sedentary life of adult plants. It is subjected to many factors and is crucial at all organizational scales.

The term “propagule” is widely used to include all different dispersal units described in plants (Cousens et al., 2008). Higher plants move in space mostly by seeds; embryos securely protected from external aggressions ready to survive on the ground and containing enough stored food to start germination. Seeds together with pollen are the gene flow mediators in plant populations (Ennos, 1994, Wright, 1969). Vegetative strategies also involve movement but this movement is usually restricted and does not result in large spatial changes (but consider also spores of lower plants, e.g. ferns, bryophytes, and vegetative propagules (gemmae, plant fragments, in, e.g. bryophytes) (Levin et al., 2003). At some point in the life of a higher plant, the formation of seeds completes the reproductive cycle started with the formation of reproductive structures, trigged by environmental conditions or merely time, and followed by pollination and fertilization. Seeds develop according to the resources received from the parent plant and the environment at that particular point in space and time (Skarpaas, 2012, Klinkhamer, 2011, Hofgaard, 1993). When a threshold combination of completion of seed formation or fruit development together with applied external forces co-occurs, the unit is detached and moved away from the origin, by passive processes or active launching mechanisms.

Seed dispersal occurs at a wide range of scales from landscapes to individuals, affecting species fitness, population dynamics, genetics and species distribution (Nathan and Muller-Landau, 2000, Levin et al., 2003, Kokko and Lopez-Sepulcre, 2006, Clobert et al., 2001). However, the seed dispersal cycle is complex and many steps and processes regulate the phase between seed production and offspring establishment (Cousens et al., 2008). These steps need to be understood in order to analyze the role of dispersal in plant distributions and in the composition of vegetation.

There is broad evidence that dispersal is a key process in plant spatial dynamics. Individuals, communities and populations are strongly affected by dispersal processes. Individual suitability, population rates of change, and community assemblies are subject to and affected by dispersal processes (Hardesty and Parker, 2003, Clark et al., 2004, Shen et al., 2007, Levin et al., 2003).

Seed dispersal crucially contributes to species niche differentiation to allow species coexistence (Fenner and Thompson, 2005, Shen et al., 2007). It directly affects potential tradeoffs between colonization, competition, and many others which, in the long term, lead to evolutionary implications (Clark et al., 2004, Tilman, 1999, Muller-Landau, 2003, Yu et al., 2004). Classically, competitive ability and colonization potential have been associated with seed morphological design and seed size and numbers, defining different dispersal behavior leading to the distinction between colonialists and persistent plants (Salisbury, 1942). Hence, dispersal patterns define the potential rate of spread involving migration rates and range expansion (Clark et al., 2004, Clark et al., 1998) and play an essential role in colonization of open habitats with important implications in gap community regeneration (Hardesty and Parker, 2003, Peart, 1989) linked with new habitat invasions (Thebaud and Debussche, 1991).

Seed dispersal determines the potential rates of seedling recruitment (Fenner and Thompson, 2005). This fact is evident in studies using seed addition experiments (Graae et al., 2011). The importance of seed dispersal processes depends on seed availability and limitation (Nathan et al., 2000). However, successful seedling establishment leading to “effective dispersal” is also determined by post-dispersal factors (Erefur et al., 2008, Nathan, 2008) and is closely correlated to microsite environment (Graae et al., 2011). Biotic and abiotic influences on establishment, growth, and survival have to be considered together with dispersal effects on populations (Schupp and Fuentes, 1995). Therefore dispersal is a major control over all processes and levels of organization and is a key factor in the attempt to understand plant population ecology.

The sum of all propagules that land on a particular piece of ground is often referred to as the “seed rain” (Nathan and Muller-Landau, 2000, Cousens et al., 2008). It is the primary reflection of seed dispersal (Hu et al., 2009). The seed rain is defined by seed quantity and species composition. These two main characteristics and their variation in time (Houle, 1998, Shen et al., 2007) and space (Nathan et al., 2000) have been recently addressed by e.g. Larsson and Molau (2001), Shen et al. (2007), and Loiselle et al. (1996). Seed rain patterns not only show heterogeneity among vegetation types (Molau and Larsson, 2000) but also reflect differences in structure and dynamics of populations in community types (Hardesty and Parker, 2003, Loiselle et al., 1996, Shen et al., 2007) and among individuals within the same community (Loiselle et al., 1996, Schupp and Fuentes, 1995) where differential fecundity (Herrera, 1998) and pre-dispersal seed loss (Ehrlen, 1996) affect seed output and dispersal success.

Over recent decades, the role of dispersal in maintaining biodiversity and structure of local communities has been increasingly demonstrated (Wehncke et al., 2003). The species pool determines diversity of species at the local community scale and it is limited by the arrival of propagules from the next larger scale (Zobel and Kalamees, 2005). Several studies claim that limited dispersal might modify abundance and diversity patterns observed in nature (Zobel and Kalamees, 2005, Vandvik and Goldberg, 2005) leading to dispersal as one of the most important factors determining the structure of ecological communities (Ozinga et al., 2004, Thompson and Townsend, 2006, Linares-Palomino and Kessler, 2009). However, the role of dispersal in diversity maintenance and limitation is not a straight forward issue to test. It is suspected to vary among and within communities being influenced by the effects of several factors such as species traits, environmental variables including climate, landscape and habitat structure, and the scale of measurement (Vandvik and Goldberg, 2005).

Dispersal, like any other ecological process, should not be considered in isolation; seeds during their independent stage are influenced by external physical and biological factors. A large number of alleged dispersal drivers are nowadays on the ecological research agenda. Indeed, the environment with its complex interaction of variables is highlighted as the main contributor to dispersal and the subsequent processes within a plant's life-history, such as germination and seedling establishment (Linares-Palomino and Kessler, 2009).

During the 20th century, the planet has experienced the strongest warming trend of the last millennium. It is forecast to continue with temperatures predicted to rise between 0.1^{o}C and 0.4^{o}C per decade across Europe (IPCC, 2007). Besides an increase of global mean temperatures, changes in precipitation patterns are predicted (IPCC, 2007). Norway is not an exception; future projections show an increase in precipitation especially noticeable at the west coast (Hanssen-Bauer, 2003, Engen-Skaugen et al., 2007). Climate and dispersal capacity work in conjunction to determine community composition and structure: climate is primarily responsible for broad scale species distribution (Davis and Shaw, 2001, Ibanez et al., 2006, Clobert et al., 2001), while dispersal capacity is the main factor in changing distribution ranges (Holt, 2003, Engler et al., 2009). As a result of a changing climate, the chance of some plant species of avoiding extinction relies on shifts in their geographical distribution by migrating and establishing in new suitable habitats (Pitelka et al., 1997, Jump and Peñuelas, 2005). In fact, distributional shifts characterize the past 2.6 million years, during the Quaternary (Huntley and Thompson Webb, 1989), when sharp climatic fluctuations occurred as a result of Milankovich Astronomic Cycles. Then, successful plant responses to sharp climatic changes resulted in several episodes of dispersal and isolation (Willis et al., 2004, Birks and Willis, 2008). Clark et al. (1998) proposed that past rapid migrations of plant species could be taken as models to guide forecasts for plant populations in the twenty-first century. However, the present climate change is at unprecedented rates; it is uncertain whether plants will be able to tolerate and adapt in their present locations to the climate change forecast for the 21st century or to migrate to suitable locations fast enough (Jump and Peñuelas, 2005, Davis and Shaw, 2001). Facing the predicted rate of climate warming, the potential response will have to be substantially faster than historical shifts in plant distribution (Overpeck et al., 1991, Kirilenko et al., 2000).

Therefore, if the chance for a population to survive relies on the capacity to move a reliable number of individuals towards a more suitable habitat (Clark et al., 2004, Wang and Smith, 2002), the key role of dispersal under the ongoing climate change is obvious. A major factor influencing migration is the accessibility of a new suitable habitat. In addition to the rapidity of climate change, human-driven habitat fragmentation hampers plant establishment by reducing habitat availability and seed dispersal (Davis and Shaw, 2001, Pitelka et al., 1997). In the current times of climate change, focus on plant dispersal and migration ability is increasing as a hot topic in journals, providing evidence that intensive studies of dispersal and its role in migration are urgently required for predictive ecology that attempts to track species responses to future environmental change (Jump and Peñuelas, 2005, Kokko and Lopez-Sepulcre, 2006).

Both dispersal limitation and climate are important factors affecting colonization of new habitats, thus shaping range limits in the past (Linares-Palomino and Kessler, 2009, Davis and Shaw, 2001). Distribution models have been broadly used to assess the climatic change impact on vegetation (Guisan and Thuiller, 2005) but modifications of dispersal limitations could change the predicted results of climate effects (Engler and Guisan, 2009, Engler et al., 2009). Lately Some studies have included dispersal limitation in their projections (Dullinger et al., 2004). Engler et al. (2009) showed that species with higher dispersal capacity appear to be less affected by climate change.

Despite the growing interest in the topic, we still know little about many of the aspects describing seed dispersal patterns (Myers and Harms, 2009). Lately, research has focused on assessing dispersal

in time, via stored ungerminated seeds in the soil (seed bank) and space, via the flow of seeds (seed rain) in different habitats within different ecological scopes. Both components have been found to vary through different habitats and communities and with environmental factors such as temperature and precipitation at broader scales (Cummins and Gordon, 2002, Molau and Larsson, 2000).
From the first studies assessing seed dispersal through seed rain by Ryvarden (1971) in Finse, Norway, high seed rain variation between years and seasons and different distribution patterns through space at different scales have been studied and contrasted (e.g. Hardesty and Parker (2003), Urbanska and Fattorini (2000), Larsson (2003), Molau and Larsson (2000)).

Above-ground vegetation composition has been found, overall, to determine seed rain patterns, but this relationship varies among habitats. As seed rain is the primary component of plant dispersal and the production of viable seeds is the first basic requirement for germination success (Hofgaard, 1993), it is essential to increase knowledge of the effects of establishment on the vegetation under different ambient conditions. To understand dynamics of change in plant communities, it is crucial to quantify the availability of propagules, the likelihood of plant establishment, and its effects on vegetation composition, interacting factors, patterns in the established vegetation, and their interactions. Thus, in order to assess the role of dispersal in communities and its characteristics along climatic gradients, experimental approaches are needed (Vandvik and Goldberg, 2005, Zobel and Kalamees, 2005, Myers and Harms, 2009).

I set up a seed trapping experiment to assess the main seed rain components in low-productivity basic-neutral grasslands along temperature (altitude) and precipitation (oceanity) gradients. Previous studies have pointed out that these two environmental factors are important drivers of seed dispersal and that they may influence the seed flow in the same way that they do on vegetation composition. The main components of the seed rain were studied through a one-year period in different temperature and precipitation regimes. Hence, this study considers different plant communities determined by precipitation and temperature regimes. Thus not only the generally understudied components of the seed rain as the main component of community dispersal could be assessed, but also the effects of different climatic conditions on the magnitude and composition of the seed rain within a geographical area, which may allow us to predict how the ongoing changes in climatic conditions will impact seed rain and seed dispersal in the future.

I structured my aims on three main gaps in knowledge: patterns in seed rain density and richness, the relationship between seed rain and vegetation, and the dispersal distances travelled by the seed rain. For each main research question, I investigated climatic effects. First of all, to get an overview on patterns in the seed rain I asked: (i) How does seed rain vary across the climatic grid? and (ii) Do seed rain vary between winter and summer seasons? To explicitly consider possible effects of climate on seed rain I asked: (iii) Is there an effect of temperature and precipitation on the seed rain? To assess how the vegetation - seed rain relationships vary under different climatic conditions and across different spatial scales of community and individual species I asked: (iv) Are the most abundant seeds also the most dominant plants?, (v) How does richness, diversity and evenness of seed rain compare to vegetation?, (vi) Do the local vegetation and climatic variables affect seed rain abundance and composition? Knowledge of the composition of the seed rain and the local vegetation gives the opportunity to distinguish between seed rain originating from within the local vegetation and seed rain that must have originated from outside the local vegetation patch (Vandvik & Goldbergh 2006). Using this information, I ask: (vii) What role do dispersal distances and climatic variables play in seed rain properties.

2. Materials and Methods

2.1 Study area

The Western Norwegian landscape, characterized by its fjords and mountains, provides an excellent location for climate and vegetation studies; due to its topography and oceanic conditions, many different climate conditions are included, resulting in a high diversity of species and strong biogeographic gradients within a relatively small area. Temperature varies with altitude and continentality (Fig. 2.1(a)). Annual mean temperature ranging from 7.58°C to -8.22°C (met.no, 2009) decreases from low to high altitude (regional lapse rate of ca. 0.5°C / 100 m.a.s.l. (Tveito & Førland 1999)). Annual precipitation increases from the East towards the West coast (Hanssen-Bauer et al., 2003) (Fig. 2.1(b)). Seasonality is reflected in the landscape with a snow cover ranging from 0 to 8 months. Grazing by free-ranging domestic and wild herbivores is widespread throughout the Norwegian countryside.

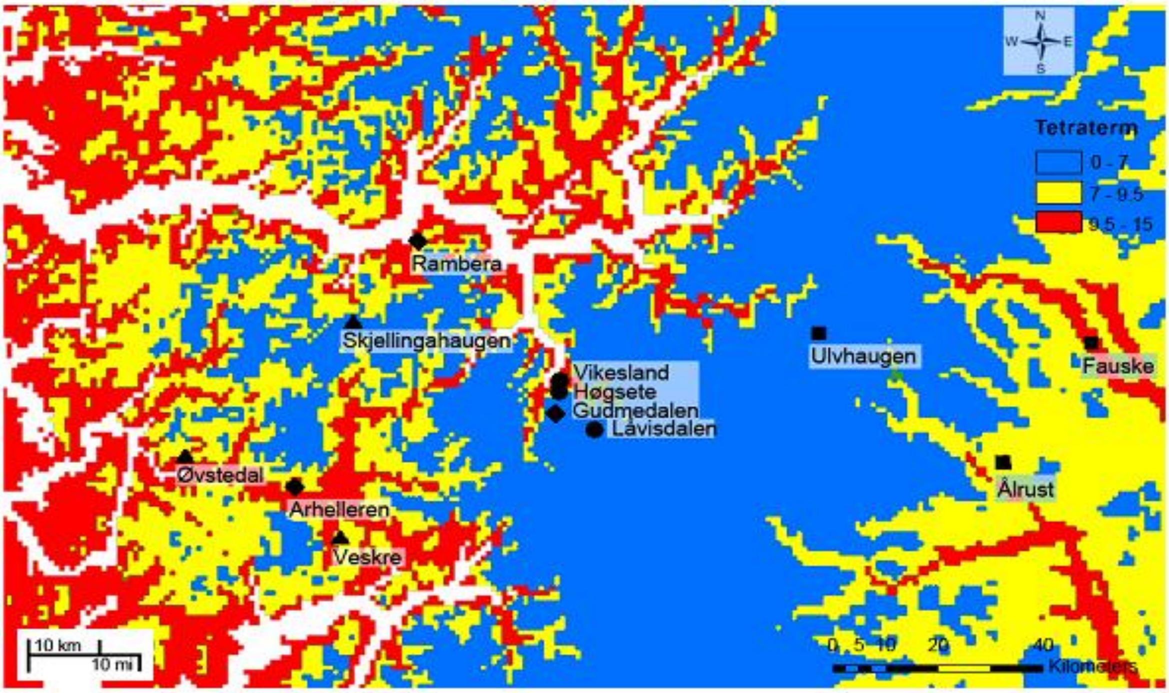
Twelve experimental sites were selected to sample the climatic space along temperature and precipitation gradients (Fig. 2.2). This 'climate grid´ was created by the SeedClim Project in 2008 based on climate data obtained from the Norwegian Meteorological Institute (met.no, 2009). 4 levels of annual precipitation (ca 600mm (level 1), 1200mm (level 2), 2000mm (level 3) and 2700mm (level 4)) were chosen and combined with 3 levels of mean summer temperatures (ca 6.5°C (alpine), 8.5°C (intermediate), and 10.5°C (lowland) (Table 2.1, Fig.2.3). The gradient covers approximately 6°C in mean summer temperatures across the boreal to the low-alpine zone transition.

To be able to compare sites, the sites were selected so that biotic and abiotic variables like grazing intensity, slope exposure, bedrock and vegetation structure in local scale species richness were as constant as possible across sites. Thus, all selected sites are low productivity moderately grazed grasslands associated with phyllite or other calcium-rich bedrock with southwest to southeast exposures and they have with a relatively high local scale species diversity.

Table 2.1: Site descriptions sorted by elevation categories (Lowland, intermediate and Alpine) and precipitation (low to high) with their UTM coordinates and environmental variables. Precipitation and temperature data are provided by the Norwegian Meteorological Institute (met.no, 2009)[1] and data on bedrock are provided by the Norwegian Geological Survey (NGU, 2009)[2]. Precipitation is represented by the annual mean, while Tetratherm temperature is the mean temperature for the four warmest months in one year.

Site	**UTM zone33** ***Coordinate x***	**UTM zone 33** ***Coordinate y***	**Altitude** ***m asl***	**Precipitation mm[1]** ***Annual Mean***	**Temperature °C [1]** ***Tetratherm***	**Bedrock[2]**
Lowland						
Fauske	180405.00	6781200.00	589	(1) 600	10.3	Phyllite. Mica schist
Vikesland	75604.70	6774850.00	474	(2) 1161	10.6	Phyllite. Mica schist
Arhelleren	27494.10	6756720.00	439	(3) 2044	10.6	Phyllite. Mica schist
Øvstedal	7643.94	6762220.00	476	(4) 2923	10.8	Ryolite. Ryodacite. Dacite
Intermediate						
Ålrust	157951.00	6759200.00	815	(1) 789	9.1	(Meta)sandstone Shale
Høgsete	75917.50	6774330.00	700	(2) 1356	9.2	Phyllite. Mica schist
Rambera	49407.80	6801320.00	779	(3) 1848	8.8	Phyllite. Mica schist
Veskre	35390.20	6742090.00	780	(4) 3029	8.7	(Meta)sandstone Shale
Alpine						
Ulvehaugen	128833.00	6785010.00	1208	(1) 596	6.2	Ryolite. Ryodacite. Dacite
Låvisdalen	80587.50	6767820.00	1097	(2) 1321	6.5	Phyllite. Mica schist
Gudmesdalen	75285.30	6769540.00	1213	(3) 1925	5.9	Phyllite. Mica schist
Skjellingahaugen	35627.60	6785870.00	1133	(4) 2725	6.6	Marble

a)



b)

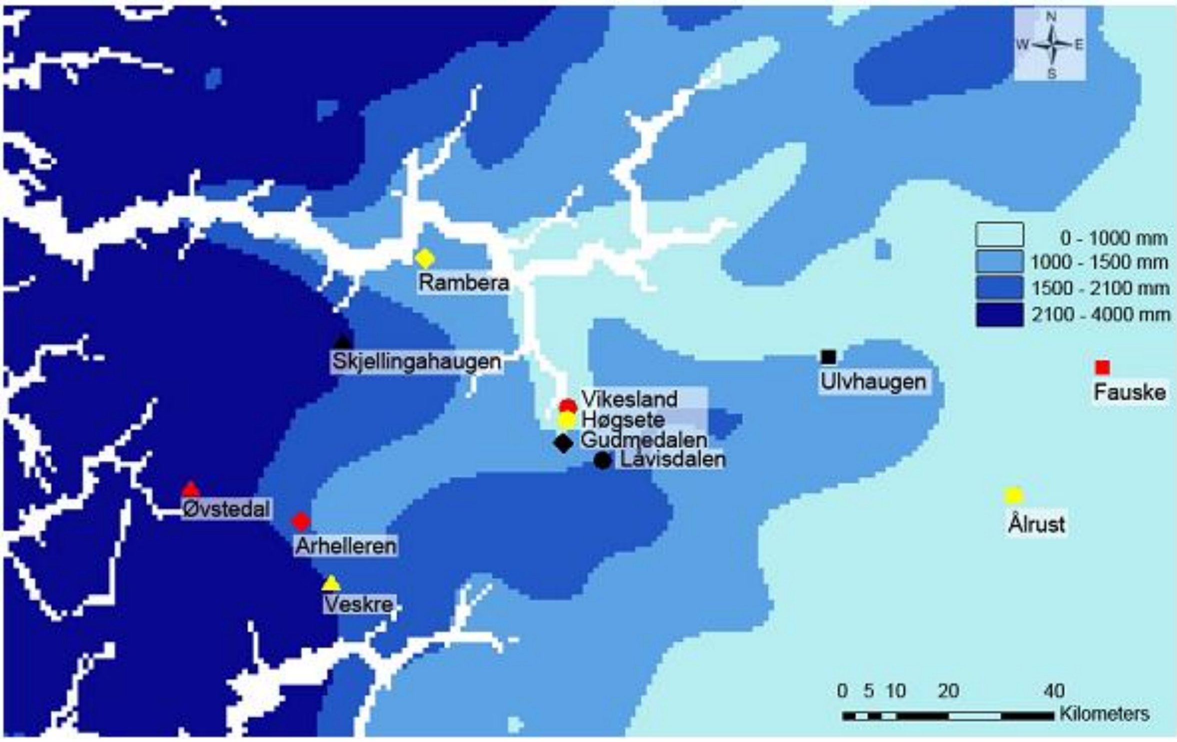


Fig. 2.1: Maps of the study area showing; a) Summer temperature (in tetratherm summer values) and b) Annual precipitation. All 12 sites are located on the maps. Altitudinal ranges distinct by colors, precipitation ranges distinct by symbols (see legend of colors and symbols on figure 2.2).

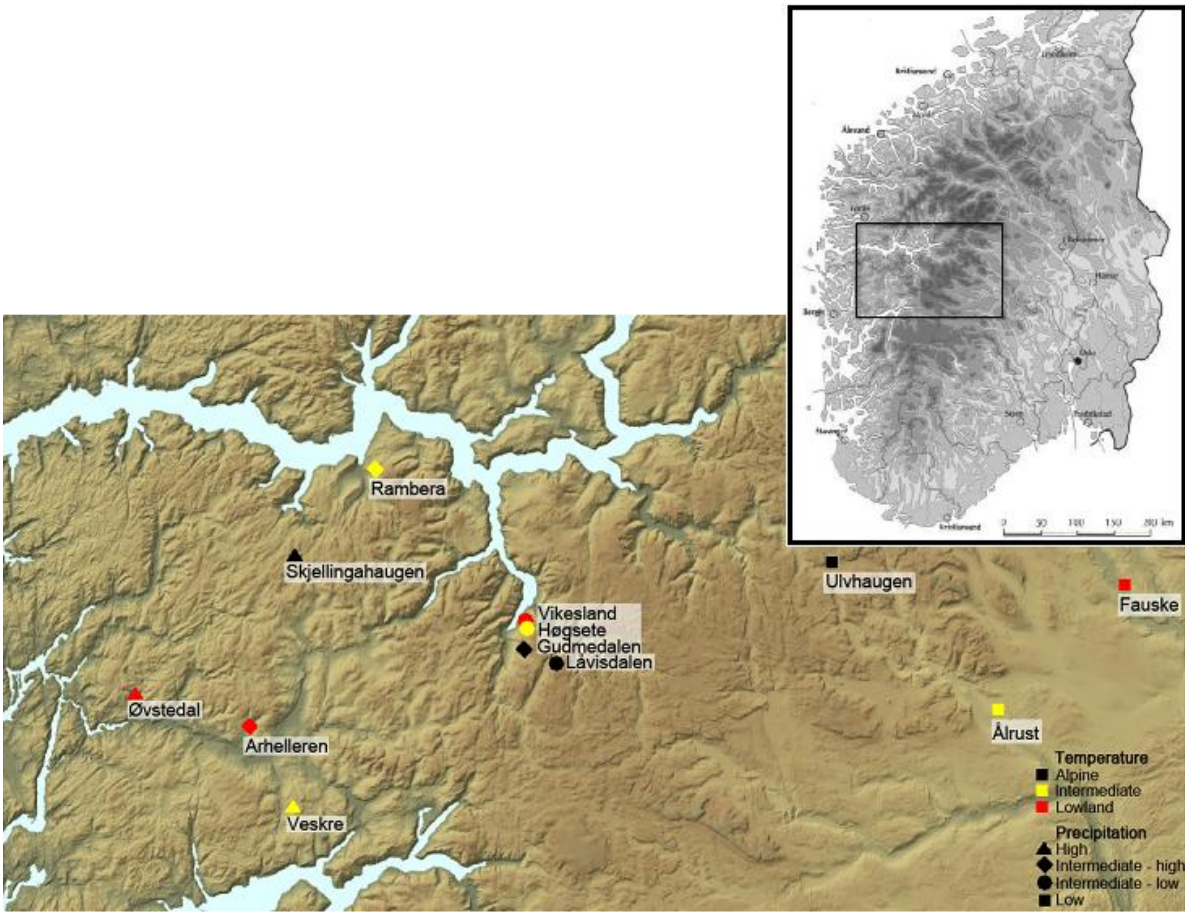


Fig. 2.2: Site locations in Norway. Altitudinal ranges distinct by colors, precipitation ranges distinct by shapes.

