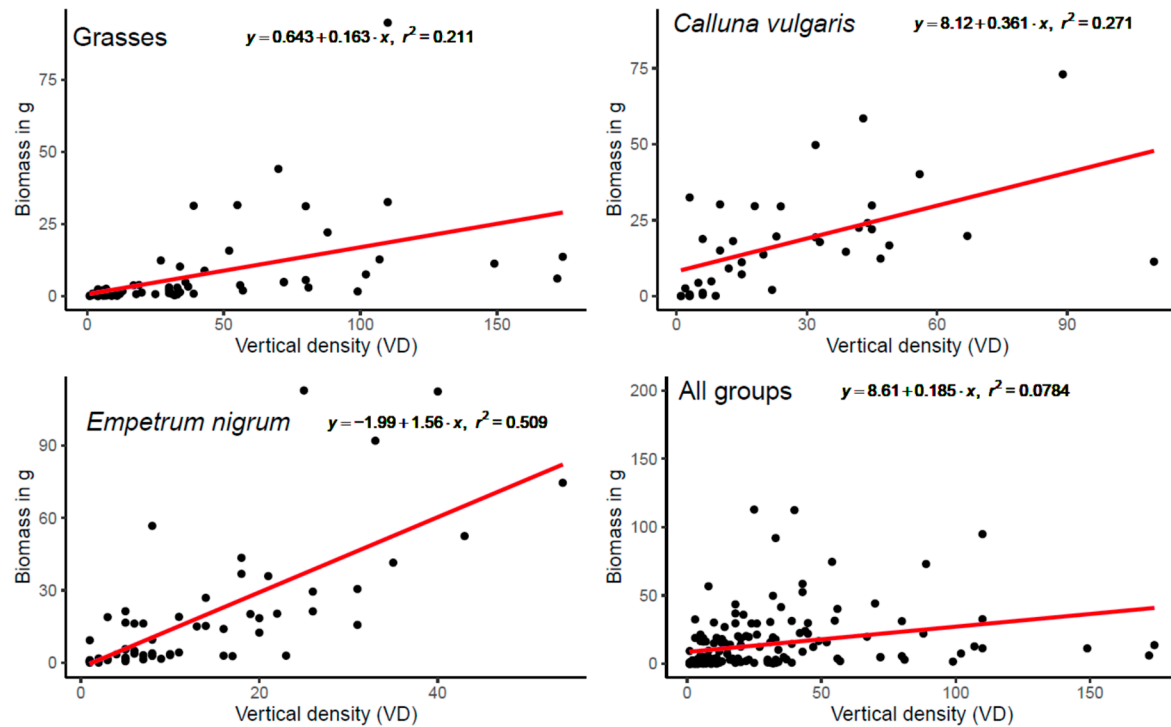


## Supplementary

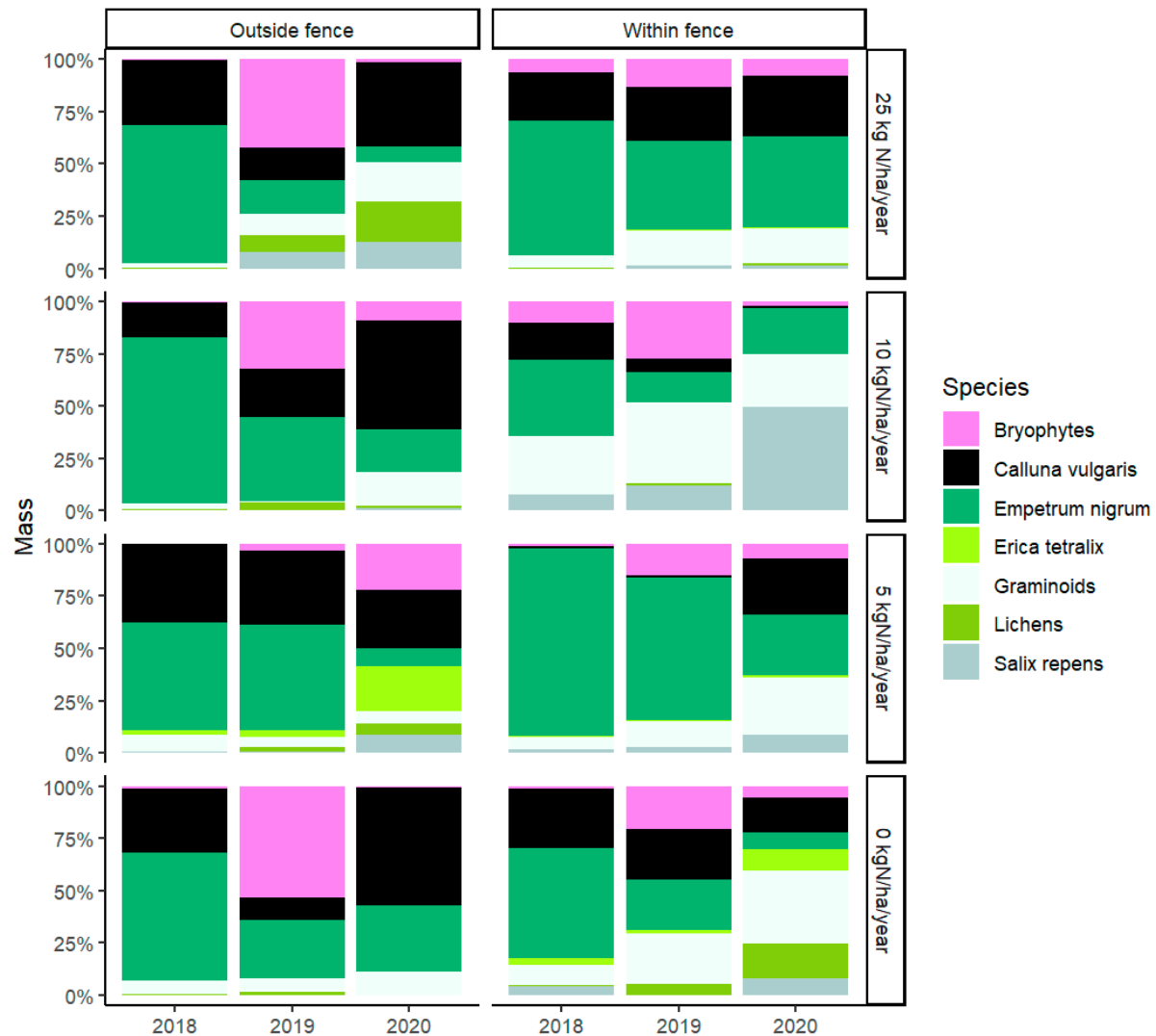
### Biomass

As a supplement to pinpoint sampling, the mowed plots' (n=40) material was gathered and sorted into functional groups or taxonomic species. The vertical density measurements were used to estimate biomass from the plots. Plotting the biomass material and vertical density from the same plots supports the hypothesis that higher vertical density equals higher biomass (Fig. S1). Results from the mowed plots show a higher biomass increase of ~51 per cent from 2019 to 2020 in mowed plots within the exclosures compared to the plots exposed to deer grazing.

**Figure S1.** Biomass as a function of vertical density (VD) with adjusted  $R^2$ . Here grasses are graminoids.



**Figure S2.** Proportional stacked bar graph of biomass harvest (i.e. mowing conducted in autumn) in the three different years. The plot shows the change in biomass for the different species or functional groups over three years.



## Models

**Figure S3.** Code syntax for models fitted in R with Block and plot ID as random effects (R Core Team, 2021).

Model for cover data; here, bbs is *Deschampsia flexuosa* summer data.

```
glmmTMB(cbind(COVER,25-COVER)
(Year+Dose+Fence+Harvest+Year:Dose+Year:Fence+Year:Harvest)+(1|Block)+(1|ID),
family=betabinomial(link = "logit"), data = bbs)
```

Model for vertical density data also with *Deschampsia flexuosa* summer data.

```
glmer.nb(VD ~ (Year+Dose+Fence+Harvest+Year:Dose+Year:Fence+Year:Harvest)+(1|Block)+(1|ID), data=bbs)
```

Model for ratio data; here, grass over dwarf shrubs ratio.

glmmTMB(Ratio ~ Year+Dose+Fence+Year:Dose+Year:Fence+Dose:Fence+Year:Dose:Fence+(1|Plot), data=bb, family=beta\_family())