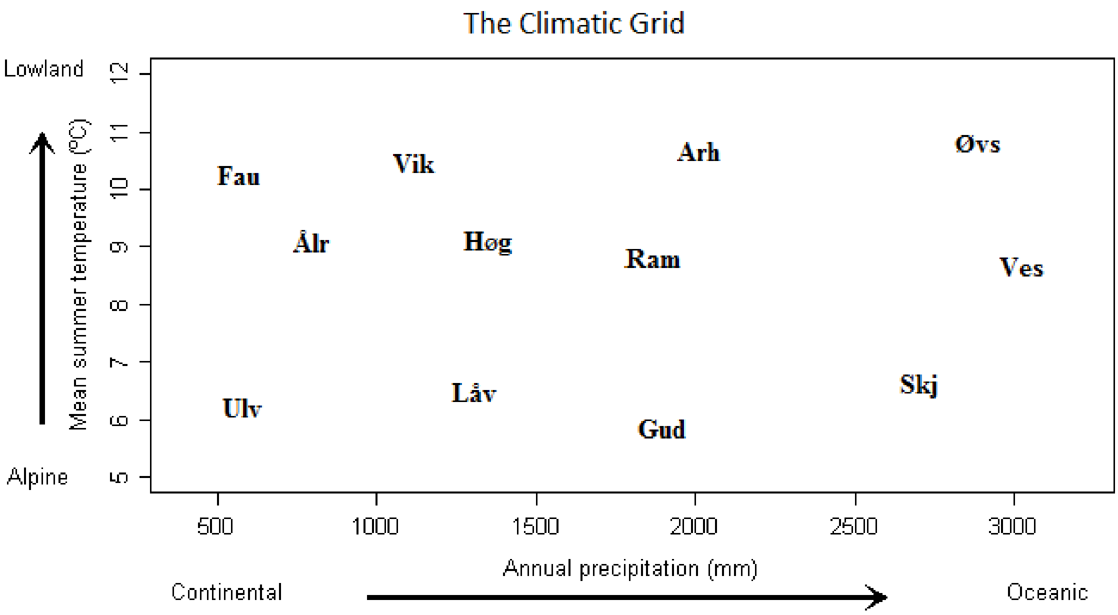


Fig. 2.3: Location of the 12 sites within the climatic grid. The abreviations refer to the three first letters in the name of the study sites; "Fau"; Fauske, "Vik"; Vikesland, "Arh"; Arhelleren, "Øvs"; Øvstedal, "Ålr"; Ålrust, "Høg"; Høgsete, "Ram"; Rambera, "Ves"; Veksre, "Ulv"; Ulvehaugen, "Låv"; Låvisdalen, "Gud"; Gudmesdalen and "Skj"; Skjellingahaugen.

2.2 Training and Fieldwork

Plastic doormats (Astroturf©) were used for trapping the seed rain. They were laid out in summer 2009 and winter 2009-2010. Training on seed identification was carried out under instruction by Hilary Birks during January 2011.

2.3 Experimental design

Doormats as part of a larger experiment

The doormats traps were included as part of a seedling recruitment experiment conducted by the SeedClim project (Berge, 2010). The full experimental set up consists of five duplicate blocks per site containing four treatment areas of 25x25 cm within each block; (I) Recruit-Tag Control (RTC), (II) Recruit-Tag Gap (RTG), (III) Recruit-Tag Shelter (RTS) and (IV) Seed rain doormat (Fig. 2.4). The RTC or control consisted of a plot where the vegetation was left intact. The RTG treatment consisted of a plot where the vegetation was removed by digging a gap of 5-10 cm deep and removing all roots and above-ground plant parts, while leaving the soil and seed bank as intact as possible. In these gaps, recruitment can occur both from seed rain from surrounding vegetation and from the soil seed bank. The RTS consisted of a gap covered by a meshed shelter fine enough to prevent seed rain from the surrounding vegetation from entering, thus allowing only seedling emergence from the seed bank. Species composition and number of individuals within RTC, RTG, and RTS was recorded annually from 2009. The seed rain doormats contain the seeds coming from the seed rain only and for comparison with the RTS and RTG treatments. These doormats comprise the basis of this Master's thesis, as they contribute knowledge on seed rain by themselves as well as providing additional information input to the total SeedClim seedling recruitment experiment.

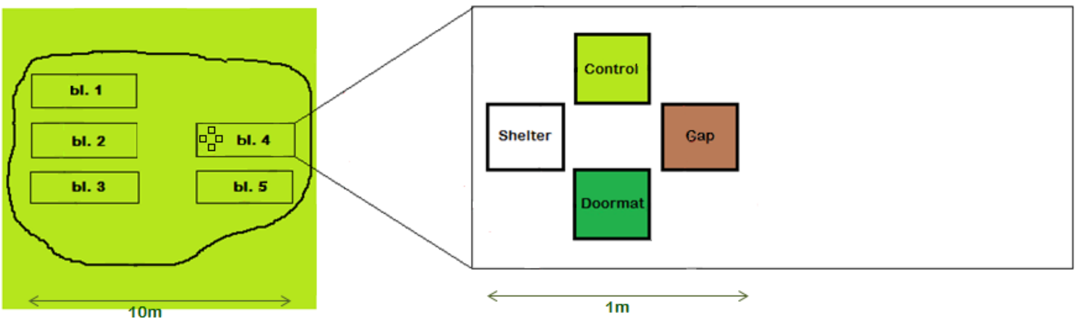


Fig. 2.4: Diagram of the SeedClim experiment set up in each of the 12 sites. There are 5 blocks (bl.) at each site. Each block contains one set of treatments.

2.4 The doormat experiment

Seed traps consisted of Astro Turf doormats. Doormats simulate the normal vegetation cover, and trap seeds from the seed rain coming from the surrounding vegetation (Jägerbrand, 2007, Birks and Bjune, 2010) and have proved to be efficient seed traps in previous studies (Birks and Bjune, 2010, Larsson, 2003, Molau and Larsson, 2000). The plastic ”turf” is very efficient at holding small particles, including seeds, minimising the loss of them by natural factors, such as rain water or wind. They are an economical and easy way to study seed dispersal as they are resistant enough to withstand the harsh Nordic climate.

Experimental doormats of 25 x 25cm (0,625m^2) were placed in cut gaps in the vegetation, pegged to the ground with nails through the corners and left there without being manipulated until harvesting. Two sets of 60 doormats were collected and replaced by new ones twice a year, timed to sample summer and winter deposition; winter - 8 months; from September 2009 to June 2010 and summer - 4 months; from June to September 2010. Each 60 set consists of one doormat per block with five blocks per site within the twelve sites (Fig. 2.5).

Collected doormats were wrapped in individual plastic bags with a secure lock and stored in a refrigerator at 4^{o}C. During transport, one set of 5 doormats corresponding to winter seed rain at the lowland site *“Fauske”* got lost and the corresponding data are missing.

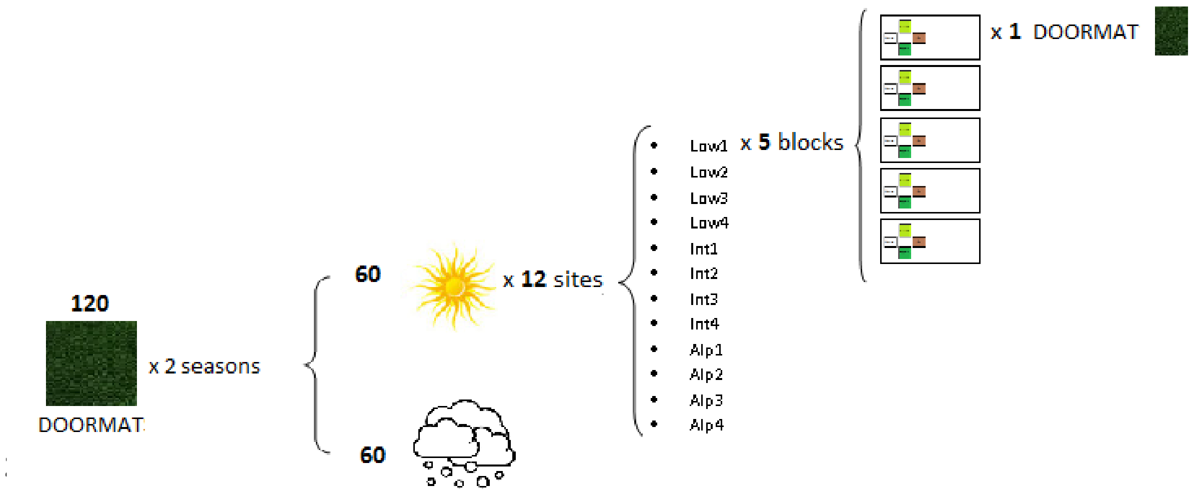


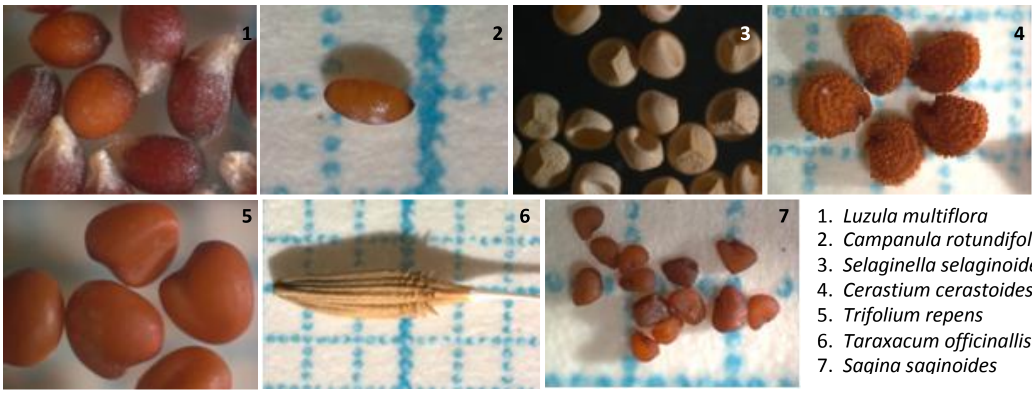
Fig. 2.5 : Diagram of the experiment design: 120 doormats in total; 60 per season, 5 per site in each of the 12 sites.

The Seed rain collected within the doormat was processed and analyzed to measure the seed rain in an area of 0,625m^2. From each doormat sample, four steps were carried out during the processing: washing out, sorting seeds, species identification, and storage.

Doormats were washed out with water using a shower head. The water was collected in a basin and passed through 500µm and 125µm diameter sieves to discriminate seeds by size and get rid of other organic material. Seeds and fruits were picked out systematically from the material retained on the sieve, using a stereomicroscope at x 12 magnification. Seeds were identified as far as possible, usually to species level, and counted (see Fig. 2.6). Throughout this thesis, the term "seed" is used to refer not only to seeds but also to other dispersal units like fruits, macrospores (*Selaginella selaginoides*) and bulbils (*Bistorta vivipara).* Plant species nomenclature follows Lid and Lid (2007). When determining species, a training period was necessary with help from specialists in macrofossil identification. Identification was aided by comparisons with the reference papers and databases, as listed in Birks (2007) and the reference collection at the Biology Department, University of Bergen.

The seeds from each sample were placed in Eppendorf tubes in glycerol with a little phenol added to inhibit fungal growth, and stored at 4^{o}C.
Unfortunately, in some cases identification to the species level was impossible, and some species were assigned to aggregate species (e.g., Xxx undiff.) or to individual, but unidentified, species (Xxx Sp.). Only clearly distinct and identifiable taxa at the species or genus level were included as different taxa in the statistical analyses (Appendix I).

When comparing seed rain with vegetation data, adjustments had to be made to the seed rain dataset to ensure that they were of identical taxonomic resolution. Thus, *Viola* undiff., *Sagina* undiff., *Luzula* undiff. and *Alchemilla* undiff. were merged to *Viola* spp, *Sagina* spp, *Luzula* spp, and *Alchemilla* spp in the vegetation data set.



1. *Luzula multiflora*
2. *Campanula rotundifolia*
3. *Selaginella selaginoides*
4. *Cerastium cerastoides*
5. *Trifolium repens*
6. *Taraxacum officinallis*
7. *Sagina saginoides*

Fig. 2.6 : Some seeds collected in doormats.

2.5 Statistical analysis

Statistical analyses were carried out to address the three main research questions in the thesis, (1) Seed rain composition and quantity, (2) the relationship between seed rain and the local vegetation and (3) long or short seed dispersal. For each of the three main research questions, data were analyzed among sites within the grid and along the climatic variables temperature and precipitation.

2.5.1 Seed rain density and richness

Birch fruits are numerous and wind dispersed (Birks and Bjune, 2010). *B. pubescens* is very common around many of the sites, so it was not surprising to find high number of birch seeds in most doormats from sites below the forest line (Fig. 2.7). Its representation in the seed rain varied considerably among sites and it sometimes dominated the seed rain (0-2316 seeds). *B. pubsecens* does not grow in the grassland vegetation that has been investigated. Therefore, birch seeds were omitted from all statistical analyses.

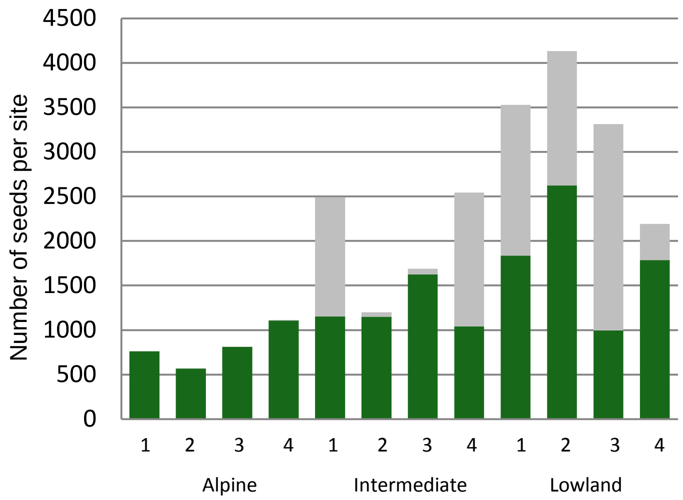


Fig. 2.7: Total number of seeds from *Betula* sp. (grey) contrasted to all other vascular plant species (green) per site. On the X axis; sites are arranged by precipitation ranges, from 1 to 4 within 3 altitudinal ranges: alpine, intermediate and lowland.

Count data (total numbers of seeds or species) was considered a direct and easily-understandable way of presenting results and was selected, instead of densities, to analyse data from the equal-sized plots. In order to avoid bias due to missing doormats from the lowland site "Fauske", the average seed numbers and species richness from the other three lowland sites were calculated and replaced the missing winter data at that site.

Analyses of variance (aov) were used across sites and seasons to examine species richness and seed abundance variability. Mean values were contrasted using Tukey's Post-Hoc multicomparison test (TukeyHSD) to check pair wise differences between sites or levels.

The Indicator value index (IndVal) was calculated from 'multipatt' and function= 'r' in the indicspecies-package in R (De Cáceres et al., 2010) to assess the association of each species to different site groups (alpine , lowland and west, east).

To test the effect of the climatic explanatory variables on species richness and total number of seeds, a linear regression model was selected and generalized linear models (glmmPQL) were performed. Number of seeds or species richness were the response variable in each comparison while Temperature and Precipitation were the predictors. To find the optimal model, hypothesis testing was employed and the backwards model selection process performed by a top-down strategy according to the Akaike's information criterion (AIC), (Diggle et al., 2002, Smith et al., 2009).

2.5.2 Seed rain and vegetation

Evenness (Evan) and Shannon-Weiner index were calculated per site (Smith and Wilson, 1996, Peet, 1974). To examine the effect of vegetation abundance and climate variables, a model selection was carried out using Poisson generalized linear model (glmmPQL) by a backwards strategy with the number of seeds as the response variable, and site nested as a random factor. Contrast analysis and model selection were assessed at two different scales: community scale (by block) and species scale (by species within blocks).

2.5.3 Seed rain and dispersal distances

When analysing the origin of the seeds, dispersal source referred to seeds coming from the vegetation within the blocks in contrast to seeds coming from the vegetation at that site with no plant representation within blocks. Dispersal source is assessed as a proxy for dispersal distance.

Analysis of variance was used to test if the amount of seeds and number of species represented by seeds dispersed from outside local vegetation differed among sites.

Correlation analyses for seed numbers and species richness by block as response variable were performed considering dispersal source, temperature and precipitation as fixed factors and site as random factor. A generalized linear model was used and the best fitted model was selected.

According to the Shapiro-Wilks test for normality (p-value <0,05), data were found to be non-normally distributed, although, Poisson distribution and loglink transformation were considered for all analyses and over-dispersion corrected when required. All significant models were validated by the Shapiro test for normality and the Levene´s test for constancy of variance of residuals.

All statistical tests were performed with R version 2.14.0 (R Development Core Team, 2011), while R or Microsoft Office Excel 2007 were used to create graphical illustrations.

3. Results

3.1 Seed density and richness

3.1.1 Seed rain along a climatic grid (Question I)

Throughout the climate grid 115 samples were analyzed, and a total of 123 plant taxa and 22 803 seeds were recorded in the total seed rain. Seeds of birch species (*Betula pendula* and *B. pubescens*) often dominated the seed rain, with a total of 7 563 seeds recorded. As these extremely well-dispersed tree species are not part of the target community, these seeds were not included in any of the subsequent analyses and graphs. The final dataset thus consists of 15 853 vascular plant seeds, on average 4 227 seeds m^{-2} $year^{-1}$.

Total seed and species numbers per site for summer, winter and annual seed rain are given in Table 3.1. The total number of seeds in the seed rain did not differ among sites, with the exception of the lowland site “low 2” where the highest number was recorded (2 621 seeds). The seed rain differed in species richness among sites ($p < 0.001$) (Fig. 3.1). The species composition of the seed rain also varied among sites (Table 3.2).

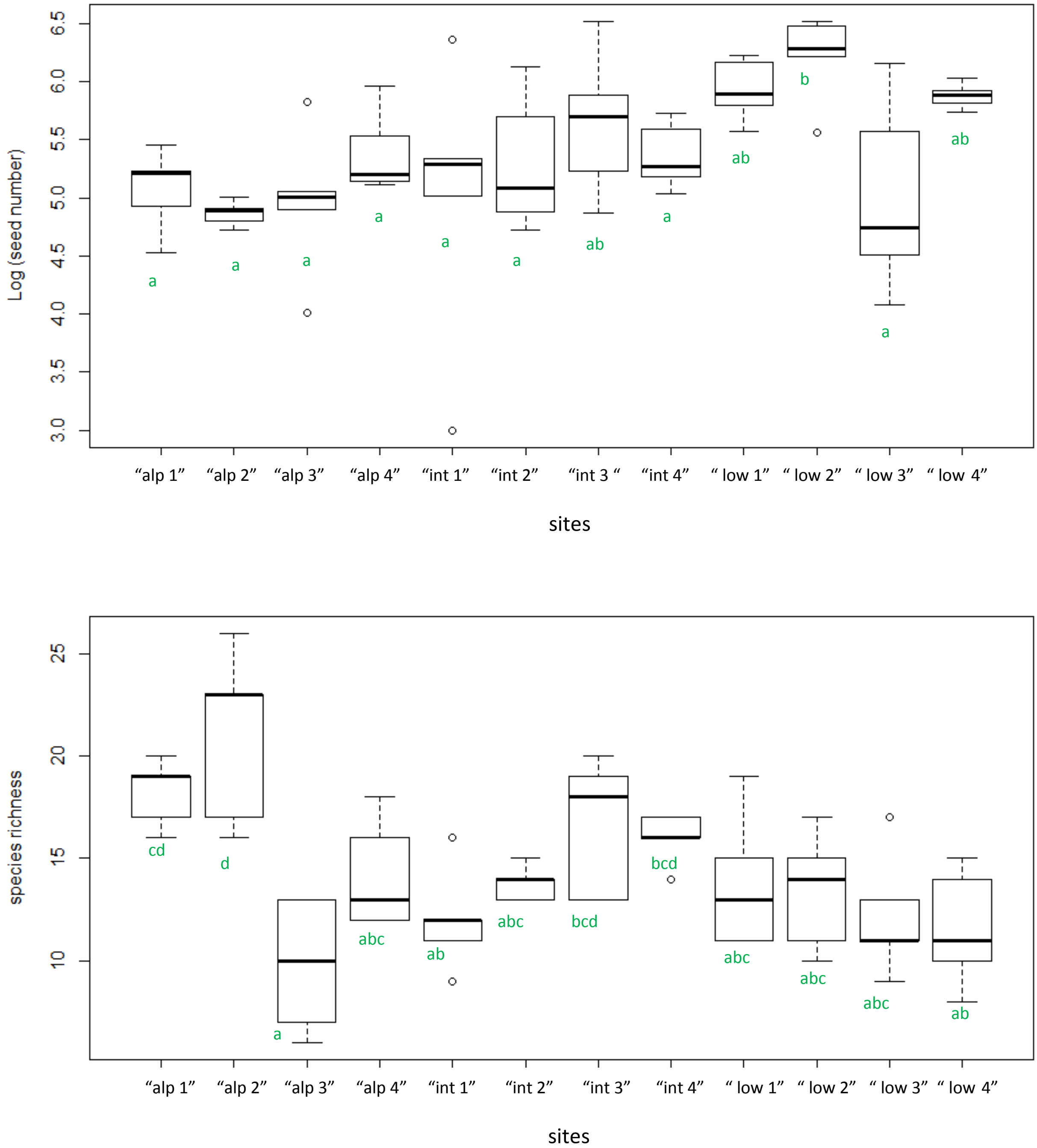


Fig. 3.1: Above: total number of seeds per site; **below**: species richness per site. The boxes represent lower median, median and upper median and indicate the degree of spread and skewness in the data. Whiskers extend out to the data's smallest number and largest number and outliers are represented with dots. Letter code represents a significant difference between sites; sites that share a letter do not differ from each other.

Table 3.1: Seed number and species richness per site in summer, winter, and total year periods (vascular plants only). Winter values for "Low1" are estimates.

		Summer		Winter		Total	
Site	**Precipitation range**	**∑seeds site^{-1}**	**Species richness (# species site^{-1})**	**∑seeds site^{-1}**	**Species richness (# species site^{-1})**	**∑seeds site^{-1}**	**Species richness (# species site^{-1})**
Alpine							
Ulvehaugen	**(1)** Low	627	28	204	23	831	42
Låvisdalen	**(2)** Medium-low	72	19	577	33	649	39
Gudmesdalen	**(3)** Medium-high	529	15	300	15	829	25
Skjellingahaugen	**(4)** High	324	23	830	23	1154	32
Intermediate							
Ålrust	**(1)** Low	726	21	426	11	1152	25
Høgsete	**(2)** Medium-low	825	20	332	12	1157	24
Rambera	**(3)** Medium-high	862	21	786	28	1648	34
Veskre	**(4)** High	822	26	273	15	1095	30
Lowland							
Fauske	**(1)** Low	1312	27	[621	17]	1933	28
Vikesland	**(2)** Medium-low	1737	25	884	18	2621	28
Arhelleren	**(3)** Medium-high	392	16	605	24	997	27
Øvstedal	**(4)** High	1414	20	373	9	1787	20

Table 3.2: Multilevel pattern analysis, species associated to particular sites or groups of sites. Asterisks represents three levels of significance;'***' 0.001,'**' 0.01 and '*' 0.05. In black species associated at one site and in red species associated to a group of sites (2, 3, 4 or 5 groups). Presence of species at different sites indicated with hyphens.