### Coefficient tables

**Table S1.** Parameter estimates of *Avenella flexuosa* summer cover data significant terms are in bold.

| <u>Random effects</u> | Estimate      | Std. deviation | Std. Error   | z value       | Pr(> z )     |
|-----------------------|---------------|----------------|--------------|---------------|--------------|
| Block                 |               | 0.642          |              |               |              |
| ID                    |               | 0.881          |              |               |              |
| <u>Fixed effects</u>  |               |                |              |               |              |
| (Intercept)           | <b>-2.545</b> |                | <b>0.529</b> | <b>-4.812</b> | <b>0.000</b> |
| Year                  | <b>0.368</b>  |                | <b>0.171</b> | <b>2.156</b>  | <b>0.031</b> |
| Dose                  | -0.005        |                | 0.023        | -0.205        | 0.838        |
| FenceWithin           | 0.510         |                | 0.430        | 1.187         | 0.235        |
| HarvestYes            | <b>-0.869</b> |                | <b>0.429</b> | <b>-2.028</b> | <b>0.043</b> |
| Year:Dose             | 0.003         |                | 0.009        | 0.360         | 0.719        |
| Year:FenceWithin      | 0.012         |                | 0.165        | 0.074         | 0.941        |
| Year:HarvestYes       | <b>0.388</b>  |                | <b>0.165</b> | <b>2.352</b>  | <b>0.019</b> |

**Table S2.** Parameter estimates of *Avenella flexuosa* autumn cover data, significant terms are in bold.

| <u>Random effects</u> | Estimate      | Std. deviation | Std. Error   | z value       | Pr(> z )     |
|-----------------------|---------------|----------------|--------------|---------------|--------------|
| Block                 |               | 0.762          |              |               |              |
| ID                    |               | 1.126          |              |               |              |
| <u>Fixed effects</u>  |               |                |              |               |              |
| (Intercept)           | <b>-1.932</b> |                | <b>0.467</b> | <b>-4.137</b> | <b>0.000</b> |
| Year                  | -0.011        |                | 0.091        | -0.115        | 0.908        |
| Dose                  | -0.001        |                | 0.017        | -0.055        | 0.956        |
| FenceWithin           | 0.546         |                | 0.310        | 1.763         | 0.078        |
| HarvestYes            | -0.323        |                | 0.309        | -1.043        | 0.297        |
| Year:Dose             | 0.006         |                | 0.005        | 1.228         | 0.220        |
| Year:FenceWithin      | -0.048        |                | 0.089        | -0.547        | 0.584        |
| Year:HarvestYes       | <b>0.256</b>  |                | <b>0.088</b> | <b>2.900</b>  | <b>0.004</b> |

**Table S3.** Parameter estimates of graminoids summer cover data, significant terms are in bold.

| <u>Random effects</u>  | Estimate      | Std. deviation | Std. Error   | z value       | Pr(> z )     |
|------------------------|---------------|----------------|--------------|---------------|--------------|
| Block                  |               | 0.611          |              |               |              |
| ID                     |               | 0.874          |              |               |              |
| <u>Fixed effects</u>   |               |                |              |               |              |
| (Intercept)            | <b>-2.106</b> |                | <b>0.485</b> | <b>-4.340</b> | <b>0.000</b> |
| Year                   | <b>0.261</b>  |                | <b>0.154</b> | <b>1.690</b>  | <b>0.091</b> |
| Dose                   | -0.003        |                | 0.021        | -0.131        | 0.896        |
| FenceWithin            | 0.502         |                | 0.388        | 1.293         | 0.196        |
| HarvestYes             | <b>-0.809</b> |                | <b>0.387</b> | <b>-2.093</b> | <b>0.036</b> |
| Year:Dose              | 0.005         |                | 0.008        | 0.647         | 0.518        |
| Year:FenceWithin       | 0.070         |                | 0.148        | 0.472         | 0.637        |
| <b>Year:HarvestYes</b> | <b>0.335</b>  |                | <b>0.147</b> | <b>2.275</b>  | <b>0.023</b> |

**Table S4.** Parameter estimates of graminoids autumn cover data, significant terms are in bold.

| <b><u>Random effects</u></b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                        |                 | 0.680                 |                   |                |                    |
| ID                           |                 | 0.978                 |                   |                |                    |
| <b><u>Fixed effects</u></b>  |                 |                       |                   |                |                    |
| (Intercept)                  | <b>-1.027</b>   |                       | <b>0.406</b>      | <b>-2.529</b>  | <b>0.011</b>       |
| Year                         | -0.087          |                       | 0.079             | -1.100         | 0.271              |
| Dose                         | -0.008          |                       | 0.014             | -0.594         | 0.552              |
| FenceWithin                  | 0.392           |                       | 0.264             | 1.485          | 0.138              |
| HarvestYes                   | -0.312          |                       | 0.265             | -1.179         | 0.238              |
| Year:Dose                    | 0.007           |                       | 0.004             | 1.680          | 0.093              |
| Year:FenceWithin             | 0.120           |                       | 0.077             | 1.562          | 0.118              |
| Year:HarvestYes              | <b>0.207</b>    |                       | <b>0.077</b>      | <b>2.697</b>   | <b>0.007</b>       |

**Table S5.** Parameter estimates of dwarf shrubs autumn cover data, significant terms are in bold.

| <b><u>Random effects</u></b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                        |                 | 0.232                 |                   |                |                    |
| ID                           |                 | 0.569                 |                   |                |                    |
| <b><u>Fixed effects</u></b>  |                 |                       |                   |                |                    |
| (Intercept)                  | <b>1.265</b>    |                       | <b>0.247</b>      | <b>5.122</b>   | <b>0.000</b>       |
| Year                         | -0.036          |                       | 0.099             | -0.368         | 0.713              |
| Dose                         | -0.010          |                       | 0.011             | -0.908         | 0.364              |
| FenceWithin                  | -0.123          |                       | 0.215             | -0.572         | 0.567              |
| HarvestYes                   | -0.367          |                       | 0.215             | -1.704         | 0.088              |
| Year:Dose                    | 0.000           |                       | 0.005             | 0.067          | 0.947              |
| Year:FenceWithin             | -0.053          |                       | 0.097             | -0.551         | 0.582              |
| Year:HarvestYes              | <b>-0.648</b>   |                       | <b>0.098</b>      | <b>-6.643</b>  | <b>0.000</b>       |

**Table S6.** Parameter estimates of *Empetrum nigrum* summer cover data, significant terms are in bold.

| <b><u>Random effects</u></b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                        |                 | 0.723                 |                   |                |                    |
| ID                           |                 | 1.100                 |                   |                |                    |
| <b><u>Fixed effects</u></b>  |                 |                       |                   |                |                    |
| (Intercept)                  | -0.561          |                       | 0.522             | -1.074         | 0.283              |
| Year                         | 0.045           |                       | 0.147             | 0.304          | 0.762              |
| Dose                         | -0.014          |                       | 0.022             | -0.636         | 0.525              |
| FenceWithin                  | -0.442          |                       | 0.420             | -1.053         | 0.293              |
| HarvestYes                   | <b>-1.083</b>   |                       | <b>0.441</b>      | <b>-2.458</b>  | <b>0.014</b>       |
| Year:Dose                    | 0.006           |                       | 0.008             | 0.773          | 0.440              |
| Year:FenceWithin             | 0.205           |                       | 0.157             | 1.304          | 0.192              |
| Year:HarvestYes              | <b>-0.582</b>   |                       | <b>0.175</b>      | <b>-3.329</b>  | <b>0.001</b>       |

**Table S7.** Parameter estimates of *Empetrum nigrum* autumn cover data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                 |                 | 0.72                  |                   |                |                    |
| ID                    |                 | 1.53                  |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | -0.16           |                       | 0.51              | -0.32          | 0.75               |
| Year                  | -0.02           |                       | 0.10              | -0.20          | 0.84               |
| Dose                  | 0.00            |                       | 0.02              | -0.16          | 0.87               |
| FenceWithin           | 0.12            |                       | 0.39              | 0.32           | 0.75               |
| HarvestYes            | -0.03           |                       | 0.39              | -0.07          | 0.94               |
| Year:Dose             | 0.00            |                       | 0.01              | -0.17          | 0.87               |
| Year:FenceWithin      | 0.07            |                       | 0.10              | 0.64           | 0.53               |
| Year:HarvestYes       | <b>-1.17</b>    |                       | <b>0.12</b>       | <b>-10.05</b>  | <b>0.00</b>        |