	Ulvehaugen "alp 1"	**Låvisdalen "alp 2"**	**Gudmesdalen "alp 3"**	**Skjellingahaugen "alp 4"**	**Ålrust "int1"**	**Høgsete "int2"**	**Rambera "int3"**	**Veskre "int4"**	**Fauske "low1"**	**Vikesland "low2"**	**Arhelleren "low3"**	**Øvstedal "low4"**
Achillea millefolium						-	**					
Agrostis capillaris				-	-	-	-	-	-	***	-	-
Alchemilla alpina	*	*	-	*		-	-	*	-			
***Alchemilla* undiff**							-		**		-	
Anntenaria alpina		**										
Anthoxanthum odoratum	-	-	-	-	-	-	**	-	-	**	-	-
Avenella flexuosa		-				**	-					-
Carex bigelowii		*	-	*			-	-				
Carex capillaris			**	**				**				
Carex leporina												***
Dianthus deltoides	-	-	-	-			-	-	***			
Empetrum nigrum	**	**										
Festuca ovina	-		-			-		-	-	*	-	-
Gentiana nivialis	*		-									
Hieracium pilosella					*				*		-	*
Juncus trifidus	-	**							-		-	
Leucanthemum vulgaris	-	-							***			
Lotus corniculatus	-		-	-	**	-	-	-	-		-	-
Luzula multiflora	-	-					*	*	-		-	
***Luzula* undiff**		*							-		-	
Nardus stricta			*	*			*					
Oxalis acetosella		-		-			***					
Phyllodoceae caerulea		*							-	-		
Pimpinella saxifraga				-					***			
Plantago lanceolata									-		**	
Poa alpina	**				-	-				-		
Poa pratensis		-		-	*	*	-		-	-		-
Potentilla erecta						*	*	-		*	*	*
Prunella vulgaris					**			**				
***Ranunculous* sp**	-	-			-			**	-	-		
Ranunculus acris					*			-		*		
Rumex acetosa	-	-			-				-	***		-
Sagina nivialis	-	**										
Selaginella selaginoides	**	**	**	-								
Silene acaulis		**		**	-							
***Taraxacum* spp**				-				-	**			
Vaccinium myrtillus	-	**										
Veronica alpina	***	***							-		-	
Veronica chamaedrys				-					*		*	
Veronica officinalis						*	-		-	*	-	*
Viola biflora	***		-	-		-	-				-	
Viola palustris			-		-	***	***		-	-	-	
***Viola* undiff**								*		*		

3.1.2 Seasonal variation in seed-rain (Question II)

The number and species diversity of seeds collected in the summer did not differ significantly (p=0.108 and 0.214 respectively) from seeds collected in the winter (Fig. 3.2). Of the total 122 species present in the seed rain, 65 species (53 %) were found both in summer and winter, 32 species (26%) only in summer samples, and 25 species (21%) only in winter samples (Appendix I).

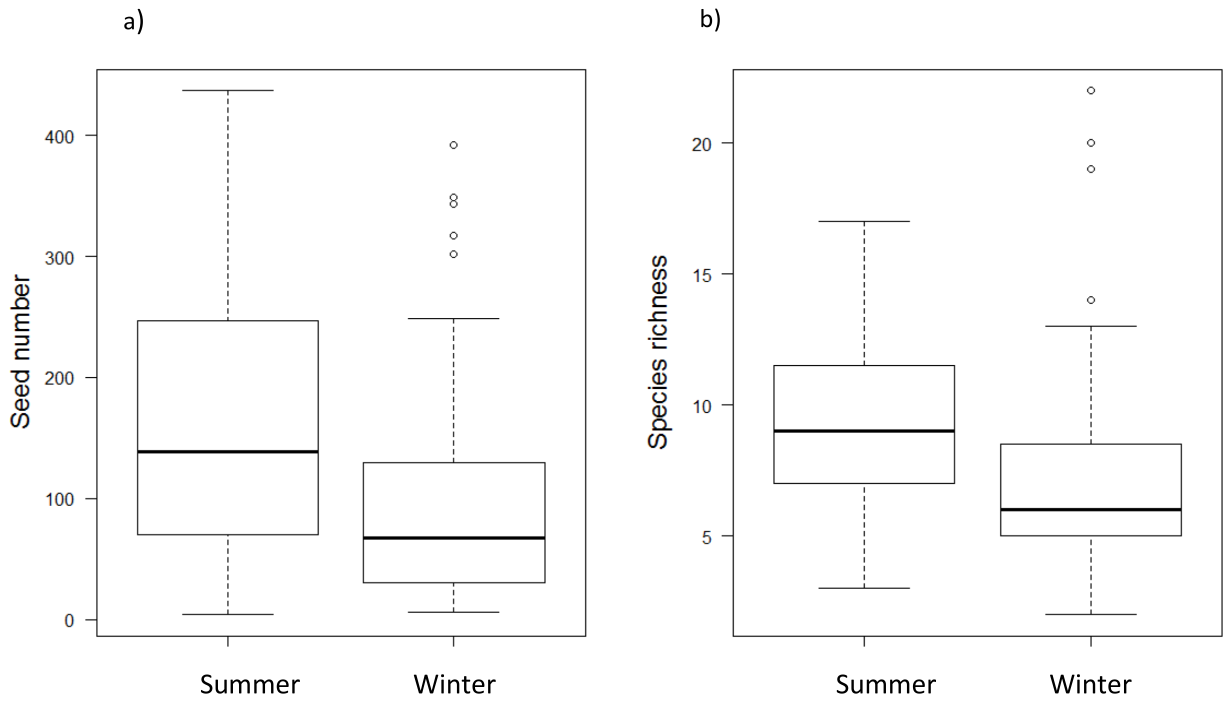


Fig. 3.2: a) Number of seeds and b) species recorded from different season (Summer and Winter).

3.1.3 The effect of climate on seed rain (Question III)

The total number of seeds in the seed-rain responded positively to increasing mean summer temperature (Table 3.3, Fig. 3.3). Temperature did not affect species richness of the seed-rain (Fig. 3.3), and instead influenced species composition (Table 3.4). 17 species were associated with colder temperatures. Of these: *Viola biflora, Veronica alpina, Silene acaulis, Selaginella selaginoides, Empetrum nigrum* and *Carex bigelowii* were the main ones. Of the 12 species associated with warmer temperatures, *Rumex acetosa, Pimpinella saxifraga, Potentilla erecta*, *Carex leporina, Rumex acetosella* and *Stellaria graminea* were the most important. 9 species were associated with medium temperatures. (Table. 3.4).

The fixed effect of precipitation in the statistical analysis did not appear to have a significant effect either for seed numbers or species richness.

Table 3.3: a) Results from the glmPQL investigating seed number and climatic variables (only significant for tetratherm temperature) and b) Results from the glmPQL investigating species richness and climatic variables (any effect was found to be statistically significant).

a)

	value	**Std.Error**	**DF**	**t-value**	**P-value**
(Intercept)	4.073751	0.4309032	48	9.453983	0
Tetratherm temperature	0.1693	0.0474	10	3.5708	0.0051

b)

	value	**Std.Error**	**DF**	**t-value**	**P-value**
(Intercept)	2.652512	0.05897566	48	44.97639	0

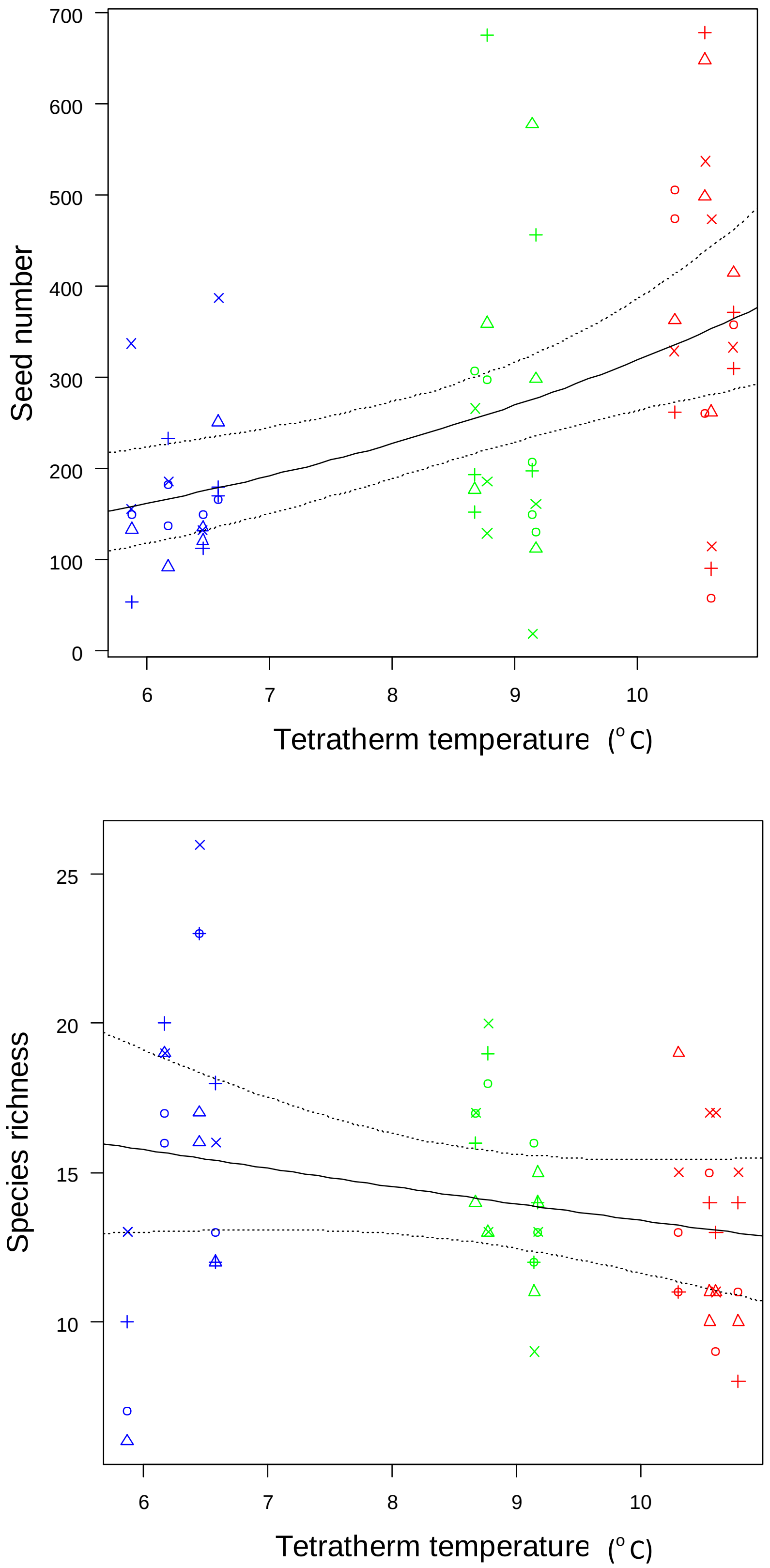


Fig. 3.3 : Predicted seed number and species richness with increasing tetratherm temperature based on the models. Altitudinal gradients are represented by colors (blue: alpine, green: intermediate, red: lowland) and symbols represent precipitation gradients (○ Low, △ Medium-low, + Medium-high, × High). Broken lines represent confidence intervals (95%).

Table 3.4: Multilevel pattern analysis: species composition in relation to tetratherm temperatures. Number of asterisk represent three levels of significance;'***' 0.001,'**' 0.01 and '*' 0.05.

Cold temperatures (5.9-6.6°C)		**Medium temperatures (8.7-9.1°C)**		**Warm temperatures (10.3-10.8°C)**	
Carex bigelowii	***	*Prunella vulgaris*	***	*Rumex acetosa*	***
Empetrum nigrum	***	*Viola palustris*	**	*Pimpinella saxifraga*	***
Selaginella selaginoides	***	*Leontodon autumnalis*	**	*Potentilla erecta*	**
Silene acaulis	***	*Achillea millefolium*	*	*Carex leporina*	**
Veronica alpina	***	*Carex pilulifera*	*	*Rumex acetosella*	**
Viola biflora	***	*Luzula multiflora*	*	*Stellaria graminea*	**
Alchemilla alpina	**	*Oxalis acetosella*	*	*Agrostis capillaris*	*
Gentiana nivalis	**	*Poa pratensis*	*	*Dianthus deltoides*	*
Juncus trifidus	**	*Rhinanthus minor*	*	*Geranium sylvaticum*	*
Phleum alpinum	**			*Hieracium pilosella*	*
Antennaria dioica	*			*Leucanthemum vulgaris*	*
Loiseleuria procumbens	*			*Veronica chamaedrys*	*
Phyllodoce caerulea	*				
Sagina undiff.	*				
Saxifraga aizoides	*				
Tofieldia pusilla	*				
Vaccinium myrtillus	*				

3.2 Seed rain and vegetation

The total number of species recorded in seed rain and vegetation was 122 and 155 respectively. From the recorded species in the seed rain, 79% were shared with vegetation while 21 % were only represented within the seed rain (Appendix V). 98% of the total number of seeds came from species present in the vegetation. Only 2% came from species not present in the local vegetation (Fig. 3.6).

3.2.1 Species doiminance in the seed rain and vegetation (Question IV)

Overall, the dominant species in the vegetation were also the most abundant in the seed rain; *Agrostis capillaris, Anthoxanthum odoratum, Hieracium pilosella, Nardus stricta, Potentilla erecta* and *Veronica officinalis* (Fig. 3.4). Species such as *Carex leporina, Carex pallescens, Carex pilosella, Euphrasia* sp., *Leontodon autumnalis, Luzula multiflora, Rumex acetosa, Rumex acetosella* and *Selaginella selaginoides* were relatively more common in the seed rain than in the vegetation. In contrast, species like *Achillea millefolium, Viola palustris, Trifolium repens, Alchemilla sp., Thalictrum alpinum* or *Salix herbacea* were more common in the vegetation.

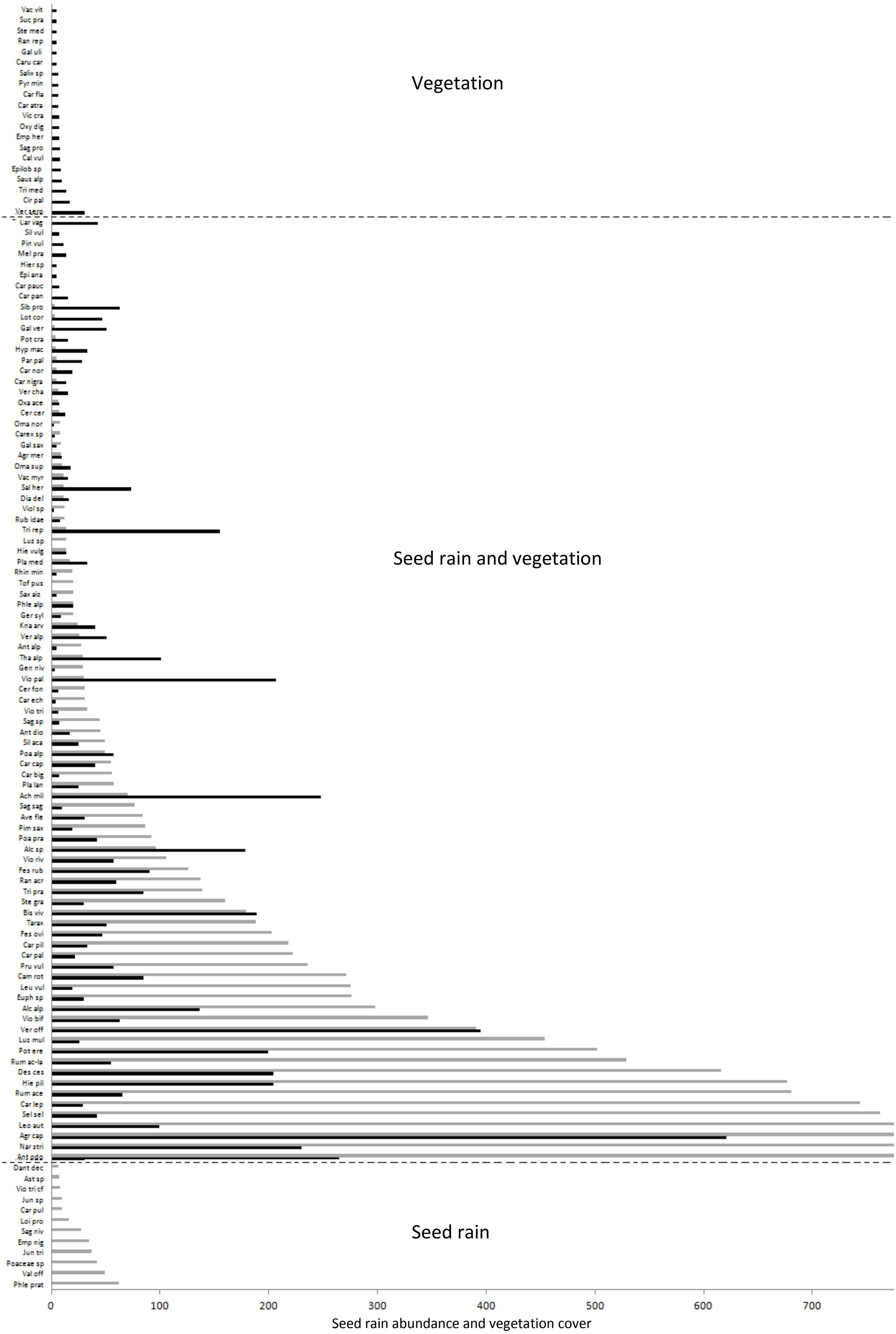


Fig. 3.4: Seed counts (grey) and plant cover (black) recorded in total. For species abbreviations, see Appendix VII. Species with less than 5 counts or 5 % cover were excluded from the graph; from seed rain: *Agr sp, Arr sp, Car dem, Cer sp, Gen ama, Gen cam, Gen sp, Gen ten, Pot tab, Ran sp, Sax niv, Sax ste, Vac sp, Vac uli*.; from vegetation: *Bot lun, Car sax, Cer alp, Cer gla, Fes viv, Gal bor, Gen pur cf, Gram sp, Gym dry, Hypo mac, Ran aur, Rho ros, Sal ret, Sorbus*; from both vegetation and seed rain: *Bet nan, Dac glo, Oma syl, Phyl caer, Sol vir, Thla arv, Ver fru*.

3.2.2 Comparison of richness, diversity and evenness between seed rain and vegetation (Question V)

Species richness, diversity and evenness followed overall the same pattern throughout sites and all three components yielded lower numbers in seed traps than found in the vegetation inventory (Fig. 3.5). Seed rain in alpine sites had the highest values of species richness, diversity and evenness. Evenness and Shannon-Weiner diversity index showed a subtle trend: increasing from lowland to alpine sites. Species richness, diversity and evenness in the vegetation varied greatly among sites.

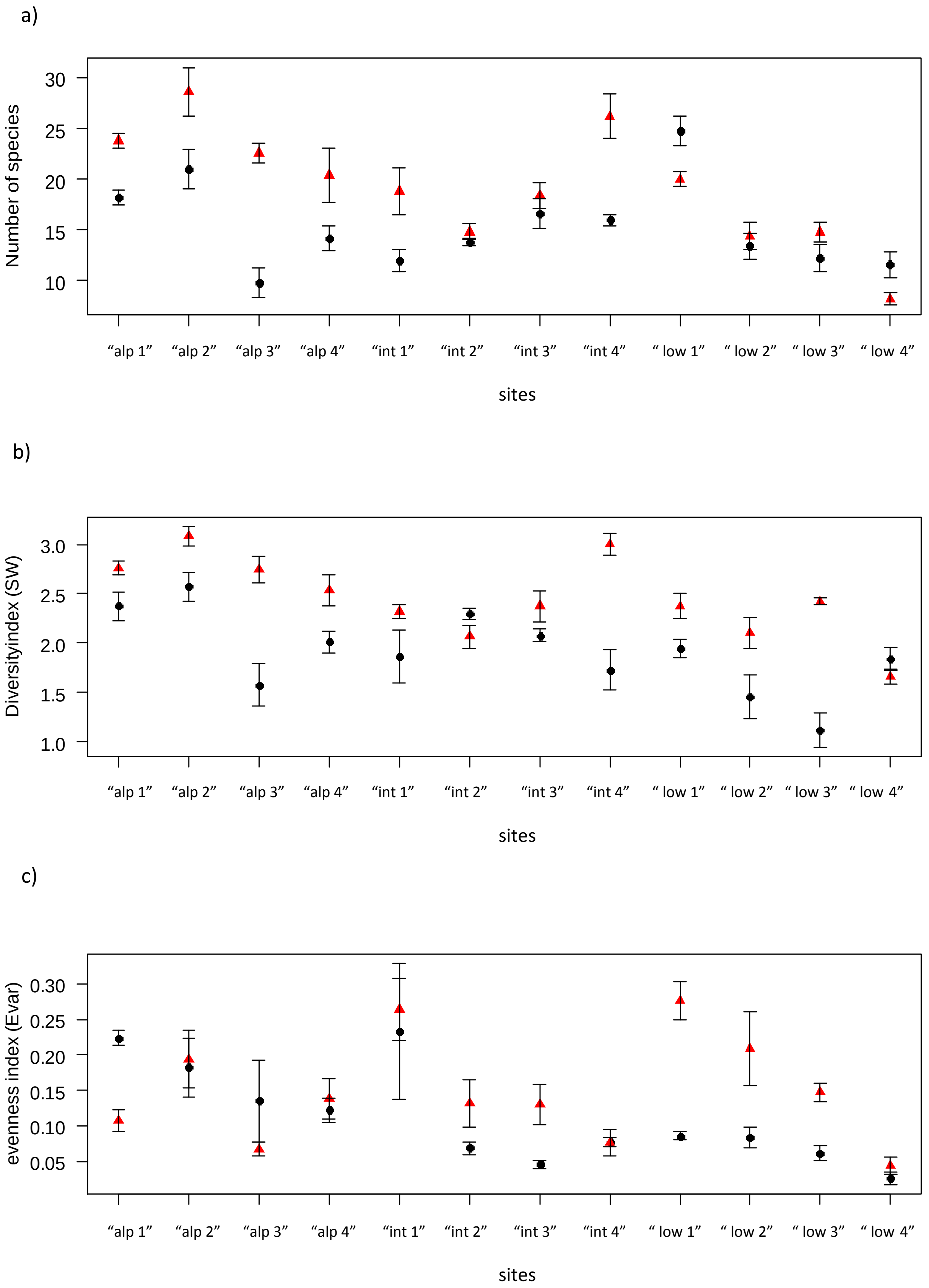


Fig. 3.5: a) Species richness, b)Shannon-Weiner Diversity index and c) Evenness “Evar index” for vegetation and seed rain within side community. Red triangles and black dots represent vegetation and seed rain means. Whiskers represent the standard error.

3.2.3 Effect of local vegetation and climatic variables on the seed rain (Question VI).

At species level, species abundance in the vegetation and temperature ($p<0.05$) best explained the variation in the total number seeds in the seed-rain (Table 3.5). Precipitation effect was negligible.

Vegetation abundance, temperature and precipitation did not influence seed abundance and species richness.

Table 3.5: Results from the glmmPQL model analyzing number of seeds per plot as a function of vegetation dominance, environmental factors and their interactions, providing parameter estimates values, their standard errors, degrees of freedom, t-value and p-value.

	value	**Std.Error**	**DF**	**t-value**	**P-value**
(Intercept)	0.0387	0.6190	1514	0.0626	0.9501
vegetation dominance	0.1235	0.0546	1514	2.2633	0.0238
Tetratherm temperature	0.2556	0.0691	10	3.7045	0.0041

3.3 Seed rain and dispersal distance

3.3.1 Dispersal distance and climate effects to seed rain (Question VII)

In every site, some seeds collected had no origin in the local vegetation. Accordingly, these seeds must have arrived from distances further away, and could potentially have arrived through processes of long-distance dispersal. Overall, the amount of seeds with their source location outside the block was lower than that which originated within the local vegetation. The contrast of this proportion of seeds between sites was not significant ($p = 0.417$). In the data analysis the fixed effects of dispersal source and temperature were significant ($p < 0.001$, $p < 0.05$). A two way interaction of temperature with dispersal source ($p < 0.05$) and a three-way interaction between all three variables ($p < 0.05$, Table 3.6) were also included into the model. Thus, dispersal from outside the local community is higher at lower temperatures in alpine sites and in the more oceanic regions, but this is only true for relatively cold-climate sites, as suggested by the negative three-way interaction between source, temperature and precipitation (Fig. 3.6).

Number of species of seeds that originated outside the local vegetation was found to be significantly different between sites ($p <0.001$). Overall, a significant effect of dispersal source on species richness has been tested (Table 3.6) but climatic effects were not found.

Table 3.6: Results from the glmmPQL analyzing number of seeds and seed species richness with seed source and climatic variables (inside=1; outside=2).

	value	Std.Error	DF	t-value	P-value
Number of seeds					
(Intercept)	3.6524	0.7900	105	4.6232	0
dispersal source (inside vs. outside)	-0.8258	0.0003	105	-4.4755	0
Tetratherm temperature	0.2606	0.1845	10	3.0302	0.0127
dispersal source:Precipitation	0.0005	0.0860	105	2.2459	0.0268
Dispersal source: Tetratherm temperature:Precipitation	$-6.3e^{-5}$	0.0003	105	-2.0997	0.0382
Species richness					
(Intercept)	2.2171	0.1043	107	21.2626	0
dispersal source	-0.1967	0.0576	107	-3.4102	9e-04

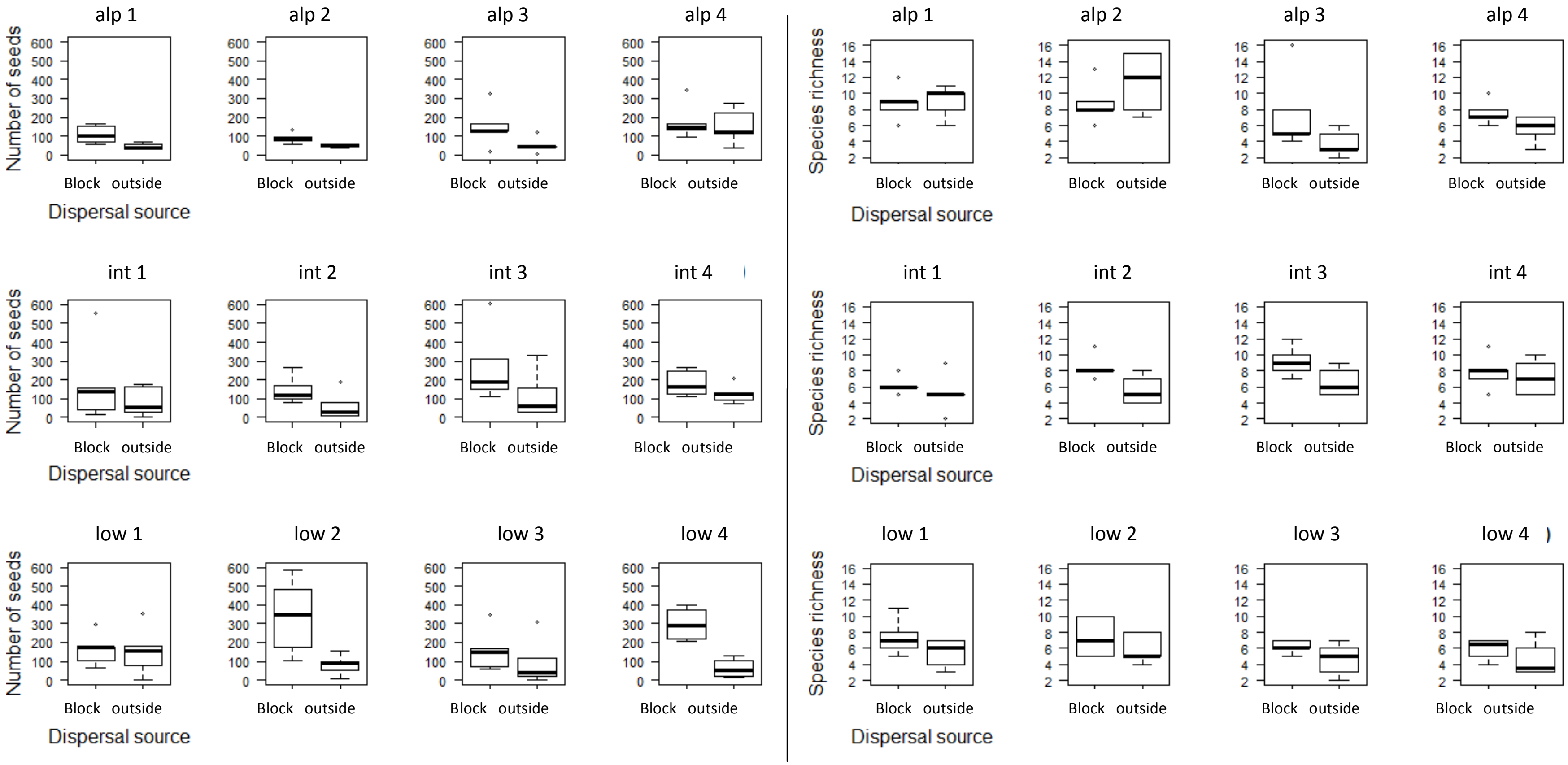


Fig. 3.6: Comparison of seed species recorded within the 5 blocks/site and species not recorded in the vegetation plots within blocks by site. **Left;** Seed number vs dispersal source. **Right**; Species richness vs dispersal source

4. Discussion

We recorded an annual seed rain of 4133 seeds m^{-2} among a total of 122 species across the sites. In comparison to other studies from alpine areas (e.g. Spence, 1990, Unbanska and Fattorini, 2000), these values are slightly above average. In one of the first studies of seed rain (Ryvarden, 1971) in Finse (Norway), 650 diaspores m^{-2} were recorded from 57 species during the favorable season. This difference can be explained by the fact that our study spread over different communities, only some of which were alpine. Vegetation composed mainly of forbs and grasses has been related to high seed rain deposition (Graae et al., 2011). The high abundance and species richness of seeds recorded in the present study may be the result of accurate seed identification, in addition to a great seed production during the study. Warm summers ensure successful pollination and good seed maturation that increase seed production while below average summer temperatures and rainy growing seasons reduce the seed set substantially. This results in a wide annual variation in seed production and deposition (Stöcklin and Bäumler, 1996, Cummins and Gordon, 2002, Molau and Larsson, 2000).

Summer is the high peak growing season and the time for sexual reproduction in boreal latitudes. It is therefore not surprising that our results, like previous studies (e.g. Ryvarden, 1971), show higher seed number and species diversity in seed rain collected in the summer in comparison to winter. In Norway, this period lasts from June to September when most of the plants take advantage of the good climatic conditions to produce flowers and spread their seeds. Urbanska and Fattorini (2000) recorded two peaks of seed rain density and diversity at high-altitudes in the Jacobshorn Mountain in Switzerland; 1) right after the first snowmelt and 2) in early autumn. Both these peaks would be included within the summer set of samples in our case. During the winter season, from September to June, plants remain reproductively inactive with a low rate of vegetative growth. Seeds trapped after September may be adapted to winter dispersal. However, more seeds from a higher number of species are shed in summer when sexual reproduction takes place trigged by propitious climatic conditions.

A strong correlation was found between the species composition of the seed rain and the plant community. Our results increase the evidence that seed rain reflects the floristic composition, as shown in a number of other studies (Urbanska and Fattorini, 2000, Molau and Larsson, 2000, Larsson and Molau, 2001, Stöcklin and Bäumler, 1996, Ryvarden, 1971, Hardesty and Parker, 2003). Thus, most of the seed rain belonged to local vegetation representing the seed shadow. The 40 species only found in vegetation were rare species, with 35 of the 40 species being recorded with less than

10 individuals (Fig. 3.4). Some of these plant species do not reproduce annually, but by vegetative strategies, like *Epilobium* or *Veronica* species.

Despite the high overall qualitative similarity between vegetation and seed rain in our system, a few species showed different dominance in the seed rain and in the standing vegetation. Thus we infer that some seeds have been dispersed from sites outside the homogeneous vegetation around the seed trap. Stöcklin (1996) provided evidence that species with highly efficient seed dispersal show longer dispersal distances, up to 100m in some cases. Examples of such species in our data include *Leontodon autumnalis,* a forb from the family Asteraceae with a pappus highly adapted to wind dispersal, or the genera *Rumex* whose fruits are 3-angled achenes inside papery flower parts. Dispersal by ants (myrmechory) may also explain long-distance dispersal in *Luzula multiflora*, *Viola* spp., in *Rumex* spp. and especially in *Carex* species which are very specialized to such mode of dispersal. Dispersal by ants in *Carex* has been shown to increase the seed dispersal distance from 0.4 m after falling from the parent plant to 1.4 m after being transported by ants (Kjellsson, 1985). A higher number of seeds produced by a plant may enhance the chance of being trapped. This may be the case for species like *Rumex acetosa* in which the number of fruits per shoot can vary from 0 to 1000 (Kleyer, 1995), and the high megaspore production in *Selaginella selaginoides*. Despite most of the dominant species in seed rain are also dominant in vegetation, overall it is feasible that seed input from longer distances and high seed production per plant may explain a high number of recorded seeds to low plant cover in the vegetation.

As shown by the strong correlation between vegetation and seed rain, the present study demostrates that seed dispersal is highly local. This results agrees with other available evidence (e.g. Urbanska and Fattorini (2000), Ryvarden (1971), Spence (1990), Stöcklin and Bäumler (1996)). Despite the fact that specific dispersal distances were not assessed we can conclude that 98% of the seeds (within 79% of the total seed-species recorded) were shortly dispersed from their origin in the local vegetation. Only 2% of the seeds are dispersed from beyond the local community. Likewise, Berge (2010), within the same study sites, estimated that 2.8% of seedlings were dispersed from distances exceeding 10m. The portion of the seed rain from species with no occurrence in the vegetation may be linked to long distance dispersal (LDD).

Adding evidence to the existence of LDD, seeds of *Betula pubescens* were recorded far from the limit of the forest. Birch seeds were present in all sites except one alpine site ("alp 1") but these data were excluded from the present analyses as forbs and graminoids were the main focus of research (Fig. 2.7). Together with pine (*Pinus sylvestris*) , *B. pubesens* constitutes the Norwegian tree-line (Birks and Bjune, 2010). A fast upwards movement of this ecotone during the last century has been recorded and this fact has been discussed as an effect of climate change (Grace et al., 2002). However, reduction in mountain grazing plays an important role. These findings are interesting as the presence of seeds in alpine plots located hundreds of meters away from the tree line may suggest that the upward shift of these woody species, accelerated during recent years, is not limited by seed dispersal.

4.1 Seed-rain responses to climate

Our results revealed high variation in seed rain quantity and richness under different climate conditions. Temperature appeared to have a large effect on seed rain density (Fig. 3.3) but not precipitation (Table 3.3). A less clear pattern was found in seed species richness along the temperature gradient (Fig. 3.3). Even though the seed rain substantially reflected the vegetation composition, long distance dispersal was recorded. The amount of seeds dispersed from beyond the vegetation plots was variable and was mainly at high altitudes and in oceanic areas. Dispersal distances are further at low temperatures and only observed at lower altitudes, in drier conditions (Table 3.6).

In agreement with my hypothesis and in concordance with previous studies (Cummins and Gordon, 2002, Molau and Larsson, 2000, Larsson, 2003), seed rain density increased with temperature. Temperature has been claimed to control seed production and maturation in boreal areas (Sarvas, 1957, Andersson, 1965, Zasada & Gregory, 1969, Simak, 1974) and therefore, the seed deposition. High correlation between temperature and biomass means higher vegetation biomass in warmer areas has been associated with higher seed rain density (Peart, 1989).

In contrast to the precipitation effect on seed bank and recruitment, results from this study suggests that precipitation does not control seed deposition (Table 3.3). Precipitation affects mostly plant germination and establishment. Furthermore, the high precipitation in Western Norway is probably not a limiting factor for seed production and deposition.

We tested that higher vegetation dominance from one specie lead to more seeds in the seed rain and that both increase with temperature. However, no correlation between vegetation and climatic variables and the species richness or abundance as the predictor factor at the community scale suggest that analyses at the community scale do not reflect species variability and hamper the possibility of modeling the relationship between seed rain and vegetation. The results were scale dependant. Correlation between seed rain, vegetation and climate variables is higher when zooming up from individual plots to the total abundance of species in the vegetation and seed rain in the entire dataset (Appendix IV).

A higher proportion of seeds were long-distance dispersed at lower temperatures (Table 3.6). Dispersal distance increases from wetter to drier conditions, but in warmer sites only. Increasing dispersal with decreasing temperature and decreasing precipitation might be better explained by other variables favoring dispersal in alpine communities. Wet conditions in the field and frequent rain showers may result in seeds falling straight under or very close to the parent plants preventing propagules from dispersing further away. In some cases, seed release occurs only in specific moisture conditions. For instance, in some Asteraceae like *Taraxacum*, the bracts around the inflorescence close up under high humidity and open when dry ensuring that the achenes are blown away by wind (Sheldon and Burrows, 1973). Also species like *Achillea* and *Trifolium,* adapted to dispersal of dried up of flowers, may show lower dispersal distances by wind in wet environments. On the other hand, Aparicio et al., (2008) found in dry, moisture limited Mediterranean landscapes that the number of species with potential long-distance dispersal tended to increase with greater precipitation. To my knowledge there is no evidence for precipitation influencing dispersal distances.

4.2 Patterns of seed rain in altitudinal gradients

Resource availability is variable along an altitude gradient thus influencing inter and intra-specific variability in plant size and seed production. At high altitudes, while plants may flower, the numbers of viable seeds per capsule approaches zero in some years. Our findings of lower seed densities with increasing altitude (Fig. 3.3) might be due to reduced seed production (Cummins and Gordon, 2002). Adaptations in alpine habitats such as vegetative reproduction strategies and perennial habit may also explain lower seed deposition in these plots. In lowland and warmer sites, where plants are not exposed to climatic stress and resources are abundant, greater seed production occurs.

Altitude plays an important role in regulating species richness patterns (Grytnes, 2003, Shimono et al., 2010). Similarly, species richness of the seed rain was highly variable between sites and generally increased with altitude (Fig. 3.3). It has been tested that at high altitudes vegetation is more species-diverse than in lowlands which is reflected in seed rain patterns. We could not, however, find a clear relationship between seed-rain species richness and altitude, although a greater number of species was usually found in the alpine sites (Fig 3.5). Grytnes (2003) found that vascular plant species richness decreases with altitude in Norway (Grytnes, 2003). Thus it is not clear if there are any common patterns of species richness and altitude as the records depend on plot size. Alpine species are smaller, so that we find more species in small areas like our 25x25cm plots.

The complex interaction of environmental factors at different altitudes leads to variation of habitat types, plant communities, and population ranges. Seed species associated to alpine, intermediate and lowlands altitudinal ranges in our study reflect the different flora composition at different altitudes. A high number of seeds from alpine-specialist species, such as *Carex bigelowii*, *Empetrum nigrum*, *Selaginella selaginoides*, *Silene acaulis, Veronica alpina, Viola biflor*a, etc. were associated with alpine sites. In contrast, a larger number of species were present through both lowland and intermediate communities and belong to a range of generalist species, not restricted to specific climate conditions. Our results (Table 3.4) show that seed rain reflects altitudinal patterns in species diversity (Cummins and Gordon, 2002).

Different composition of species defined by different structure and architecture attributes (traits) along altitude gradients may also explain the patterns followed by vegetation and seed rain. Although vegetation appears, overall, species richer, more diverse and even than the seed rain, values of species richness, diversity, and evenness between vegetation and seed rain nearly always followed the same pattern; sites richer in seed species were also the richer in plants (Fig 3.5). This fact attests to their strong link. However, a large number of small species in alpine sites may lead to a wider disparity of species richness between seed rain and vegetation at high altitude in contrast to low altitudes. Recent experiments with synthetic communities found that plant diversity increased with seed rain density (Mouquet et al., 2004). However, the present non-manipulative approach along environmental gradients shows that the opposite pattern occurs in intact communities. Moreover, higher seed-rain evenness of seed species was found at high altitudes decreasing toward the lowlands while vegetation shows a more stochastic distribution (Fig. 3.5) (see Appendix III). The higher evenness in seed rain at alpine sites and greater similarity to vegetation values, suggests that better movement of propagules in space at high altitudes leads to a better representation of the species composition by the seed rain .

4.3 Seed rain and dispersal distances

The seed-rain response to climate and altitude found in this study may be partially influenced by dispersal distances. Long distance dispersal (LDD) has been considered to be “chance dispersal” (Nathan, 2008, Stöcklin and Bäumler, 1996). Dispersal success is related to a great assortment of morphologies and appendages in seeds and fruits specially designed to aid dispersal and selected to optimize a special dispersal strategy to specific vectors (Cousens et al., 2008, Pijl, 1982). The parallel evolution of different propagule morphologies and dispersal vectors (McKey, 1975) is a result of the high effectiveness of dispersal strategies in specific environments (Pijl, 1982, Loiselle et al., 1996). Wind is one of the most important vectors related to LDD and it has been suggested that strong winds and wind updrafts, for example from fjords up the steep valley sides, provide a key mechanism for LDD of seeds (Nathan, 2008, Cousens et al., 2008). Indeed, many aerodynamic features in seeds decrease the drag or lift coefficients and facilitate wind dispersal. Despite the fact that the association with a propagule-vector is not a straight forward issue (Cousens et al., 2008, Tackenberg et al., 2003), some characteristics may explain the presence of some seeds in seed traps supposedly long dispersed. For instance, seeds of *Valeriana officinalis* are small and light with pappuses. Some other plants have evolved tiny seeds, often containing air pockets, to adapt to wind dispersal. This trait decreases the ratio of seed mass to area thus increasing drag and decreasing rate of fall (Cousens et al., 2008). It has been assumed that there is a trade-off between dispersal capacity and seed size (Greene and Johnson, 1993, Howe and Westley, 2009). In our study this may be the case for producers of small seeds, especially those typical of the alpine zone like *Sagina nivalis* ("alp 1"), *Loiseleuria procumbens* ("alp 1 and 2"), *Gentianella amarella* ("alp 1 and 3"), *Gentianella tenella* ("alp 3"), *Gentiana campestris* ("alp 1"), *Saxifraga nivalis* ("alp 1"), and *Saxifraga stellaris* ("alp 2"). Winds are stronger at high altitudes on mountain tops or where there are gaps in the landscape for the air to funnel through such as along narrow fjords. Van der Pijl (1982) observed fewer aerodynamic traits in understory species than in emergent species in forest, suggesting that adaptations for wind dispersal are more frequent in habitats easily exposed to the effects of wind. Other species like *Empetrum nigrum* and *Vaccinium uliginosum* have fleshy fruits (crowberry and bog blueberry respectively). They are mainly dispersed by birds, which may explain their presence in plots after being dispersed long distances. But LDD events, subjected to high stochasticity, cannot always be explained through the relation between seed dispersal traits and a vector. For instance, Molau and Larsson (2000) found that *Viola biflora* seeds, with no adaptations for long-distance dispersal, dispersed 400m from the upper distributional limit of the species in their area. Similar results were found by Ryvarden (1971). Thus, many species without an obvious adaptation have the potential to be long-distance dispersed.

Other factors besides LDD, like identification problems, may explain the non-matching record from seed samples and vegetation plots. Due to difficult identification, ten seed-species only recorded in the seed rain were identified only to family or genera (*Poaceae* sp., Asteraceae sp., or *Juncus* sp., *Ranunculus* sp., etc.). These probably do belong to species present in the vegetation survey. On the other hand, some species of sedges like *Juncus trifidus, Carex pulicaris, Carex demissa* or grasses like

Danthonia decumbens may have been overlooked during the vegetation survey. In this case, another analysis of the plot vegetation during the flowering season may provide a better record of the species present.

Most of the research based on LDD focuses on the quantification of LDD events and few try to assess patterns, causes and drivers of such rare events. At the spatial scale of our study, data show that the number of seeds found in plots was strongly dependent on the distance from the source and was affected by temperature (Table 3.6, Fig 3.6). A higher proportion of seeds were dispersed from long distances in alpine sites (Fig 3.6). Whether or not long-distance dispersal is more frequent in the alpine sites is still under debate. However, events like snow melting or high wind exposure or local topography may explain occurrences. For instance, the special location of the alpine site “alp2” (Låvisdalen) (Fig. 3.6), might be explained by seed transportation by wind updrafts from the fjord below. Alternatively, high seed production, seed dispersal by other vectors, and different environmental conditions may explain the association of higher seed deposition and shorter dispersal in lowland communities.

Attributes and structure of the mother plant also determine dispersal patterns and limitations (Ozinga et al., 2004). Empirical studies have related basic plant traits like plant height or seed production to LDD (Stöcklin and Bäumler, 1996, Thomson et al., 2011). Ecologists have recently started to quantify the link between plant traits and dispersal distances (Ozinga et al., 2004). A clear traits distribution pattern through communities along environmental gradients is evident in all landscapes in the world. Such non-random distribution of dispersal traits appears to be clearly determined by the environmental context (Ozinga et al., 2004). Trait variation has been suggested to alter ecological dynamics (Bolnick et al., 2011) and trait-based responses at the community scale have been proposed as predictors of community dynamics experiencing climate change (Suding et al., 2008, Diaz and Cabido, 1997). Thus if plant dispersal traits in and beyond the investigated sites were recorded, they might contribute to the understanding of the complex link between community traits and dispersal limitations with climate.

4.4 Method limitations

The observed species composition of the seed-rain in this study may partly be an artifact of the chosen methodology. Traps are a convenient and effective method to sample plant community seed rain, although different trap types are appropriate for different environments and vegetation types (Cummins and Gordon, 2002, Stöcklin and Bäumler, 1996, Ryvarden, 1971, Urbanska, 2000,etc.). The present study follows Molau and Larsson (2000) with plastic AstroTurf traps that are appropriate for alpine grasslands, in part because they accommodate a wide range of seed sizes including *Selaginella* macrospores and tiny seeds like *Loiseleuria* and *Phyllodoce*. Conversely, the design of open traps (mats) allows for removal of seeds by wind, rain, ants, mites, or other animals. Fruit and seed loss experiments were assessed by Hardesty (2002). The results showed minimal loss of seeds from traps in a tropical forest study in Cameroon. However, in boreal areas further empirical evidence of trapping efficiencies is needed. Ryvarden (1971) discusses the possibility that different traps are more selective towards some types of diaspores than others depending on different dispersal strategies. For instance, the considerable number of seeds dispersed by animals (zoochores) will be rarely trapped by plastic doormats and will probably be under-represented in the samples. Similarly, Stöcklin and Bäumler (1996) showed that more seeds were trapped that were adapted for wind dispersal.

The reported trap sizes vary considerably according to the studied vegetation type and habitat, ranging from 11.5 cm diameter traps used in a ski run at 2 500 m altitude in Switzerland (Urbanska and Fattorini, 2000) to 0.5 m^2 seed traps used in a West-African tropical forest (Hardesty and Parker, 2003). In comparison with similar habitat studies, the size of 0.25x0.25 m traps is below average (doormats of 0.25 m^2 (Molau and Larsson, 2000, Larsson, 2003), 0.4 m^2 (Birks and Bjune, 2010). However, the, small trap size is offset by having five replicates in each investigated site. Some species produce only a small amount of seeds that are difficult to trap. Thus, an increase of trapping area might have improved the quantification of the seed rain. A minimum of ten traps is recommended and Larsson (2003) suggested that the ideal total trap size may be larger than 2 m^2. However, the processing of doormats is highly time consuming and the study was time limited. Furthermore, the aim of the present study focuses on the seed rain itself within different environmental conditions more than assessing all the dispersing species in an area. More work is needed regarding trap size and number, especially in assessing alpine and arctic seed rain.

Highly variable growing season conditions among years cause variations in annual seed rain (Chambers, 1995). In particular, annual fluctuations in seed rain abundance of herbs and graminoids among other functional types have been linked to summer temperatures (Molau and Larsson, 2000). This variation cannot be detected when extracting conclusions from a one-year long study. However, it is important to emphasize the fact that the present study provides seed rain data over one whole sampled year unlike most of the previous assessments where only the summer season was sampled. A second year or more of monitoring is highly recommended to obtain greater knowledge about the seed rain under different climatic conditions and to provide a better basis for predicting seed dispersal responses to future climate change.

In this study, dispersal distances were assessed by simply splitting the seed set into two sub groups: present or absent in the surrounding vegetation (Fig 3.6). The association between seed source and dispersal distance gives a broad overview and not a quantitative estimate of dispersal distances. Consequently, conclusions concerning whether some seeds are long-distance dispersed are a matter of discussion. More precise estimates of dispersal distances could have been obtained by surveying the vegetation at different distance radii from the treatments but the estimates would still be hypothetical. The only way to know for sure is to track individual seeds or to use genetic methods. LDD events are very difficult to measure and model, although, recent studies have explored a range of new methods to provide better data about LDD (Cain et al., 2000).

4.5 Summary discussion and predictive scenarios

The alpine flora is highly sensitive to impacts of climate change (Parmesan, 2006). The seed rain may make an important contribution in the mediation of the anticipated changes in range margins. Our results suggest that a future increase of temperature will work against alpine plant communities whose lower seed deposition may lead to dispersal limitation, even though long-distance dispersal is more important in alpine habitats. In addition, a large persistent seed bank at all altitudes and the accumulation of well suited seeds in the soil may partly counteract this effect (Cummins and Gordon, 2002).

A warmer climate favors increased seed quantity which may in turn be important for plant migration capacity, in the same way as hypothesized for seed quality (Graae et al., 2009). Assuming seed rain abundance is not limiting dispersal and colonization ability; our results suggest that plants may be able to move fast enough to find the conditions they are best suited for in the forecast climate-induced changes in habitat distribution. Predicted upwards movement of lowland species will threaten alpine communities. However, the chance of these seeds of germinating and succeeding in a new environment is also dependent on other abiotic factors like wind exposure, organic matter and soil moisture (Stöcklin and Bäumler, 1996, Cummins and Gordon, 2002).

Precipitation has been predicted as a limiting factor for seedling recruitment and establishment (Berge, 2010) and years with higher rainfall may be related to higher seed production (Klinkhamer, 2011). However, in this study, precipitation did not affect species diversity.

This study emphasizes the importance of local vegetation as the dominant seed source. It suggests that the species dominance in vegetation and temperature both affect seed rain at the species scale and at the scale of this study. These results emphasize the pivotal role of the seed rain in maintaining vegetation community composition, thus contributing to the adult vegetation structure. However, the seed dispersal cycle from seed rain deposition to adult plant composition consists of a complex succession of processes subjected to many variables. Our focus has been put on only one step, the seed rain. Therefore, approaches to enhance the understanding of all the steps might bring us closer to reaching the goal of linking seed dispersal and adult vegetation structure.

With regard to dispersal distance, although most of the seeds fall very close to mother plant, this study adds to the evidence that LDD occurs. This provides the potential for plants to move above their limit of occurrence and links to potential redistribution of species. The results imply that the long-distance dispersed portion of the community seed rain varies with climate through different communities. As a consequence, the chance of long-distance dispersal happening will probably change with a warmer and wetter predicted future climate.

5. Conclusions

I have shown that seed rain composition and density vary across different environments and seasons, reflecting climate constraints on seed dispersal in plant communities. When zooming in on individual species in the study system, vegetation and seed rain appear highly correlated and affected by temperature. This is an expression of species´ adaptive variability in space and time and highlights the importance of considering individual species when studying seed dispersal patterns at community level.

Mean summer temperature appears to be the most important factor limiting seed rain density through the grid. It interacts with precipitation to limit dispersal distances associated with long distance dispersal between communities, especially in drier climates. Thus climate variables affect dispersal which then regulates local community dynamics in addition to many factors related to altitude that affect species richness, composition, and dispersal success.

My results add to the evidence that seed rain almost completely reflects the vegetation composition. In fact, seed dispersal appears to be extremely local. Seed rain constitutes a very important stage within the dispersal loop, making a strong contribution to maintenance of the community composition. I conclude therefore that dispersal of different species is affected by environmental factors which are therefore contributing to restriction of species distribution ranges through the landscape.

However, 2% of the seed rain has been linked to long distance dispersal events (LDD). Despite representing a small proportion of seeds, dispersal distances appeared to influence seed rain abundance and composition to a different degree in different communities. This not only provides compelling evidence that LDD events do occur, but also their importance in determining community dynamics and the potential for species to change their distribution limits in a changing climate.

According to my results, climate seems to play a role in seed rain variability, affecting dispersal processes. However, this is a short term one-year study. I outline the importance of long-term approaches to provide more comprehensive data for understanding seed dispersal. This is necessary for any attempt to predict dispersal implications in a changing climate.

6. References

APARICIO, A., ALBALADEJO, R. G., OLALLA-TARRAGA, M. A., CARRILLO, L. F. & RODRIGUEZ, M. A. 2008. Dispersal potentials determine responses of woody plant species richness to environmental factors in fragmented Mediterranean landscapes. *Forest Ecology and Management,* 255**,** 2894-2906.

BERGE, A. 2010. *Seedbank, Seedrain and Seedling Recruitment along Climate Gradients in Southern Norway.* Master of Science Thesis, Dept. of Biology, University of Bergen.

BIRKS, H. H. 2007. Plant macrofossils in palaeocology-an overview. *In:* S.A. Elias (ed.) *Encyclopedia of Quaternary Science.* Amsterdam: Elsevier.

BIRKS, H. H. & BJUNE, A. E. 2010. Can we detect a west Norwegian tree line from modern samples of plant remains and pollen? Results from the DOORMAT project. *Vegetation History and Archaeobotany,* 19**,** 325-340.

BIRKS, H. J. B. & WILLIS, K. J. 2008. Alpines, trees, and refugia in Europe. *Plant Ecology & Diversity,* 1**,** 147-160.

BOLNICK, D. I., AMARASEKARE, P., ARAUJO, M. S., BURGER, R., LEVINE, J. M., NOVAK, M., RUDOLF, V. H., SCHREIBER, S. J., URBAN, M. C. & VASSEUR, D. A. 2011. Why intraspecific trait variation matters in community ecology. *Trends Ecol Evol,* 26**,** 183-92.

BULLOCK, J. M., KENWARD, R. E. & HAILS, R. S. 2002. *Dispersal Ecology.Cambridge University Press*.

CAIN, M. L., MILLIGAN, B. G. & STRAND, A. E. 2000. Long-distance seed dispersal in plant populations. *American Journal of Botany,* 87**,** 1217-1227.

CLARK, J. S., FASTIE, C., HURTT, G., JACKSON, S. T., JOHNSON, C., KING, G. A., LEWIS, M., JASON, L., PACALA, S., PRENTICE, C., SCHUPP, E. W., THOMPSON WEBB, III & WYCKOFF, P. 1998. Reid's Paradox of Rapid Plant Migration. *BioScience,* 48**,** 13-24.

CLARK, J. S., LADEAU, S. & IBANEZ, I. 2004. Fecundity of trees and the colonization-competition hypothesis. *Ecological Monographs,* 74**,** 415-442.

CLOBERT, J., DANCHIN, E., DHONDT, A. & NICHOLS, J. D. 2001. *Dispersal,* Oxford University Press.

COOK, L. G. & CRISP, M. D. 2005. Directional asymmetry of long-distance dispersal and colonization could mislead reconstructions of biogeography. *Journal of Biogeography,* 32**,** 741-754.

COUSENS, R., DYTHAM, C. & LAW, R. 2008. *Dispersal in plants: a population perspective,* Oxford University Press.

CUMMINS, R. P. & GORDON, R. M. 2002. Altitudinal gradients in seed dynamics of Calluna vulgaris in eastern Scotland. *Journal of Vegetation Science,* 13**,** 859-866.

CHAMBERS, J. C. 1995. Disturbance, Life history strategies, and seed fates in alpine herbfield communities. *American Journal of Botany,* 82**,** 421-433.

DAVIS, M. B. & SHAW, R. G. 2001. Range shifts and adaptive responses to Quaternary climate change. *Science,* 292**,** 673-679.

DE CÁCERES, M., LEGENDRE, P. & MORETTI, M. 2010. Improving indicator species analysis by combining groups of sites. *Oikos,* 119**,** 1674-1684.

DIAZ, S. & CABIDO, M. 1997. Plant functional types and ecosystem function in relation to global change. *Journal of Vegetation Science,* 8**,** 463-474.

DIGGLE, P. J., HEAGERTY, P., LIANG, K. & ZEGER, S. L., 2002. Analyses of longitudinal data. Oxford University Press.

DULLINGER, S., DIRNBOCK, T. & GRABHERR, G. 2004. Modelling climate change-driven treeline shifts: relative effects of temperature increase, dispersal and invasibility. *Journal of Ecology,* 92**,** 241-252.

EHRLEN, J. 1996. Spatiotemporal variation in predispersal seed predation intensity. *Oecologia,* 108**,** 708-713.

ENGEN-SKAUGEN, T., HAUGEN, J. & TVEITO, O. 2007. Temperature scenarios for Norway: from regional to local scale. *Climate Dynamics,* 29**,** 441-453.

ENGLER, R. & GUISAN, A. 2009. MIGCLIM: Predicting plant distribution and dispersal in a changing climate. *Diversity and Distributions,* 15**,** 590-601.

ENGLER, R., RANDIN, C. F., VITTOZ, P., CZÁKA, T., BENISTON, M., ZIMMERMANN, N. E. & GUISAN, A. 2009. Predicting future distributions of mountain plants under climate change: does dispersal capacity matter? *Ecography,* 32**,** 34-45.

ENNOS, R. A. 1994. Estimating the relative rates of pollen and seed migration among plant populations. *Heredity,* 72**,** 250-259.

EREFUR, C., BERGSTEN, U. & DE CHANTAL, M. 2008. Establishment of direct seeded seedlings of Norway spruce and Scots pine: Effects of stand conditions, orientation and distance with respect to shelter tree, and fertilisation. *Forest Ecology and Management,* 255**,** 1186-1195.

FENNER, M. & THOMPSON, K. 2005. The Ecology of seeds. Cambridge University Press.

GIVNISH, T. J. & RENNER, S. S. 2004. Tropical intercontinental disjunctions: Gondwana breakup, immigration from the boreotropics, and transoceanic dispersal. *International Journal of Plant Sciences,* 165**,** S1-S6.

GRAAE, B., EJRNÆS, R., LANG, S., MEINERI, E., IBARRA, P. & BRUUN, H. 2011. Strong microsite control of seedling recruitment in tundra. *Oecologia,* 166**,** 565-576.

GRAAE, B. J., VERHEYEN, K., KOLB, A., VAN DER VEKEN, S., HEINKEN, T., CHABRERIE, O., DIEKMANN, M., VALTINAT, K., ZINDEL, R., KARLSSON, E., STROM, L., DECOCQ, G., HERMY, M. & BASKIN, C. C. 2009. Germination requirements and seed mass of slow- and fast-colonizing temperate forest herbs along a latitudinal gradient. *Ecoscience,* 16**,** 248-257.

GRACE, J., BERNINGER, F. & NAGY, L. 2002. Impacts of climate change on the tree line. *Annals of Botany,* 90**,** 537-544.

GREENE, D. F. & JOHNSON, E. A. 1993. Seed mass and dispersal capacity in wind-dispersed diaspores. *Oikos,* 67**,** 69-74.

GRYTNES, J. A. 2003. Species-richness patterns of vascular plants along seven altitudinal transects in Norway. *Ecography,* 26**,** 291-300.

GUISAN, A. & THUILLER, W. 2005. Predicting species distribution: offering more than simple habitat models. *Ecology Letters,* 8**,** 993-1009.

HANSSEN-BAUER, I., FØRLAND, E. J., HAUGEN, J. E. & TVEITO, O. E. 2003. Temperature and precipitation scenarios for Norway: Comparison of results from dynamical and empirical downscaling. . *Climate Research,* 25**,** 10-27.

HARDESTY, B. D. & PARKER, V. T. 2003. Community seed rain patterns and a comparison to adult community structure in a West African tropical forest. *Plant Ecology,* 164**,** 49-64.

HERRERA, C. M. 1998. Population-level estimates of interannual variability in seed production: what do they actually tell us? *Oikos,* 82**,** 612-616.

HOFGAARD, A. 1993. Seed rain quantity and quality, 1984–1992, in a high altitude old-growth spruce forest, northern Sweden. *New Phytologist,* 125**,** 635-640.

HOLT, R. D. 2003. On the evolutionary ecology of species' ranges. *Evolutionary Ecology Research,* 5**,** 159-178.

HOULE, G. 1998. Seed dispersal and seedling recruitment of Betula alleghaniensis: Spatial inconsistency in time. *Ecology,* 79**,** 807-818.

HOWE, H. F. & WESTLEY, L. C. 2009. Ecology of Pollination and Seed Dispersal. *Plant Ecology.* Blackwell Publishing Ltd.

HU, F. S., HAMPE, A. & PETIT, R. J. 2009. Paleoecology meets genetics: deciphering past vegetational dynamics. *Frontiers in Ecology and the Environment,* 7**,** 371-379.

HUBBELL, S. P., FOSTER, R. B., O'BRIEN, S. T., HARMS, K. E., CONDIT, R., WECHSLER, B., WRIGHT, S. J. & DE LAO, S. L. 1999. Light-gap disturbances, recruitment limitation, and tree diversity in a neotropical forest. *Science,* 283**,** 554-557.

HUNTLEY, B. & WEBB, T. III 1989. Migration: Species' response to climatic variations caused by changes in the earth's orbit. *Journal of Biogeography,* 16**,** 5-19.

IBANEZ, I., CLARK, J. S., DIETZE, M. C., FEELEY, K., HERSH, M., LADEAU, S., McBRIDE, A., WELCH, N. E. & WOLOSIN, M. S. 2006. Predicting biodiversity change: Outside the climate envelope, beyond the species-area curve. *Ecology,* 87**,** 1896-1906.

IPCC 2007. Climate change 2007: the physical science basis. Contribution of Working Group I to the Fourth Assessment. Report of the Intergovernamental Panel on Climate Change. Cambridge University Press.

JÄGERBRAND, A. 2007. A new method for assessing dispersal and colonization of bryophytes. *Journal of Bryology,* 29**,** 133-134.

JUMP, A. S. & PEÑUELAS, J. 2005. Running to stand still: adaptation and the response of plants to rapid climate change. *Ecology Letters,* 8**,** 1010-1020.

KIRILENKO, A. P., BELOTELOV, N. V. & BOGATYREV, B. G. 2000. Global model of vegetation migration: incorporation of climatic variability. *Ecological Modelling,* 132**,** 125-133.

KJELLSSON, G. 1985. Seed fate in a population of Carex pilulifera L. *Oecologia,* 67**,** 416-423.

KLEYER, M. 1995. Biological traits of vascular plants. A database. *Arbeitsberichte Inst. f. Landschaftsplanung u. Ökologie Univ.* Stuttgart, N.F.

JONG, T. J. & KLINKHAMER, P. G. L. 1989. Limiting factors for seed production in *Cynoglossum officinale*. *Oecologia,* 80**,** 167-172.

KOKKO, H. & LOPEZ-SEPULCRE, A. 2006. From individual dispersal to species ranges: Perspectives for a changing world. *Science,* 313**,** 789-791.

LARSSON, E.-L. 2003. Two ways of trapping seeds in alpine environments, Lapland, Sweden. *Nordic Journal of Botany,* 23**,** 333-343.

LARSSON, E.-L. & MOLAU, U. 2001. Snowbeds trapping seed rain—a comparison of methods. *Nordic Journal of Botany,* 21**,** 385-392.

LEVIN, S. A., MULLER-LANDAU, H. C., NATHAN, R. & CHAVE, J. 2003. The ecology and evolution of seed dispersal: A theoretical perspective. *Annual Review of Ecology Evolution and Systematics,* 34**,** 575-604.

LINARES-PALOMINO, R. & KESSLER, M. 2009. The role of dispersal ability, climate and spatial separation in shaping biogeographical patterns of phylogenetically distant plant groups in seasonally dry Andean forests of Bolivia. *Journal of Biogeography,* 36**,** 280-290.

LOISELLE, B. A., RIBBENS, E. & VARGAS, O. 1996. Spatial and temporal variation of seed rain in a tropical lowland wet forest. *Biotropica,* 28**,** 82-95.

McKEY, D. 1975. The ecology of coevolved seed dispersal systems. In: *Coevolution of Animals and Plants*. University of Texas Press**,** 159-191.

MET.NO 2009. Dette Norsk meteorologisk Institutt. [Internet] Acccessible from: <http://met.no/>.

MOLAU, U. & LARSSON, E. L. 2000. Seed rain and seed bank along an alpine altitudinal gradient in Swedish Lapland. *Canadian Journal of Botany,* 78**,** 728-747.

MOUQUET, N., LEADLEY, P., MERIGUET, J. & LOREAU, M. 2004. Immigration and local competition in herbaceous plant communities: a three-year seed-sowing experiment. *Oikos,* 104**,** 77-90.

MULLER-LANDAU, H. C. 2003. Seeds of understanding of plant diversity. *Proceedings of the National Academy of Sciences of the United States of America,* 100**,** 1469-1471.

MYERS, J. A. & HARMS, K. E. 2009. Seed arrival, ecological filters, and plant species richness: a meta-analysis. *Ecology Letters,* 12**,** 1250-1260.

NATHAN, R. 2006. Long-Distance Dispersal of Plants. *Science,* 313**,** 786-788.

NATHAN, R. & MULLER-LANDAU, H. C. 2000. Spatial patterns of seed dispersal, their determinants and consequences for recruitment. *Trends Ecol Evol,* 15**,** 278-285.

NATHAN, R., SAFRIEL, U. N., NOY-MEIR, I. & SCHILLER, G. 2000. Spatiotemporal variation in seed dispersal and recruitment near and far from Pinus halepensis trees. *Ecology,* 81**,** 2156-2169.

NGU 2009. Norges Geologiske Undersøkelse. *NGU (2009) Norges Geologiske Undersøkelse.* [Internet] Accessible from: <http://www.ngu.no/kart/bg250/>.

OVERPECK, J. T., BARTLEIN, P. J. & WEBB, T. 1991. Potential magnitude of future vegetation change in Eastern North America: Comparisons with the past. *Science,* 254**,** 692-695.

OZINGA, W. A., BEKKER, R. M., SCHAMINÉE, J. H. J. & VAN GROENENDAEL, J. M. 2004. Dispersal potential in plant communities depends on environmental conditions. *Journal of Ecology,* 92**,** 767-777.

PARMESAN, C. 2006. Ecological and Evolutionary Responses to Recent Climate Change. *Annual Review of Ecology, Evolution, and Systematics,* 37**,** 637-669.

PEART, D. R. 1989. Species interactions in a successional grassland .1. Seed rain and seedling recruitment. *Journal of Ecology,* 77**,** 236-251.

PEET, R. K. 1974. The Measurement of Ssecies diversity. *Annual Review of Ecology and Systematics,* 5**,** 285-307.

PIJL, L. VAN DER. 1982. *Principles of dispersal in higher plants,* Berlin; New York, Springer-Verlag.

PITELKA, L. F., GARDNER, R. H., ASH, J., BERRY, S., GITAY, H., NOBLE, I. R., SAUNDERS, A., BRADSHAW, R. H. W., BRUBAKER, L., CLARK, J. S., DAVIS, M. B., SUGITA, S., DYER, J. M., HENGEVELD, R., HOPE, G., HUNTLEY, B., KING, G. A., LAVOREL, S., MACK, R. N., MALANSON, G. P., McGLONE, M., PRENTICE, I. C. & REJMANEK, M. 1997. Plant migration and climate change. *American Scientist,* 85**,** 464-473.

RYVARDEN, L. 1971. Studies in seed dispersal I. Trapping of diaspores in the alpine zone at Finse, Norway. *Norwegian Journal of Botany,* 18**,** 215-226.

SALISBURY, E. 1942. *The reproductive capacity of Plants,* London: G. Bell.

SCHUPP, E. W. & FUENTES, M. 1995. Spatial patterns of seed dispersal and the unification of plant-population ecology. *Ecoscience,* 2**,** 267-275.

SHELDON, J. C. & BURROWS, F. M. 1973. The dispersal effectiveness of the achene-pappus units of selected compositae in steady winds with convection. *New Phytologist,* 72**,** 665-675.

SHEN, Z.-H., TANG, Y.-Y., LÜ, N., ZHAO, J., LI, D.-X. & WANG, G.-F. 2007. Community Dynamics of Seed Rain in Mixed Evergreen Broad-leaved and Deciduous Forests in a Subtropical Mountain of Central Not Capitals China. *Journal of Integrative Plant Biology,* 49**,** 1294-1303.

SHIMONO, A., ZHOU, H., SHEN, H., HIROTA, M., OHTSUKA, T. & TANG, Y. 2010. Patterns of plant diversity at high altitudes on the Qinghai-Tibetan Plateau. *Journal of Plant Ecology,* 3**,** 1-7.

SKARPAAS, O., MEINERI, E., BARGMANN, T., PÖTSCH, C., SPINDELBÖCK, J. & VANDVIK, V. 2012. Allometric ontogenetic and optimal biomass partitioning in plant responses to climate. *Unpublished manuscript*.

SMITH, B. & WILSON, J. B. 1996. A consumer's guide to evenness indices. *Oikos,* 76**,** 70-82.

SMITH, G. M., IENO, E. N., SAVELIEV, A. A., WALKER, N. & ZUUR, A. F. 2009. *Mixed effects models and extensions in ecology with R,* Springer-Verlag, New York.

STÖCKLIN, J. & BÄUMLER, E. 1996. Seed rain, seedling establishment and clonal growth strategies on a glacier foreland. *Journal of Vegetation Science,* 7**,** 45-56.

SUDING, K. N., LAVOREL, S., CHAPIN, F. S., CORNELISSEN, J. H. C., DÍAZ, S., GARNIER, E., GOLDBERG, D., HOOPER, D. U., JACKSON, S. T. & NAVAS, M.-L. 2008. Scaling environmental change through the community-level: a trait-based response-and-effect framework for plants. *Global Change Biology,* 14**,** 1125-1140.

TACKENBERG, O., POSCHLOD, P. & BONN, S. 2003. Assessment of wind dispersal potential in plant species. *Ecological Monographs,* 73**,** 191-205.

THEBAUD, C. & DEBUSSCHE, M. 1991. Rapid invasion of fraxinus-ornus along the Herault river system in southern France - the importance of seed dispersal by water. *Journal of Biogeography,* 18**,** 7-12.

THOMSON, F. J., MOLES, A. T., AULD, T. D. & KINGSFORD, R. T. 2011. Seed dispersal distance is more strongly correlated with plant height than with seed mass. *Journal of Ecology,* 99**,** 1299-1307.

THOMPSON, R. & TOWNSEND, C. 2006. A truce with neutral theory: local deterministic factors, species traits and dispersal limitation together determine patterns of diversity in stream invertebrates. *Journal of Animal Ecology,* 75**,** 476-484.

TILMAN, D. 1999. The ecological consequences of changes in biodiversity: A search for general principles. *Ecology,* 80**,** 1455-1474.

URBANSKA, K. M. & FATTORINI, M. 2000. Seed rain in high-altitude restoration plots in Switzerland. *Restoration Ecology,* 8**,** 74-79.

VANDVIK, V. & GOLDBERG, D. E. 2005. Distinguishing the roles of dispersal in diversity maintenance and in diversity limitation. *Folia Geobotanica,* 40**,** 45-52.

WANG, B. C. & SMITH, T. B. 2002. Closing the seed dispersal loop. *Trends Ecol Evol,* 17**,** 379-385.

WEHNCKE, E. V., HUBBELL, S. P., FOSTER, R. B. & DALLING, J. W. 2003. Seed dispersal patterns produced by white-faced monkeys: implications for the dispersal limitation of neotropical tree species. *Journal of Ecology,* 91**,** 677-685.

WILLIS, K. J., BENNETT, K. D. & WALKER, D. 2004. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences,* 359**,** 157-158.

WRIGHT, S. 1969. *Evolution and the Genetics of Populations,* Chicago, Chicago University Press.

YU, D. W., WILSON, H. B., FREDERICKSON, M. E., PALOMINO, W., DE LA COLINA, R., EDWARDS, D. P. & BALARESO, A. A. 2004. Experimental demonstration of species coexistence enabled by dispersal limitation. *Journal of Animal Ecology,* 73**,** 1102-1114.

ZOBEL, M. & KALAMEES, R. 2005. Diversity and dispersal - Can the link be approached experimentally? *Folia Geobotanica,* 40**,** 3-11.

7. Appendices

Appendix I: Seed rain recording

Counts of seeds per species in winter (W) and summer (S) from doormats I-V in each site

Ulvehaugen (alp1)

Season	w	w	w	w	w		s	s	s	s	s
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	-	-	-	-	-		-	-	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	2	5	32	2		3	5	12	8	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	6	32	-
Anthoxanthum odoratum	-	3	2	2	-		3	3	26	6	24
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	3
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	-	-	-	-	-		-	-	-	-	-
Bistorta vivipara	15	2	-	-	-		4	12	2	-	-
Campanula rotundifolia	4	2	2	-	-		12	-	-	-	-
Carex bigelowii	-	1	-	-	2		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-		-	5	1-	81	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	4	2	-	-	5		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	1	-	-	-		-	2	-	1	-
Festuca ovina	-	-	-	-	-		-	12	4	-	-
Festuca rubra	-	-	-	2	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	12	3	4	1	1		2	-	-	-	-
Gentianella amarella	-	1	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	1	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	1	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	2	-	4	1	-		-	-	-	-	-
Juncus undiff.	-	-	-	1	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	6		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	2	-	-	-	-		-	1	2	-	24
Luzula undiff.	-	-	-	-	-		-	-	-	-	1

Appendix I: Seed rain recording continued

Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	3	6	-
Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	1	-	-	1		-	-	1	1	8
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	1	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	2	17	3-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	-	-	-		-	-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	5	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		-	1	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	1	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	73	4	-
Sagina undiff.	1	-	-	14	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	1	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	1	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	4	-	-	-	47		1-4	1-	5	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		3	-	2	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	1		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	1		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	2		-	-	-	-	-
Vaccinium undiff.	1	-	-	1	-		-	-	-	-	-
Valeriana officinalis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	5	2	3	6
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	-	-	-	-	-		1	-	-	-	-
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		4	11	3	4	2
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	1
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Låvisdalen (alp 2)

Season	w	w	w	w	w		s	s	s	s
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**
Achillea millefolium	-	-	-	-	-		-	-	-	-
Agrostis capillaris	-	-	-	-	-		-	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-
Agrostis undiff.	-	-	-	-	4		-	-	-	-
Alchemilla alpina	-	27	21	-	28		-	-	2	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-
Antennaria alpina	-	-	1	8	18		-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-
Anthoxanthum odoratum	2	23	6	51	27		-	-	-	-
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-
Betula nana	1	1	-	-	-		-	-	-	-
Betula pubescens	-	2	-	-	-		-	-	-	-
Bistorta vivipara	-	-	1	-	-		1	1	-	5
Campanula rotundifolia	-	7	4	7	12		-	-	-	1
Carex bigelowii	2	3	1-	12	-		-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-
Carex pallescens	-	-	-	1	-		-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-
Carex undiff.	-	-	-	-	-		-	2	-	-
Carex vaginata	-	-	1	-	-		-	-	-	-
Cerastium cerastoides	-	-	-	-	6		-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-
Cerastium undiff.	-	1	-	-	-		-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-
Deschampsia cespitosa	-	-	-	-	-		-	-	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-
Empetrum nigrum	1	2	3	9	-		-	3	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	1
Euphrasia sp.	2	1	-	1	1		-	-	-	-
Festuca ovina	-	1	2	3	2		1	-	-	-
Festuca rubra	-	-	-	-	-		-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-
Hieracium sp.	-	-	-	-	-		-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-
Juncus trifidus	-	9	5	13	1		-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-
Loiseleuria procumbens	-	2	6	2	-		-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-
Luzula multiflora	-	-	-	-	-		-	-	-	-
Luzula undiff.	2	-	1	2	5		-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	1	-
Phleum alpinum	-	-	-	1	5		-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-
Phyllodoce caerulea	-	1	-	1	-		-	-	1	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-
Poaceae undiff.	2	3	4	-	6		-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-
Potentilla erecta	-	-	-	-	-		-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-
Ranunculus acris	1	-	-	-	-		2	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-
Rumex acetosa	-	-	-	-	-		-	-	-	-
Rumex acetosella	-	-	2	-	-		-	-	-	-
Sagina nivalis	-	-	-	-	-		19	-	5	3
Sagina saginoides	-	-	-	-	-		-	-	-	-
Sagina undiff.	-	3	4	-	-		-	-	-	-
Salix herbacea	-	-	-	-	-		-	1	-	-
Saxifraga aizoides	-	7	-	1	-		-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-
Saxifraga stellaris	-	-	-	1	-		-	-	-	-
Selaginella selaginoides	84	1-	18	5	-		4	1	1	1
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-
Silene acaulis	2	6	8	3	-		-	-	-	3
Silene vulgaris	-	-	-	-	-		-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-
Taraxacum spp.	-	4	-	-	-		2	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-
Tofieldia pusilla	-	7	-	11	-		-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-
Vaccinium myrtillus	-	2	3	2	-		1	1	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-
Veronica alpina	2	2	1	1	2		1	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-
Veronica officinalis	-	-	-	-	-		-	-	-	-
Veronica undiff.	-	-	-	-	-		-	-	-	-
Viola biflora	-	1	-	-	-		3	-	1	-
Viola palustris	-	-	-	-	-		-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-

Appendix I: Seed rain recording continued

Gudmesdalen (alp 3)

Season	w	w	w	w	w		s	s	s	s	S
Block	I	II	III	IV	V		I	II	III	IV	V
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	-	-	-	-	-		-	-	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	15	-	1		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	-	-	-	-	-		-	2	2	-	2
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	7	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	-	-	-	1	2		-	-	-	-	-
Bistorta vivipara	-	-	-	-	-		2	3	9	-	31
Campanula rotundifolia	-	-	-	5	-		-	-	-	-	1
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		4	-	-	-	8
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	4	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	19	1	6	-	4		-	-	-	5	216
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		1	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		-	-	-	-	-
Festuca ovina	-	3	-	-	-		-	-	-	-	-
Festuca rubra	3	-	-	-	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		1	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	1
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	-	-	-	-	3		-	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	18	7	23	1--	19		-	2	3	14	12
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	5	-	-	-		-	-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		-	-	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	1	-	-	-	-		7	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	12	11	19	-	4		77	17	68	2	29
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	7	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	2	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	5
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	1	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	-	-	-	-	-		-	-	-	-	-
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		1	-	-	-	-
Viola palustris	-	-	-	-	-		-	1	-	-	-
Viola riviniana	-	-	-	-	-		1	1	-	-	1
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Skjellingahaugen (alp 4)

Season	w	w	w	w	w		s	s	s	s	S
Block	I	II	III	IV	V		I	II	III	IV	V
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	1	-	-	-	-		-	-	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	1-	2	-	-	32		3	-	-	1	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	1	-	6
Anthoxanthum odoratum	-	-	-	1	1		3	-	-	-	-
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	-	-	-	-	-		-	6	-	-	-
Bistorta vivipara	2	2	1	-	-		-	8	-	3	-
Campanula rotundifolia	5	-	-	-	-		-	-	-	-	-
Carex bigelowii	-	-	8	17	-		-	-	1	-	-
Carex capillaris	1	2	-	7	12		-	-	1	2	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	6	-	-	-		2	5	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	2-	3	8	-		-	-	-	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	1	-	-	-	-		2	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	4	13	9	7	12		2	1	2	1	6
Festuca ovina	-	-	-	-	-		-	-	-	-	-
Festuca rubra	-	-	-	-	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivalis	4	-	-	-	-		2	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	2	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	28	-		5	4	-	9	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	1	-	2-	-	46		-	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	2	95	94	232	-		-	-	12	2	36
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	4	-
Phleum alpinum	-	-	-	-	-		-	1	-	-	-
Phleum pratense	-	-	-	17	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	1	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	2	-	-	1	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	-	-	-		-	-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		-	-	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	22
Salix herbacea	-	-	-	-	-		-	-	-	-	3
Saxifraga aizoides	4	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	58	-	-	7	-		39	2	85	21	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	1	-		14	4	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	1-	17	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	1		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	1
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	3	-	-	-	-		-	1	-	-	-
Veronica officinalis	-	-	-	-	-		-	-	-	-	-
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	2	-	2
Viola riviniana	-	-	-	-	-		-	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Ålrust (int 1)

Season	w	w	w	w	w		s	s	s	s	S
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	1	46	-	-	-		-	-	-	-	1
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	-	-	-		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	1	1	-	-	-		4	-	-	3	1
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	1-	94	6	39	11		273	844	8	28	26
Bistorta vivipara	-	-	-	-	-		22	1	-	-	1
Campanula rotundifolia	-	-	-	-	-		-	-	-	-	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	5	-	-	1
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-		-	3	-	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		15	2-	-	-	-
Festuca ovina	-	-	-	-	-		-	-	-	-	-
Festuca rubra	-	-	-	-	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	1	-		59	-	3	41	33
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	1	-	2
Leontodon autumnalis	4	3--	-	-	-		47	199	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseeluria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	1	1	-	1		-	-	-	-	-
Luzula multiflora	-	-	-	-	-		-	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	23	-	-	15	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	-	-	-		-	-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	25	69
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	1	56	28
Rhnianthus minor	-	-	-	-	-		13	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		1	-	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	-	1
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	5		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	1	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	1	-	5	11	-		-	-	-	1	2
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pursilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	3	-		16	-	4	-	-
Trifolium repens	-	-	-	4	1		-	-	-	3	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	-	-	-	-	-		-	-	-	24	2
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	3	1-	2
Viola tricolor	-	-	-	-	-		-	1	-	1	-
Viola undiff.	-	1	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Høgsete (int 2)

Season	**w**	**w**	**w**	**w**	**w**		**s**	**s**	**s**	**s**	**s**
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	1	-	-	-	-		-	-	-	-	-
Agrostis capillaris	-	2	121	3	3		-	-	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	5	-	2	-	-		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	9	-	1	1	-		26	2	18	13	29
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	35	26	4	1
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	21	5	7	5	6		-	2	-	-	2
Bistorta vivipara	-	-	-	-	-		-	-	-	-	-
Campanula rotundifolia	-	-	-	-	-		-	2	43	-	5
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	3	-	1		-	-	93	6	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	29	-	-	-	-		72	48	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	5	1		29	-	24	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		-	-	-	-	-
Festuca ovina	-	-	-	-	-		-	6	-	-	34
Festuca rubra	2	1	3	1	-		38	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	9	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-	1
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiselura procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	-	-	5	-	-		-	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		1	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoceacaerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		23	-	-	15	-
Poaceae undiff.	-	-	-	-	-		7	-	-	-	2
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	2	-	-		29	11	12	1	2
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		2-	2-	-	1	3
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	5-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	5	18	77	26	4		-	2	5	3	4
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	1	-	-	-		2	11	12	1	13
Viola riviniana	-	-	-	-	-		-	-	-	-	9
Viola tricolor	-	-	-	-	-		-	2	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Rambera (int 3)

Season	w	w	w	w	w		s	s	s	s	s
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	1	66	-	-	2		-	-	-	-	-
Agrostis capillaris	-	12	43	-	-		2	1	-	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	8	-	3	1	9		-	-	-	-	-
Alchemilla undiff.	5	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	24	3-	1	4	2		88	186	18	1-6	23
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	3	-	-	-	-		1	1	-	-	1
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	16	16	4	7	23		-	-	-	-	-
Bistorta vivipara	-	-	-	1	-		-	-	-	26	-
Campanula rotundifolia	-	-	-	-	-		-	-	-	-	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	1	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	2	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	1	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	1	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	13	11	3-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	2	1	-	-		-	-	3	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	1
Cerastium fontanum	-	-	-	-	-		3	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	17	9	47	9		-	-	-	3	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		1	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	2	2	1	-	-		-	3	3	-	-
Festuca ovina	-	-	-	-	-		-	-	-	-	-
Festuca rubra	-	-	-	-	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	-	-	-	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseeluria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	3	12	-	2-	-		3	27	2	95	47
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	1-	24-	7	11	11		-	17	2	1	-
Omalotheca norvegica	-	-	1	-	-		-	7	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		1	-	-	-	-
Oxalis acetosella	1	-	-	-	1		-	2	-	1	1
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	3	-	-	-	-		2	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	3	4	1	-	4		2	15	28	3	5
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	1	-	-	-		-	-	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	1	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	8	1
Sibbaldia procumbens	-	3	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	1	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	2	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	1	-	-	-	-		-	-	16	1	-
Veronica undiff.	-	-	134	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	1	-	-		17	12	9	1	12
Viola riviniana	-	-	-	-	-		-	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Veskre (int 4)

Season	w	w	w	w	w		s	s	s	s	s
Block	I	II	III	IV	V		I	II	III	IV	V
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	-	-	-	-	-		-	9	-	1	-
Agrostis mertenzii	9	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	3	-	-	-		25	15	1	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	-	-	-	1	-		24	8	-	1	2
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	466	167	478	215	83		27	9	48	3	6
Bistorta vivipara	1	-	-	11	-		2	3	-	-	5
Campanula rotundifolia	-	-	-	-	-		-	-	-	-	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	2	-		-	6	2	-	7
Carex demissa	-	2	1	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	3-	-	1
Carex leporina	-	-	-	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		1	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	1-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-		-	-	-	4	3
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	1
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		1	79	2	2	37
Festuca ovina	-	-	-	-	-		-	-	-	-	-
Festuca rubra	-	-	-	-	-		-	-	51	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	35	-	8	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	26	11	85	12		1	2-	13	21	2-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	-	-	24	-	-		91	4	8	11	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	26	5	37	-		4	37	6	3	35
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omlotheca sylvatica	-	-	-	-	-		-	1	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	1	-	-	-		-	6	-	-	4
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	1
Prunella vulgaris	-	-	2	-	-		17	23	15	73	11
Ranunculus sp.	-	-	-	-	-		-	1	-	2	1
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	3	-	2	-	-		-	-	-	1	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	-	-		-	-	-	-	-
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		5	-	-	1	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	2		-	-	2	1	-
Thalictrum alpinum	-	-	-	-	-		2	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	2	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	5	-	-	-	-		-	-	-	-	-
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		2	2	-	1	-

Appendix I: Seed rain recording continued

Fauske (low 1)

Season	w	w	w	w	w		s	s	s	s	s
Block	I	II	III	IV	V		I	II	III	IV	V
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	8	7-	8-	4	15		-	3	8	-	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	-	-	-		9	6	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	3	63	1	23
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	7	3	6	2	8		-	2	-	-	-
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	195	277	253	391	2-9		114	48	49	43	114
Bistorta vivipara	-	-	-	-	-		-	-	-	-	-
Campanula rotundifolia	-	8	1	-	-		-	-	-	-	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	4	16	43	31	13		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	5	1	2	25	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	1		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	8	1	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	1	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	6	12		-	-	-	-	-
Dianthus deltoides	-	-	-	-	-		-	1	8	1	1
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	2	3		-	-	-	-	-
Festuca ovina	-	2	-	2	-		-	-	-	-	11
Festuca rubra	-	-	-	4	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	3	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	1	1
Hieracium pilosella	-	-	-	-	-		191	7	2	1-	81
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	5		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	4
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	3	-		-	-	-	-	-
Knautsia arvensis	-	-	-	-	-		-	7	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	15-	3	3-	92
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	1	-	-	-	-		-	-	-	-	-
Luzula undiff.	-	1	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	1	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	43	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	1	-	-		32	1-	2	1	38
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	1-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	17
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	1		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		4	-	-	-	-
Potentilla erecta	1	-	-	5	2		-	-	-	-	-
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		5	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	1	-	-	-		5	3	12	2	54
Rumex acetosella	97	6	13	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	1	-	-	-		7	2	1	123	-
Taraxacum spp.	-	-	-	-	-		117	8	17	-	5
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	1	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	32	16	7	7
Trifolium repens	-	1	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinallis	-	-	1	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		3	1	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	7	3	-	1	-		-	-	4	-	-
Veronica undiff.	-	-	-	-	71		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	-	1	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Vikesland (low 2)

Season	w	w	w	w	w		s	s	s	s	s
Block	I	II	III	IV	V		I	II	III	IV	V
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	21	168	223	5	39		-	3	-	-	12-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	-	-	-		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	1	-	13	3	9		1-9	64	239	19	131
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	153	326	378	338	285		-	-	9	1-	1-
Bistorta vivipara	-	-	-	-	-		-	-	-	-	-
Campanula rotundifolia	-	24	4	-	-		-	-	-	1	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	2	-	-		-	-	-	-	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-		-	-	-	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	7	1-		-	-	-	26	-
Festuca ovina	-	7	-	7	-		-	38	9	61	-
Festuca rubra	1	-	-	-	-		-	-	-	7	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		-	1	-	1	-
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	2	-	1-	-
Leontodon autumnalis	-	-	-	-	-		6	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	-	-	-	-	-		-	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	1	-	-		-	-	1	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	2	-	1		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		5	3	-	-	-
Poaceae undiff.	-	-	-	-	-		-	4	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	-	3	1		-	-	95	35	35
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	1	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		8	-	9	-	22
Rhianthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		12	-	-	-	-
Rumex acetosa	-	-	1	-	-		151	139	68	24	128
Rumex acetosella	29-	18	1	-	-		38	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	4	-	1	-		-	21	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	4	-	-	-
Trifolium repens	-	3	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinalis	-	-	2	-	-		-	-	3	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	4	5	-	1	-		2	25	-	47	1
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	1	-	-	-		-	1	-	-	-
Viola tricolor	-	-	-	-	-		-	2	-	1	-
Viola undiff.	-	-	-	-	1		-	-	5	-	-

Appendix I: Seed rain recording continued

Arhelleren (low 3)

Season	**w**	**w**	**w**	**w**	**w**		**s**	**s**	**s**	**s**	**s**
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	1	3	2	-	-		-	-	-	1	-
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	-	-	-		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		1	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	16	9	2	3	9		42	46	26	26	48
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	-	-	-	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	41-	468	3-8	7-7	3-9		12	3	13	7-	16
Bistorta vivipara	1	-	-	-	-		-	1	-	-	-
Campanula rotundifolia	-	-	-	-	-		-	-	-	-	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	-	-	-	86	-		-	-	-	2	-
Carex nigra	-	-	-	-	-		-	-	-	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	15	3	7	76	-		2	-	8	7	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	2		-	-	-	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	-	-
Deschampsia cespitosa	-	-	-	17	36		-	-	-	-	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		-	-	-	-	-
Festuca ovina	-	-	-	-	-		-	-	-	-	-
Festuca rubra	-	-	-	11	-		-	-	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		16	-	-	-	2
Hieracium pilosella	-	-	-	-	-		-	-	-	-	-
Hieracium sp.	-	1	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	14		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	9	-		-	-	-	-	-
Knautia arvensis	1	-	-	-	-		-	1	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	2	-	-	-	-		-	-	-	-	-
Luzula undiff.	-	3	-	-	-		-	-	-	-	-
Melampyrum pratense	1	-	-	-	-		-	-	-	-	-
Nardus stricta	-	-	-	-	-		-	-	-	-	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	1	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	1	-	-	-	29		1	-	3	-	23
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	-		-	-	-	-	-
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	3	1	-	1-	-		2	6	4	9	54
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhinanthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	1	4	-	-	-		-	1	-	4	1
Rumex acetosella	-	-	-	-	-		-	-	-	-	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		-	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinalis	-	-	1	-	-		-	-	-	-	43
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	1	-	-	-	-		-	1	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	4	5	-	-	-		-	1	-	-	-
Veronica undiff.	-	-	-	-	212		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	4	4	1	-
Viola riviniana	1	-	1	-	-		1	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Øvstedal (low 4)

Season	**w**	**w**	**w**	**w**	**w**		**s**	**s**	**s**	**s**	**s**
Block	**I**	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Achillea millefolium	-	-	-	-	-		-	-	-	-	-
Agrostis capillaris	2	38	15	7	7		-	45	9	3-	5
Agrostis mertenzii	-	-	-	-	-		-	-	-	-	-
Agrostis undiff.	-	-	-	-	-		-	-	-	-	-
Alchemilla alpina	-	-	-	-	-		-	-	-	-	-
Alchemilla undiff.	-	-	-	-	-		-	-	-	-	-
Antennaria alpina	-	-	-	-	-		-	-	-	-	-
Antennaria dioica	-	-	-	-	-		-	-	-	-	-
Anthoxanthum odoratum	3	-	2	-	5		6-	2-	8	15	1-
Arrhenantherum sp.	-	-	-	-	-		-	-	-	-	-
Asteraceae undiff.	-	-	-	-	-		-	-	-	-	-
Avenella flexuosa	-	-	-	-	-		-	6	-	5	-
Betula nana	-	-	-	-	-		-	-	-	-	-
Betula pubescens	23	37	73	127	33		22	2-	22	3-	17
Bistorta vivipara	-	-	-	-	-		-	-	-	-	-
Campanula rotundifolia	-	-	-	-	-		63	63	3	1	-
Carex bigelowii	-	-	-	-	-		-	-	-	-	-
Carex capillaris	-	-	-	-	-		-	-	-	-	-
Carex demissa	-	-	-	-	-		-	-	-	-	-
Carex echinata	-	-	-	-	-		-	-	-	-	-
Carex leporina	13	48	126	6	38		14	1-4	93	72	138
Carex nigra	-	-	-	-	-		-	-	5	-	-
Carex norvegica	-	-	-	-	-		-	-	-	-	-
Carex pallescens	-	-	-	-	-		-	-	-	-	-
Carex panicea	-	-	-	-	-		-	-	-	-	-
Carex pauciflora	-	-	-	-	-		-	-	-	-	-
Carex pilulifera	-	-	-	-	-		4	-	9	-	-
Carex pulicaris	-	-	-	-	-		-	-	-	-	-
Carex undiff.	-	-	-	-	-		-	-	-	-	-
Carex vaginata	-	-	-	-	-		-	-	-	-	-
Cerastium cerastoides	-	-	-	-	-		-	-	-	-	-
Cerastium fontanum	-	-	-	-	-		-	-	-	-	-
Cerastium undiff.	-	-	-	-	-		-	-	-	-	-
Dactylis glomerata	-	-	-	-	-		-	-	-	-	-
Danthonia decumbens	-	-	-	-	-		-	-	-	6	-
Deschampsia cespitosa	-	-	-	-	-		2	1	3	25	-
Dianthus deltoides	-	-	-	-	-		-	-	-	-	-
Empetrum nigrum	-	-	-	-	-		-	-	-	-	-
Epilobium anagallidifolium	-	-	-	-	-		-	-	-	-	-
Euphrasia sp.	-	-	-	-	-		-	-	-	-	-
Festuca ovina	-	-	-	-	-		2	-	-	-	-
Festuca rubra	-	-	-	-	-		-	6	-	-	-
Galium saxatile	-	-	-	-	-		-	-	-	-	-
Galium verum	-	-	-	-	-		-	-	-	-	-
Gentiana nivialis	-	-	-	-	-		-	-	-	-	-
Gentianella amarella	-	-	-	-	-		-	-	-	-	-
Gentianella campestris	-	-	-	-	-		-	-	-	-	-
Gentianella tenella	-	-	-	-	-		-	-	-	-	-
Gentianella undiff.	-	-	-	-	-		-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-		-	-	-	-	-
Hieracium pilosella	-	-	-	-	-		75	12	-	114	2
Hieracium sp.	-	-	-	-	-		-	-	-	-	-
Hieracium vulgatum	-	-	-	-	-		-	-	-	-	-
Hypochoeris maculata	-	-	-	-	-		-	-	-	-	-
Juncus trifidus	-	-	-	-	-		-	-	-	-	-
Juncus undiff.	-	-	-	-	-		-	-	-	-	-
Knautia arvensis	-	-	-	-	-		-	-	-	-	-
Leontodon autumnalis	-	-	-	-	-		-	-	-	-	-
Leucanthemum vulgaris	-	-	-	-	-		-	-	-	-	-
Loiseleuria procumbens	-	-	-	-	-		-	-	-	-	-
Lotus corniculatus	-	-	-	-	-		-	-	-	-	-
Luzula multiflora	-	-	-	-	-		1	-	-	-	-
Luzula undiff.	-	-	-	-	-		-	-	-	-	-
Melampyrum pratense	-	-	-	-	-		-	-	-	-	-
Nardus stricta	-	3	-	-	-		16	-	-	2	-
Omalotheca norvegica	-	-	-	-	-		-	-	-	-	-
Omalotheca supina	-	-	-	-	-		-	-	-	-	-

Appendix I: Seed rain recording continued

Omalotheca sylvatica	-	-	-	-	-		-	-	-	-	-
Oxalis acetosella	-	-	-	-	-		-	-	-	-	-
Parnassia palustris	-	-	-	-	-		-	-	-	-	-
Phleum alpinum	-	-	-	-	-		-	-	-	-	-
Phleum pratense	-	-	-	-	-		-	-	-	-	-
Phyllodoce caerulea	-	-	-	-	-		-	-	-	-	-
Pimpinella saxifraga	-	-	-	-	-		-	-	-	-	-
Pinguicula vulgaris	-	-	-	-	-		-	-	-	-	-
Plantago lanceolata	-	-	-	-	-		-	-	-	-	-
Plantago media	-	-	-	-	-		-	-	-	-	-
Poa alpina	-	-	-	-	-		-	-	-	-	-
Poa pratensis	-	-	-	-	-		-	-	-	-	-
Poaceae undiff.	-	-	-	-	2		-	-	-	1	3
Potentilla crantzii	-	-	-	-	-		-	-	-	-	-
Potentilla erecta	-	-	-	1	4		-	-	-	36	65
Potentilla tabernaemontani	-	-	-	-	-		-	-	-	-	-
Prunella vulgaris	-	-	-	-	-		-	-	-	-	-
Ranunculus sp.	-	-	-	-	-		-	-	-	-	-
Ranunculus acris	-	-	-	-	-		-	-	-	-	-
Rhianthus minor	-	-	-	-	-		-	-	-	-	-
Rubus idaeus	-	-	-	-	-		-	-	-	-	-
Rumex acetosa	-	-	-	1	-		-	-	2	2	31
Rumex acetosella	-	-	39	-	-		23	12	1-1	3	-
Sagina nivalis	-	-	-	-	-		-	-	-	-	-
Sagina saginoides	-	-	-	-	-		-	-	-	-	-
Sagina undiff.	-	-	-	-	-		-	-	-	-	-
Salix herbacea	-	-	-	-	-		-	-	-	-	-
Saxifraga aizoides	-	-	-	-	-		-	-	-	-	-
Saxifraga nivalis	-	-	-	-	-		-	-	-	-	-
Saxifraga stellaris	-	-	-	-	-		-	-	-	-	-
Selaginella selaginoides	-	-	-	-	-		-	-	-	-	-
Sibbaldia procumbens	-	-	-	-	-		-	-	-	-	-
Silene acaulis	-	-	-	-	-		-	-	-	-	-
Silene vulgaris	-	-	-	-	-		-	-	-	-	-
Solidago virgaurea	-	-	-	-	-		-	-	-	-	-
Stellaria graminea	-	-	-	-	-		-	-	-	-	-
Taraxacum spp.	-	-	-	-	-		-	-	-	-	-
Thalictrum alpinum	-	-	-	-	-		-	-	-	-	-
Thlaspi arvense	-	-	-	-	-		-	-	-	-	-
Tofieldia pusilla	-	-	-	-	-		-	-	-	-	-
Trifolium pratense	-	-	-	-	-		-	-	-	-	-
Trifolium repens	-	-	-	-	-		-	-	-	-	-
Vaccinium myrtillus	-	-	-	-	-		1	-	-	-	-
Vaccinium uliginosum	-	-	-	-	-		-	-	-	-	-
Vaccinium undiff.	-	-	-	-	-		-	-	-	-	-
Valeriana officinalis	-	-	-	-	-		-	-	-	-	-
Veronica alpina	-	-	-	-	-		-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-		-	-	-	-	-
Veronica fruticans	-	-	-	-	-		-	-	-	-	-
Veronica officinalis	12	-	-	1	-		8-	-	-	5	-
Veronica undiff.	-	-	-	-	-		-	-	-	-	-
Viola biflora	-	-	-	-	-		-	-	-	-	-
Viola palustris	-	-	-	-	-		-	-	-	-	-
Viola riviniana	-	-	-	-	-		-	-	-	-	-
Viola tricolor	-	-	-	-	-		-	-	-	-	-
Viola undiff.	-	-	-	-	-		-	-	-	-	-

Appendix II: Vegetation recording

Vegetation data at each site in 5 blocks (I-V). The values represent species cover by block (percentage). For plant name abbreviations, see Appendix VII.

Ulvehaugen (alp1)

Block	I	II	III	IV	V	Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	5	Gal uli	-	-	-	-	-		Pyr min	1	-	-	-	-
Aco sep	-	-	-	-	-	Gal ver	-	-	-	-	-		Pyr nor	-	-	-	-	-
Agr cap	8	15	5	2-	4	Gen ama	-	-	-	-	-		Ran acr	1	5	2	1	-
Agr mer	-	-	-	-	-	Gen niv	-	-	1	-	-		Ran aur	-	-	-	-	-
Alc alp	6	2-	25	5	16	Gen pur cf	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc sp	-	5	2	1	-	Gen ten	-	-	-	-	-		Rhi min	-	-	-	-	-
Ant alp	-	-	-	-	-	Ger syl	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant dio	-	4	-	-	1	Geu riv	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant odo	2	2	1	1	2	Gym dry	-	-	-	-	-		Rum ace	-	-	-	1	-
Arc alp	-	-	-	-	-	Hie pil	-	-	-	-	-		Rum ac-la	-	-	2	2	1
Ast alp	8	4	6	1	1	Hie vulg	-	-	-	-	-		Sag pro	-	2	-	-	1
Ave fle	-	-	-	-	-	Hier sp	-	-	-	-	-		Sag sag	1	-	1	-	2
Bart alp	-	-	-	-	-	Hyp mac	-	-	-	-	-		Sag sp	-	-	-	-	-
Bet nan	-	-	-	-	-	Hypo mac	-	-	-	-	-		Sal her	5	6	3	5	-
Bet pub	-	-	-	-	-	Jun alp	-	-	-	-	-		Sal ret	-	-	-	-	-
Bis viv	2	8	5	2	-	Jun com	-	-	-	-	-		Salix sp	-	-	-	-	-
Bot lun	-	-	-	-	1	Jun tri	-	-	-	-	-		Saus alp	2	-	4	-	-
Cal vul	-	-	-	-	-	Kna arv	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cam rot	1	-	1	1	1	Kob sim	-	-	-	-	-		Sed acr	-	-	-	-	-
Car atra	2	4	-	-	-	Leo aut	-	-	-	-	-		Sel sel	1	-	-	-	-
Car big	-	-	-	-	-	Leu vul	-	-	-	-	-		Sib pro	3	2	2	5	1
Car cap	-	-	-	-	-	Lot cor	-	-	-	-	-		Sil aca	-	-	-	2	-
Car ech	-	-	-	-	-	Luz mul	1	-	-	-	1		Sil vul	-	-	-	-	-
Car fla	-	-	-	-	-	Luz pil	-	-	-	-	-		Sol vir	-	-	-	-	-
Car lep	-	-	-	-	-	Luz sp	-	-	-	-	-		Sorbus	-	-	-	-	-
Car nigra	-	-	-	-	-	Luz spi	-	2	-	-	-		Ste gra	-	-	-	-	-
Car nor	2	-	-	-	-	Lych vis	-	-	-	-	-		Ste med	-	-	-	-	-
Car pal	-	-	-	-	-	Mel pra	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pan	-	-	-	-	-	Myos cf	-	-	-	-	-		Tarax	1	-	3	-	-
Car pauc	-	-	-	-	-	Nar stri	-	-	-	-	-		Tha alp	3	3	1	1	-
Car pil	-	-	-	-	-	Oma nor	-	-	-	-	1		Thla arv	-	-	-	-	-
Car sax	-	-	-	-	-	Oma sup	1	5	1	-	-		Tof pus	-	-	-	-	-
Car vag	-	2	2	-	-	Oma syl	-	-	-	-	-		Tri ces	-	-	-	-	-
Carex sp	-	-	-	-	-	Oxa ace	-	-	-	-	-		Tri med	-	-	-	-	-
Caru car	-	-	-	-	-	Oxy dig	-	-	-	-	-		Tri pra	-	-	-	-	-
Cer alp	-	-	1	-	-	Par pal	-	-	-	-	-		Tri rep	-	-	-	-	-
Cer cer	-	-	-	-	-	Phle alp	-	4	4	1	2		Vac myr	-	-	-	-	-
Cer gla	-	-	-	-	-	Phle prat	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer fon	-	-	-	2	-	Phyl caer	-	-	-	-	1		Vac vit	-	-	-	-	-
Cir pal	-	-	-	-	-	Pim sax	-	-	-	-	-		Ver alp	2	2	2	8	3
Dac glo	-	-	-	-	-	Pimp cf	-	-	-	-	-		Ver cha	-	-	-	-	-
Dant dec	-	-	-	-	-	Pin vul	-	-	-	-	-		Ver fru	1	-	-	-	1
Des ces	2	4	-	1	1	Pla lan	-	-	-	-	-		Ver off	-	-	-	-	-
Dia del	-	-	-	-	-	Pla maj	-	-	-	-	-		Ver serp	-	-	-	-	-
Emp her	-	-	-	-	-	Pla med	-	-	-	-	-		Vic cra	-	-	-	-	-
Epi ana	-	-	-	-	-	Poa alp	2	9	6	2	1		Vio bif	6	8	5	5	6
Epilob sp	-	-	-	1	-	Poa pra	-	-	1	1	-		Vio pal	-	-	-	-	-
Euph sp	2	-	-	-	-	Poaceae sp	-	-	-	-	-		Vio riv	-	-	-	-	-
Fes ovi	-	-	-	1	-	Pot arg	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes rub	-	6	1	-	2	Pot cra	1	-	-	-	1		Vio tri cf	-	-	-	-	-
Fes viv	-	-	-	-	-	Pot ere	-	-	-	-	-		Viol sp	-	-	-	-	-
Gal bor	-	-	-	-	-	Pru vul	-	-	-	-	-		Visc vul	-	-	-	-	-
Gal sax	-	-	-	-	-													

Appendix II: Vegetation recording continued

Låvisdalen (alp 2)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	4	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	1	2	2	3	2		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	1	2	2	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	1	1	5	-	1		Gen pur cf	-	-	-	1	-		Rhi min	-	-	-	-	-
Alc sp	1	1	3	2	8		Gen ten	-	-	-	-	-		Rho ros	1	-	-	-	-
Ant alp	5	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	2	4	-	-
Ant odo	2	3	6	2	2		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	-	1	2	-
Ast alp	-	-	-	-	-		Hie vulg	1	-	-	-	-		Sag sag	-	1	-	-	-
Ave fle	-	-	3	-	-		Hier sp	-	-	-	-	-		Sag sp	1	-	1	-	1
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	1-	5	15	6	3
Bet nan	-	1	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	2	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	1	-	-	5	-
Bis viv	2	3	4	6	6		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	1	2	-	1	-		Kob sim	-	-	-	-	-		Sel sel	2	1	2	4	4
Car atra	-	-	-	-	-		Leo aut	4	-	-	-	-		Sib pro	3	2	3	8	3
Car big	-	3	-	3	-		Leu vul	-	-	-	-	-		Sil aca	2	1	-	5	1
Car cap	2	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	1	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	1	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	2		Ste med	-	-	-	-	-
Car nor	-	-	4	5	8		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	5	3	5	4	8
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	3	1	1	9	-
Car pauc	-	-	-	-	-		Nar stri	2	-	-	-	-		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	1	-	-	-	-		Tof pus	1	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	1	1	2	4	2		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	2	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	3	4		Tri rep	-	-	-	-	-
Cer alp	-	-	-	-	-		Par pal	5	-	-	4	4		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	5		Phle alp	-	1	2	-	3		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	1	-	-	-		Phyl caer	1	-	-	-	-		Ver alp	2	1	4	3	3
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	3	-	-	-	-		Ver off	-	-	-	-	-
Des ces	-	16	-	5	1-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	1	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	3	3	5	8	1-
Epi ana	-	1	-	-	-		Poa alp	3	3	3	5	4		Vio pal	-	-	-	-	-
Epilob sp	-	-	1	-	-		Poa pra	1	2	-	3	2		Vio riv	-	-	-	-	-
Euph sp	1	-	-	-	1		Poa sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	1	1	-	3	1		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	1	-	-	2	1		Pot cra	2	-	-	3	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	-	-	-	-	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Gudmesdalen (alp 3)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	4	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	1	2	2	3	2		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	1	2	2	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	1	1	5	-	1		Gen pur cf	-	-	-	1	-		Rhi min	-	-	-	-	-
Alc sp	1	1	3	2	8		Gen ten	-	-	-	-	-		Rho ros	1	-	-	-	-
Ant alp	5	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	2	4	-	-
Ant odo	2	3	6	2	2		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	-	1	2	-
Ast alp	-	-	-	-	-		Hie vulg	1	-	-	-	-		Sag sag	-	1	-	-	-
Ave fle	-	-	3	-	-		Hier sp	-	-	-	-	-		Sag sp	1	-	1	-	1
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	1-	5	15	6	3
Bet nan	-	1	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	2	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	1	-	-	5	-
Bis viv	2	3	4	6	6		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	1	2	-	1	-		Kob sim	-	-	-	-	-		Sel sel	2	1	2	4	4
Car atra	-	-	-	-	-		Leo aut	4	-	-	-	-		Sib pro	3	2	3	8	3
Car big	-	3	-	3	-		Leu vul	-	-	-	-	-		Sil aca	2	1	-	5	1
Car cap	2	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	1	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	1	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	2		Ste med	-	-	-	-	-
Car nor	-	-	4	5	8		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	5	3	5	4	8
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	3	1	1	9	-
Car pauc	-	-	-	-	-		Nar stri	2	-	-	-	-		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	1	-	-	-	-		Tof pus	1	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	1	1	2	4	2		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	2	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	3	4		Tri rep	-	-	-	-	-
Cer alp	-	-	-	-	-		Par pal	5	-	-	4	4		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	5		Phle alp	-	1	2	-	3		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	1	-	-	-		Phyl caer	1	-	-	-	-		Ver alp	2	1	4	3	3
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	3	-	-	-	-		Ver off	-	-	-	-	-
Des ces	-	16	-	5	1-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	1	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	3	3	5	8	1-
Epi ana	-	1	-	-	-		Poa alp	3	3	3	5	4		Vio pal	-	-	-	-	-
Epilob sp	-	-	1	-	-		Poa pra	1	2	-	3	2		Vio riv	-	-	-	-	-
Euph sp	1	-	-	-	1		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	1	1	-	3	1		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	1	-	-	2	1		Pot cra	2	-	-	3	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	-	-	-	-	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Skjellingahaugen (alp 4)

Block	I	I	II	II	V		Block	I	I	II	II	V		Block	I	I	II	II	V
Ach mil	-	-	-	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	2	2	8	4	4		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	1	-	-	1	-		Ran rep	-	-	-	-	-
Alc alp	1	-	-	-	5		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	1	5	5	7	3		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	-	-	1	-
Ant odo	1	-	2	2	3		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	1	-	1	-	-		Hier sp	-	-	-	-	-		Sag sp	-	-	1	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	3	-	4	-	8
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	2	4	5	5	9		Jun com	-	-	-	-	-		Saus alp	-	4	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	5	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	1	2	2	2	2		Kob sim	-	-	-	-	-		Sel sel	1	1	-	2	2
Car atra	-	-	-	-	-		Leo aut	1	-	2	2	-		Sib pro	8	1	2	6	5
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	1-	1	-	-	-
Car cap	4	2	1	6	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	1	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	1	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	12	3	2-	8	-
Car pauc	-	-	-	-	-		Nar stri	5	3-	3-	15	6		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	1	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	-	-	-	-	-
Cer alp	-	-	-	-	-		Par pal	1	-	1	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	1	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	1	-	-	1	-		Phyl caer	-	-	-	-	-		Ver alp	1	1	2	2	3
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	1	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	1	-	4	-		Ver off	-	-	-	-	-
Des ces	2	6	-	4	-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	1	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	3	1		Poa alp	1	2	1	1	-		Vio pal	1	1	8	5	7
Epilob sp	-	-	-	-	-		Poa pra	-	-	-	-	-		Vio riv	-	-	-	-	-
Euph sp	1	1	3	6	2		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	-	-	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	1	-	-	-	-		Pot cra	7	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	-	-	-	-	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Ålrust (int 1)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	5	4	2	5	3		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	1	5	-	2-	-
Agr cap	2-	5-	15	5-	1-		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	-	2	1	-	-		Gen pur cf	-	-	-	-	-		Rhi min	2	-	-	-	-
Alc sp	-	-	-	-	-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	2	-	1	-
Ant odo	5	-	-	-	-		Gym dry	-	-	-	-	-		Rum ac-la	-	1	4	1-	6
Arc alp	-	-	-	-	-		Hie pil	1-	1	2-	2-	1		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	1	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	-	-	-	-		Hier sp	-	-	-	-	-		Sag sp	1	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	3-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	25	5	-	-	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	1	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	1	2	2	-	2		Sed acr	-	-	-	-	-
Cam rot	2	2	-	1	-		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	2-	1-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	1-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	5	3-	1	2	8		Sil vul	2	-	3	-	-
Car ech	-	-	-	-	-		Luz mul	-	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	1	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	-	1	-	-		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	1	1-	1	1-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	3	1-	1-	1-	6
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	1	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	1	-	2	1-	2
Des ces	1	-	-	1	-		Pla lan	-	-	-	-	-		Ver serp	-	2	1	2-	1
Dia del	-	-	2	-	1		Pla maj	-	-	-	-	-		Vic cra	-	-	-	5	-
Emp her	-	-	-	-	-		Pla med	-	2	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	1	1	-	-	1		Vio pal	-	-	-	-	-
Epilob sp	-	-	-	-	-		Poa pra	-	-	-	-	-		Vio riv	1	5	8	1-	-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	3	-	-	-	-
Fes ovi	-	1	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	1	-	-	1	1		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	1	-	-	-	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	1	5	4	5	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Høgsete (int 2)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	1-	-	1-	1	1		Gal uli	-	-	-	1	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	15	3-	5	1-	1-		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	-	4	-	-	15		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	-	-	-	-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	-	1	-	-
Ant odo	1	5	1	35	1-		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	5	-	-	-		Hier sp	-	-	-	-	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	-	-	-	-	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	1	1	-	1	1		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	-	-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	-	-	2	1	2		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	5	-	-		Luz sp	-	-	-	-	-		Ste gra	1	-	1	1	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	-	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	-	-	-	-		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	3	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	1-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	1-	-	-	-	4
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	2	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	2	2	1	-	5
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	25	45	1-	2-	3-
Des ces	-	-	-	3-	-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	5	-	25	-	15
Epilob sp	-	-	-	-	-		Poa pra	2	1	2	1	1		Vio riv	2	-	1-	-	2
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	1	-	-
Fes ovi	2	1	1	-	2		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	5	3	2	5	4		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	1-	3	5	2	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	1	1	1	-	2		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Rambera (int 3)

Block	IV	IV	IV	V	V		Block	IV	IV	IV	V	V		Block	IV	IV	IV	V	V
Ach mil	4	4	5	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	3	3	3	6	15		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	4	-	4	8	-		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	-	-	-	1		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	5	4	2	2	2
Ant odo	7	5	4	8	1-		Gym dry	-	-	2	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	1	-	1	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	3	-	-	-	-
Ave fle	2	-	1	3	-		Hier sp	-	-	-	-	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	2	5	6	5	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	2	1	-	2	-		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	2	4	4	-	1		Sib pro	-	-	-	-	1
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	2	-	2	2	3		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	-	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	4	3	5	-	8		Thla arv	-	-	-	-	-
Car pil	-	-	3	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	1	-		Oxa ace	2	2	1	2	-		Tri pra	-	-	-	-	1
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	-	-	-	-	-
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	3	2	7	-	1
Cer cer	1	-	-	6	1		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	1	-		Phle prat	-	-	-	-	-		Vac vit	-	-	1	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	5	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	1-	6	8	-	-
Des ces	4	4-	7	4	25		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	2	-	1	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	4	4	4	35	4-
Epilob sp	3	2	2	-	-		Poa pra	-	1	-	-	-		Vio riv	-	-	-	-	-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	-	-	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	-	-	-	-	-		Pot cra	-	-	-	-	-		Viol sp	-	1	-	-	-
Fes viv	-	-	-	-	1		Pot ere	5	6	5	1	3-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Veskre (int 4)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	2	-	-
Agr cap	5	3	6	3	2		Gen ama	-	-	-	-	-		Ran aur	-	1	1	-	-
Agr mer	2	-	3	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	4	2	1	-	4		Gen pur cf	-	-	-	-	-		Rhi min	-	2	-	-	-
Alc sp	4	1-	2	-	6		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	4	-	-	-		Geu riv	-	-	-	-	4		Rum ace	-	-	-	-	-
Ant odo	3	2	1	-	-		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	2	-	5	-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	2	-	-	-	-
Ave fle	-	-	-	-	-		Hier sp	-	-	-	-	-		Sag sp	-	-	1	-	1
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	4	9	4	8	2		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	4	1	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	-	2	-	-	1		Kob sim	-	-	-	-	-		Sel sel	3	2	-	1	-
Car atra	-	-	-	-	-		Leo aut	-	4	8	16	8		Sib pro	4	4	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	2	3	2	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	3	-	1	-		Luz mul	1	2	-	1	-		Sol vir	-	-	-	-	-
Car fla	3	-	2	1	-		Luz pil	-	-	-	-	-		Sorbus	-	-	1	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	-	-	-	-	-
Car nigra	-	3	-	5	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	4	3	-	3		Mel pra	-	-	-	-	-		Tarax	-	-	4	-	-
Car pan	-	3	5	3	4		Myos cf	-	-	-	-	-		Tha alp	2	6	1	-	3
Car pauc	-	4	-	-	3		Nar stri	8	2	1	7	2		Thla arv	-	-	-	-	-
Car pil	-	6	4	2	6		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	1	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	4	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	8	-	2-	3	2
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	1	2
Cir pal	-	1-	-	2	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	2	-	-		Ver off	9	6	-	-	3
Des ces	3	2	6	2	1		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	3	5	-	8	3
Epilob sp	-	-	-	-	-		Poa pra	-	-	-	-	-		Vio riv	-	1	3	-	1
Euph sp	2	3	2	-	4		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	-	-	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	4	5	2	1	3		Pot cra	-	-	-	-	-		Viol sp	1	-	-	-	-
Fes viv	1	-	-	-	-		Pot ere	7	7	5	8	7		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	8	8	1-	12	4							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Fauske (low 1)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	15	2-	15	4	2-		Gal uli	-	-	2	-	2		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	2	8	8	-	2		Ran acr	1	-	-	1	-
Agr cap	1-	1-	5	4	15		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	-	-	-	-	-		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	25	4-	16	3-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	2	-	-	-
Ant odo	-	1	1	-	-		Gym dry	-	-	-	-	-		Rum ac-la	-	2	-	2	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	6-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	-	-	-	-		Hier sp	-	-	-	-	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	2	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	-	-	-	-	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	2	2	2	5		Sed acr	2	-	-	1	-
Cam rot	1	-	2	-	-		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	-	-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	5	2	2		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	1	-		Sil vul	-	-	2	-	-
Car ech	-	-	-	-	-		Luz mul	-	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	1	2	2	1	1
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	2	2	-	1
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	2	5	-	1	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	-	-	-	-		Thla arv	1	2	-	-	-
Car pil	-	-	-	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	1-	4	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	15	15	5	2	1-
Caru car	-	2	-	-	2		Oxy dig	-	-	-	-	-		Tri rep	2	-	-	-	5
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	6	-	2	2	8		Ver cha	-	-	-	-	-
Dac glo	1	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	1-	-	25	-	-
Des ces	-	-	-	-	-		Pla lan	-	2	-	-	-		Ver serp	1	5	-	-	-
Dia del	1	8	2	2	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	2	-
Emp her	-	-	-	-	-		Pla med	1	5	2-	-	5		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	8		Vio pal	-	-	-	-	-
Epilob sp	-	-	-	-	-		Poa pra	4	5	-	1	2		Vio riv	-	-	2	-	-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	-	-	5	1	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	-	-	-	2	5		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	-	-	-	-	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	1	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Vikesland (low 2)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	2-	3-	5	12	15		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	3-	-	-	1		Ran acr	2	2	1	-	5
Agr cap	1-	5	2-	3	5		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	5	-	-	-	-
Alc alp	-	-	-	-	-		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	-	-	-	-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	8	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	2	4	-	-	1-
Ant odo	2	5	2-	-	-		Gym dry	-	-	-	-	-		Rum ac-la	-	2	-	1	2
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	5		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	-	-	-	-		Hier sp	-	-	-	-	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	-	-	-	-	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	5	5	-	2	1-		Sed acr	-	-	-	-	-
Cam rot	2	2	1	1	1		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	-	-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	-	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	5	7	2	1	2
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	-	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	-	-	-	-		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	-		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	5	-	-	-
Caru car	-	-	1	-	-		Oxy dig	-	-	-	-	-		Tri rep	5	2-	4	-	8
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	-	-	-	1	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	75	5	2	6	2
Des ces	-	-	-	-	-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	-	-	-	-	-
Epilob sp	-	-	-	-	-		Poa pra	-	5	1	1	2		Vio riv	-	-	2	-	1-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	1	-	1
Fes ovi	-	-	-	15	4		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	1-	5	1	-	3		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	-	2	15	3	2-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

Appendix II: Vegetation recording continued

Arhelleren (low 3)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	3		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	5
Agr cap	5	6	2-	15	25		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	-	-	-	-	-		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	-	-	-	-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	2	2	-	-	2		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	4	-	-	4	-
Ant odo	6	7	2-	15	25		Gym dry	-	-	-	-	-		Rum ac-la	-	-	-	-	-
Arc alp	-	-	-	-	-		Hie pil	-	-	-	-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	-	-	-	1-		Hier sp	2	-	-	3	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	3	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	3	8	5	4	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	2	-	-	2	6		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	-	-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	-	2	-	-	2		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	4	-	-		Sorbus	-	-	-	-	-
Car lep	-	-	-	-	-		Luz sp	-	-	-	-	-		Ste gra	-	-	-	1	2
Car nigra	-	-	-	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	-	-	-	-	-
Car pal	3	4	3	2	-		Mel pra	-	5	4	5	-		Tarax	-	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	-	-	-	2		Thla arv	-	-	-	-	-
Car pil	-	-	6	-	4		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	4	7	6	6	2
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	1	-	-	-	4
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	1-	-	1	9	12
Des ces	-	-	-	-	-		Pla lan	3	1-	2	5	3		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	8	6	8	6	-
Epilob sp	-	-	-	-	-		Poa pra	-	-	-	-	2		Vio riv	-	-	-	-	-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	1	-	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	-	1	2	3	1		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	6	8	8	7	1-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

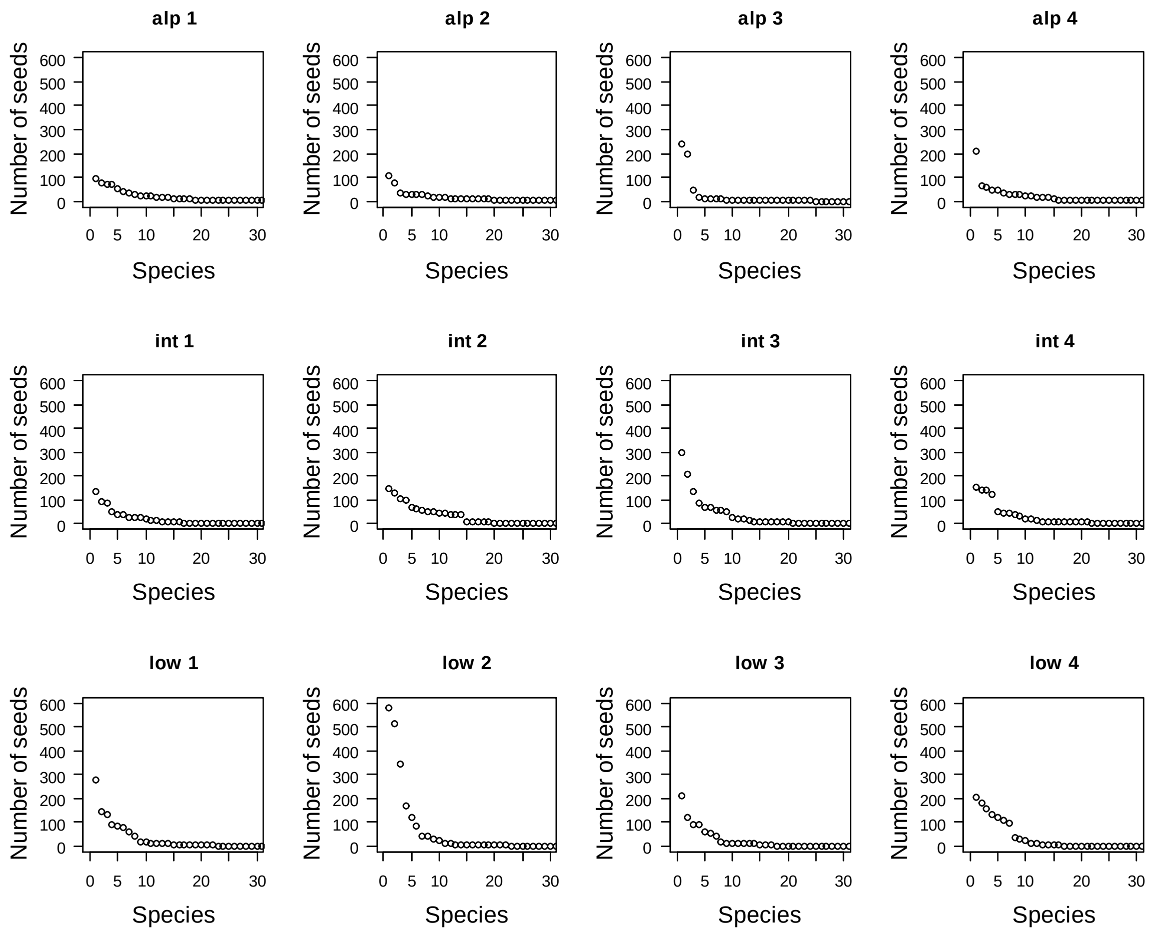
Appendix II: Vegetation recording continued

Øvstedal (low 4)

Block	I	II	III	IV	V		Block	I	II	III	IV	V		Block	I	II	III	IV	V
Ach mil	-	-	-	-	-		Gal uli	-	-	-	-	-		Pyr nor	-	-	-	-	-
Aco sep	-	-	-	-	-		Gal ver	-	-	-	-	-		Ran acr	-	-	-	-	-
Agr cap	1-	6	4-	2-	25		Gen ama	-	-	-	-	-		Ran aur	-	-	-	-	-
Agr mer	-	-	-	-	-		Gen niv	-	-	-	-	-		Ran rep	-	-	-	-	-
Alc alp	-	-	-	-	-		Gen pur cf	-	-	-	-	-		Rhi min	-	-	-	-	-
Alc sp	-	-	-	-	-		Gen ten	-	-	-	-	-		Rho ros	-	-	-	-	-
Ant alp	-	-	-	-	-		Ger syl	-	-	-	-	-		Rub idae	-	-	-	-	-
Ant dio	-	-	-	-	-		Geu riv	-	-	-	-	-		Rum ace	-	-	4	-	8
Ant odo	1-	9	2	-	3		Gym dry	-	-	-	-	-		Rum ac-la	4	2	8	6	-
Arc alp	-	-	-	-	-		Hie pil	5-	-	-	3-	-		Sag pro	-	-	-	-	-
Ast alp	-	-	-	-	-		Hie vulg	-	-	-	-	-		Sag sag	-	-	-	-	-
Ave fle	-	2	-	1	1		Hier sp	-	-	-	-	-		Sag sp	-	-	-	-	-
Bart alp	-	-	-	-	-		Hyp mac	-	-	-	-	-		Sal her	-	-	-	-	-
Bet nan	-	-	-	-	-		Hypo mac	-	-	-	-	-		Sal ret	-	-	-	-	-
Bet pub	-	-	-	-	-		Jun alp	-	-	-	-	-		Salix sp	-	-	-	-	-
Bis viv	-	-	-	-	-		Jun com	-	-	-	-	-		Saus alp	-	-	-	-	-
Bot lun	-	-	-	-	-		Jun tri	-	-	-	-	-		Sax aiz	-	-	-	-	-
Cal vul	-	-	-	-	-		Kna arv	-	-	-	-	-		Sed acr	-	-	-	-	-
Cam rot	3	5	-	3	-		Kob sim	-	-	-	-	-		Sel sel	-	-	-	-	-
Car atra	-	-	-	-	-		Leo aut	-	-	-	-	-		Sib pro	-	-	-	-	-
Car big	-	-	-	-	-		Leu vul	-	-	-	-	-		Sil aca	-	-	-	-	-
Car cap	-	-	-	-	-		Lot cor	-	-	-	-	-		Sil vul	-	-	-	-	-
Car ech	-	-	-	-	-		Luz mul	-	-	-	-	-		Sol vir	-	-	-	-	-
Car fla	-	-	-	-	-		Luz pil	-	-	-	-	-		Sorbus	-	-	-	-	-
Car lep	7	2	8	-	7		Luz sp	-	-	-	-	-		Ste gra	-	-	-	-	-
Car nigra	-	-	6	-	-		Luz spi	-	-	-	-	-		Ste med	-	-	-	-	-
Car nor	-	-	-	-	-		Lych vis	-	-	-	-	-		Suc pra	5	-	-	-	-
Car pal	-	-	-	-	-		Mel pra	-	-	-	-	-		Tarax	-	-	-	-	-
Car pan	-	-	-	-	-		Myos cf	-	-	-	-	-		Tha alp	-	-	-	-	-
Car pauc	-	-	-	-	-		Nar stri	-	15	-	-	6		Thla arv	-	-	-	-	-
Car pil	-	-	-	-	2		Oma nor	-	-	-	-	-		Tof pus	-	-	-	-	-
Car sax	-	-	-	-	-		Oma sup	-	-	-	-	-		Tri ces	-	-	-	-	-
Car vag	-	-	-	-	-		Oma syl	-	-	-	-	-		Tri med	-	-	-	-	-
Carex sp	-	-	-	-	-		Oxa ace	-	-	-	-	-		Tri pra	-	-	-	-	-
Caru car	-	-	-	-	-		Oxy dig	-	-	-	-	-		Tri rep	-	-	-	-	-
Cer alp	-	-	-	-	-		Par pal	-	-	-	-	-		Vac myr	-	-	-	-	-
Cer cer	-	-	-	-	-		Phle alp	-	-	-	-	-		Vac uli	-	-	-	-	-
Cer gla	-	-	-	-	-		Phle prat	-	-	-	-	-		Vac vit	-	-	-	-	-
Cer fon	-	-	-	-	-		Phyl caer	-	-	-	-	-		Ver alp	-	-	-	-	-
Cir pal	-	-	-	-	-		Pim sax	-	-	-	-	-		Ver cha	-	-	-	-	-
Dac glo	-	-	-	-	-		Pimp cf	-	-	-	-	-		Ver fru	-	-	-	-	-
Dant dec	-	-	-	-	-		Pin vul	-	-	-	-	-		Ver off	6	25	5	15	-
Des ces	-	-	-	-	-		Pla lan	-	-	-	-	-		Ver serp	-	-	-	-	-
Dia del	-	-	-	-	-		Pla maj	-	-	-	-	-		Vic cra	-	-	-	-	-
Emp her	-	-	-	-	-		Pla med	-	-	-	-	-		Vio bif	-	-	-	-	-
Epi ana	-	-	-	-	-		Poa alp	-	-	-	-	-		Vio pal	-	-	-	-	6
Epilob sp	-	-	-	-	-		Poa pra	-	-	-	-	-		Vio riv	-	-	-	-	-
Euph sp	-	-	-	-	-		Poaceae sp	-	-	-	-	-		Vio tri	-	-	-	-	-
Fes ovi	-	-	-	-	-		Pot arg	-	-	-	-	-		Vio tri cf	-	-	-	-	-
Fes rub	-	-	-	-	-		Pot cra	-	-	-	-	-		Viol sp	-	-	-	-	-
Fes viv	-	-	-	-	-		Pot ere	1	8	-	8	-		Visc vul	-	-	-	-	-
Gal bor	-	-	-	-	-		Pru vul	-	-	-	-	-							
Gal sax	-	-	-	-	-		Pyr min	-	-	-	-	-							

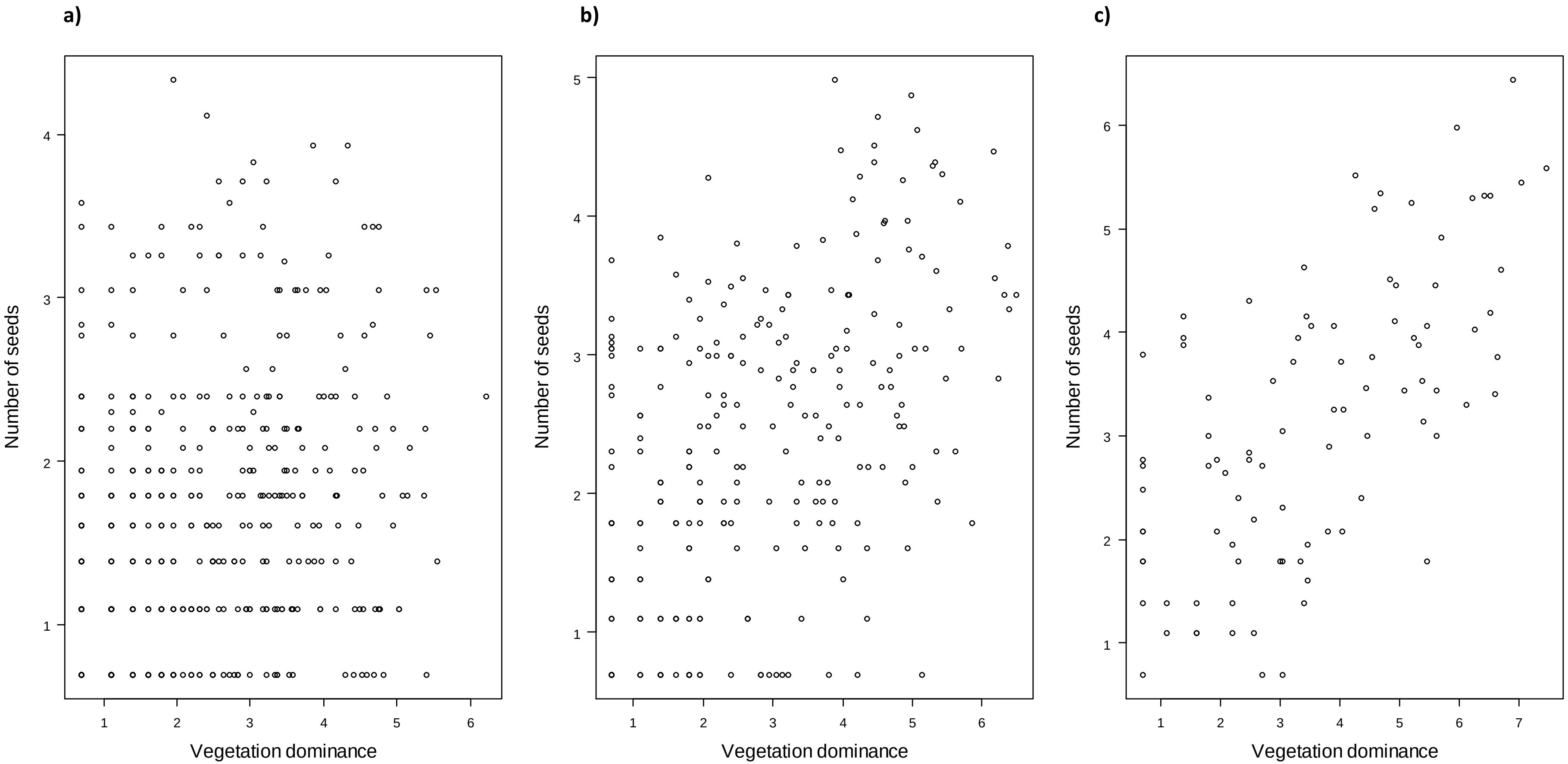
Appendix III : Abundance histograms by site (showing Evenness).

Seed species plotted from higher to lower seed abundances by site, from alpine to lowland. The plots give a graphical representation of the species evenness in seed production: higher evenness in lowland sites (fewer plants producing high number of seeds) is shown by a steeper curve-shape, while lower evenness, specially in alpine sites (a more equal abundance of seeds per species) is showed in the histogram as a flatter curve.



Appendix IV: Seed and vegetation abundance at different scales.

Number of seeds against the cover of its parent plant, in Log-transformed values, for each species in the vegetation at increasing sample areas; a) number of seeds per doormat against plant-species dominance in each block b) number of seeds in all 5 doormats in each site against mean plant-species dominance in each site and c) total number of seeds against mean plant dominance of each species in the whole data set. Vegetation dominance measured by species percentage cover within equal-size plots. A stronger correlation appears when zooming up increasing sampling areas showing an effect of sampling size and demonstrating the importance of scale when considering seed representation of species.



Appendix V: Vegetation-Seed rain species comparison

Total number of seeds produced by each species and total vegetation cover through the whole dataset.
Column A is seeds whose parent plants do not occur in the vegetation, Columns B and C compare seed and plant abundance from species present in seed and vegetation records. Column D shows the abundance of plants whose seeds were not recorded. Columns B and C provide the data plotted in Appendix IV. For plant name abbreviations, see Appendix VII.

Species Seed rain		Species Seed rain and vegetation						Species vegetation	
A		B			C			D	
Species	number of seeds	Species	Abun. ofplants	num.of seeds	Species	abun. of plants	num.of eeds	Species	abun. of plants
Phle prat	62	Ant odo	265	1756	Ant alp	5	27	Ast alp	53
Val off	49	Nar stri	230	1144	Ver alp	51	26	Ver serp	31
Poa sp	42	Agr cap	621	1001	Kna arv	40	24	Cir pal	17
Jun tri	37	Leo aut	99	811	Phle alp	20	20	Tri med	14
Emp nig	35	Sel sel	42	762	Ger syl	9	20	Saus alp	10
Sag niv	27	Car lep	29	744	Sax aiz	5	20	Epilob sp	9
Loi pro	16	Rum ace	65	681	Tof pus	1	20	Cal vul	8
Car pul	10	Hie pil	204	677	Rhin min	5	19	Sag pro	8
Jun sp	10	Des ces	204	616	Pla med	33	17	Emp her	7
Vio tri cf	8	Rum ac0la	55	529	Tri rep	155	14	Oxy dig	7
Ast sp	7	Pot ere	199	502	Hie vulg	14	14	Vic cra	7
Dant dec	6	Luz mul	26	454	Luz sp	1	14	Car atra	6
Agr sp	4	Ver off	395	391	Rub idae	8	12	Car fla	6
Ran sp	4	Vio bif	63	346	Viol sp	2	12	Pyr min	6
Vac sp	4	Alc alp	136	298	Sal her	73	11	Salix sp	6
Arr sp	3	Euph sp	30	276	Dia del	16	11	Caru car	5
Car dem	3	Leu vul	19	275	Vac myr	15	11	Gal uli	5
Gen ama	2	Cam rot	85	271	Oma sup	18	10	Ran rep	5
Vac uli	2	Pru vul	57	236	Agr mer	10	9	Ste med	5
Cer sp	1	Car pal	22	222	Gal sax	5	9	Suc pra	5
Gen cam	1	Car pil	33	218	Carex sp	3	8	Vac vit	5
Gen ten	1	Fes ovi	47	203	Oma nor	2	8	Geu riv	4
Gen sp	1	Tarax	51	188	Cer cer	13	7	Luz pil	4
Pot tab	1	Bis viv	189	179	Ver cha	15	6	Luz spi	4
Sax niv	1	Ste gra	30	160	Oxa ace	7	6	Pyr nor	4
Sax ste	1	Tri pra	85	139	Par pal	28	5	Sed acr	3

Appendix V: Vegetation-Seed rain species comparison continued

Species Seed rain and vegetation						Species vegetation	
Species	**abun. of plants**	**num.of seeds**	**Species**	**abun. of plants**	**num.ofseeds**	**Species**	**abun. of plants**
B			**C**			**D**	
Ran acr	60	137	Car nor	19	5	Bot lun	2
Fes rub	90	126	Car nigra	14	5	Fes viv	2
Vio riv	57	106	Hyp mac	33	4	Gym dry	2
Alc sp	178	96	Pot cra	15	4	Hypo mac	2
Poa pra	42	92	Ver fru	3	4	Ran aur	2
Pim sax	19	86	Phyl caer	2	4	Sal ret	2
Ave fle	31	84	Sib pro	63	3	Car sax	1
Sag sag	10	77	Gal ver	51	3	Cer alp	1
Ach mil	248	70	Lot cor	47	3	Cer gla	1
Pla lan	25	57	Oma syl	4	2	Gal bor	1
Car big	7	56	Sol vir	3	2	Gen pur cf	1
Car cap	40	55	Bet nan	2	2	Gram sp	1
Poa alp	57	49	Car pan	15	1	Rho ros	1
Sil aca	25	49	Mel pra	14	1	Sorbus	1
Ant dio	17	45	Pin vul	11	1		
Sag sp	7	44	Car pauc	7	1		
Vio tri	6	33	Sil vul	7	1		
Cer fon	6	31	Epi ana	5	1		
Car ech	4	31	Hier sp	5	1		
Vio pal	207	30	Thla arv	3	1		
Tha alp	101	29	Dac glo	1	1		
Gen niv	3	29	Car vag	43	1		

Appendix VI: List of abbreviations

Abr.	Latin name	Abr.	Latin name	Abr.	Latin name
Ach mil	*Achillea millefolium*	Fes rub	*Festuca rubra*	Pyr nor	*Pyrola norvegica*
Agr cap	*Agrostis capillaris*	Fes viv	*Festuca vivipara*	Ran acr	*Ranunculus acris*
Agr mer	*Agrostis mertenzii*	Gal bor	*Galium boreale*	Ran aur	*Ranunculus auricomus*
Agr sp	*Agrostis undifferenciated*	Gal sax	*Galium saxatile*	Ran rep	*Ranunculus repens*
Alc alp	*Alchemilla alpina*	Gal uli	*Galium uliginosum*	Ran sp	*Ranunculus* sp.
Alc sp	*Alchemilla undifferentiated*	Gal ver	*Galium verum*	Rhin min	*Rhinanthus minor*
Ant alp	*Antennaria alpina*	Gen ama	*Gentianella amarella*	Rho ros	*Rhodiola rosea*
Ant dio	*Antennaria dioica*	Gen cam	*Gentianella campestris*	Rub idae	*Rubus idaeus*
Ant odo	*Anthoxanthum odoratum*	Gen niv	*Gentiana nivalis*	Rum ace	*Rumex acetosa*
Arr sp	*Arrhenantherum* sp.	Gen pur cf	*Gentiana purpurea cf.*	Rum ac-la	*Rumex acetosella*
Ast alp	*Astragalus alpinum*	Gen sp	*Gentiana* sp.	Sag niv	*Sagina nivalis*
Ast sp	*Asteraceae* sp.	Gen ten	*Gentianella tenella*	Sag pro	*Sagina procumbens*
Ave fle	*Avenella flexuosa*	Ger syl	*Geranium sylvaticum*	Sag sag	*Sagina saginoides*
Bet nan	*Betula nana*	Geu riv	*Geum rivale*	Sag sp	*Sagina* sp..
Bet pub	*Betula pubescens*	Gym dry	*Gymnocarpium dryopteris*	Sal her	*Salix herbacea*
Bis viv	*Bistorta vivipara*	Hie pil	*Hieracium pilosella*	Sal ret	*Salix reticulata*
Bot lun	*Botrychium lunaria*	Hie vulg	*Hieracium vulgatum*	Salix sp	*Salix* sp.
Cal vul	*Calluna vulgaris*	Hier sp	*Hieracium sp.*	Saus alp	*Saussurea alpina*
Cam rot	*Campanula rotundifolia*	Hyp mac	*Hypochoeris maculata*	Sax aiz	*Saxifraga aizoides*
Car atra	*Carex atrata*	Jun sp	*Juncus sp.*	Sax niv	*Saxifraga nivalis*
Car big	*Carex bigelowii*	Jun tri	*Juncus trifidus*	Sax ste	*Saxifraga stellaris*
Car cap	*Carex capillaris*	Kna arv	*Knautia arvensis*	Sed acr	*Sedum acre*
Car dem	*Carex demissa*	Leo aut	*Leontodon autumnalis*	Sel sel	*Selaginella selaginoides*
Car ech	*Carex echinata*	Leu vul	*Leucanthemum vulgaris*	Sib pro	*Sibbaldia procumbens*
Car fla	*Carex flava*	Loi pro	*Loiseleuria procumbens*	Sil aca	*Silene acaulis*
Car lep	*Carex leporina*	Lot cor	*Lotus corniculatus*	Sil vul	*Silene vulgaris*
Car nig	*Carex nigra*	Luz mul	*Luzula multiflora*	Sol vir	*Solidago virgaurea*
Car nor	*Carex norvegica*	Luz pil	*Luzula pilulifera*	Sorbus	*Sorbus aucuparia*
Car pal	*Carex pallescens*	Luz sp	*Luzula sp.*	Ste gra	*Stellaria graminea*
Car pan	*Carex panicea*	Luz spi	*Luzula spicata*	Ste med	*Stellaria media*
Car pauc	*Carex pauciflora*	Mel pra	*Melampyrum pratense*	Suc pra	*Succisa pratensis*
Car pil	*Carex pilulifera*	Nar stri	*Nardus stricta*	Tarax	*Taraxacum* spp.
Car pul	*Carex pulicaris*	Oma nor	*Omalotheca norvegica*	Tha alp	*Thalictrum alpinum*
Car sax	*Carex saxatile*	Oma sup	*Omalotheca supina*	Thla arv	*Thlaspi arvense*
Car vag	*Carex vaginata*	Oma syl	*Oealotheca sylvatica*	Tof pus	*Tofieldia pusilla*
Car sp	*Carex* sp.	Oxa ace	*Oxalis acetosella*	Tri med	*Trifolium medium*
Caru car	*Carum carvi*	Oxy dig	*Oxycedrus digitalis*	Tri pra	*Trifolium pratense*
Cer alp	*Cerastium alpinum*	Par pal	*Parnassia palustris*	Tri rep	*Trifolium repens*
Cer cer	*Cerastium cerastoides*	Phle alp	*Phleum alpinum*	Vac myr	*Vaccinium myrtillus*
Cer fon	*Cerastium fontanum*	Phle prat	*Phleum pratense*	Vac sp	*Vaccinium sp.*
Cer gla	*Cerastium glabrum*	Phyl caer	*Phyllodoce caerulea*	Vac uli	*Vaccinium uliginosum*
Cer sp	*Cerastium* sp.	Pim sax	*Pimpinella saxifraga*	Val off	*Valeriana officinalis*
Cir pal	*Cirsium palustre*	Pin vul	*Pinguicula vulgaris*	Ver alp	*Veronica alpina*
Dac glo	*Dactylis glomerata*	Pla lan	*Plantago lanceolata*	Ver cha	*Veronica chamaedrys*
Dant dec	*Danthonia decumbens*	Pla med	*Plantago media*	Ver fru	*Veronica fruticans*
Des ces	*Deschampsia cespitosa*	Poa alp	*Poa alpina*	Ver off	*Veronica officinalis*
Dia del	*Dianthus deltoides*	Poa pra	*Poa pratensis*	Vio bif	*Viola biflora*
Emp her	*Empetrum hermaphroditum*	Poa sp	*Poaceae* sp..	Vio pal	*Viola palustris*
Emp nig	*Empetrum nigrum*	Pot cra	*Potentilla crantzii*	Vio riv	*Viola riviniana*
Epi ana	*Epilobium anagallidifolium*	Pot ere	*Potentilla erecta*	Vio tri	*Viola tricolor*
Epi sp	*Epilobium* sp.	Pot tab	*Potentilla tabernaemontani*	Viol sp	*Viola* sp.
Euph sp	*Euphrasia* sp.	Pru vul	*Prunella vulgaris*		
Fes ovi	*Festuca ovina*	Pyr min	*Pyrola minor*		