**Table S8.** Parameter estimates of *Calluna vulgaris* summer cover data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                 |                 | 0.969                 |                   |                |                    |
| ID                    |                 | 1.875                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | -0.826          |                       | 0.822             | -1.005         | 0.315              |
| Year                  | <b>-0.931</b>   |                       | <b>0.260</b>      | <b>-3.578</b>  | <b>0.000</b>       |
| Dose                  | 0.002           |                       | 0.039             | 0.050          | 0.960              |
| FenceWithin           | -1.180          |                       | 0.720             | -1.639         | 0.101              |
| HarvestYes            | <b>-2.299</b>   |                       | <b>0.731</b>      | <b>-3.142</b>  | <b>0.002</b>       |
| Year:Dose             | -0.007          |                       | 0.015             | -0.494         | 0.621              |
| Year:FenceWithin      | 0.299           |                       | 0.264             | 1.130          | 0.258              |
| Year:HarvestYes       | <b>0.762</b>    |                       | <b>0.271</b>      | <b>2.809</b>   | <b>0.005</b>       |

**Table S9.** Parameter estimates of *Carex arenaria* summer cover data, significant terms are in bold.

| <b>Random effects</b>  | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                  |                 | 0.263                 |                   |                |                    |
| ID                     |                 | 0.857                 |                   |                |                    |
| <b>Fixed effects</b>   |                 |                       |                   |                |                    |
| (Intercept)            | <b>-3.813</b>   |                       | <b>0.639</b>      | <b>-5.970</b>  | <b>0.000</b>       |
| Year                   | -0.021          |                       | 0.254             | -0.081         | 0.935              |
| Dose                   | <b>0.091</b>    |                       | <b>0.037</b>      | <b>2.498</b>   | <b>0.012</b>       |
| FenceWithin            | 1.028           |                       | 0.759             | 1.354          | 0.176              |
| HarvestYes             | -0.232          |                       | 0.621             | -0.374         | 0.709              |
| Year:Dose              | -0.024          |                       | 0.015             | -1.554         | 0.120              |
| Year:FenceWithin       | -0.007          |                       | 0.300             | -0.023         | 0.982              |
| Year:HarvestYes        | 0.160           |                       | 0.203             | 0.790          | 0.430              |
| Dose:FenceWithin       | <b>-0.116</b>   |                       | <b>0.050</b>      | <b>-2.309</b>  | <b>0.021</b>       |
| Dose:HarvestYes        | -0.040          |                       | 0.028             | -1.419         | 0.156              |
| FenceWithin:HarvestYes | -0.664          |                       | 0.532             | -1.250         | 0.211              |
| Year:Dose:FenceWithin  | <b>0.046</b>    |                       | <b>0.021</b>      | <b>2.207</b>   | <b>0.027</b>       |

**Table S10.** Parameter estimates of *Carex arenaria* autumn cover data, significant terms are in bold.

| <b>Random effects</b>  | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                  |                 | 0.504                 |                   |                |                    |
| ID                     |                 | 0.843                 |                   |                |                    |
| <b>Fixed effects</b>   |                 |                       |                   |                |                    |
| (Intercept)            | <b>-2.444</b>   |                       | <b>0.408</b>      | <b>-5.985</b>  | <b>0.000</b>       |
| Year                   | 0.023           |                       | 0.106             | 0.220          | 0.826              |
| Dose                   | 0.006           |                       | 0.023             | 0.275          | 0.783              |
| FenceWithin            | 0.475           |                       | 0.434             | 1.096          | 0.273              |
| HarvestYes             | -0.369          |                       | 0.413             | -0.892         | 0.372              |
| Year:Dose              | -0.006          |                       | 0.007             | -0.807         | 0.420              |
| Year:FenceWithin       | -0.025          |                       | 0.131             | -0.193         | 0.847              |
| Year:HarvestYes        | 0.083           |                       | 0.090             | 0.922          | 0.356              |
| Dose:FenceWithin       | -0.035          |                       | 0.028             | -1.251         | 0.211              |
| Dose:HarvestYes        | -0.001          |                       | 0.023             | -0.046         | 0.963              |
| FenceWithin:HarvestYes | -0.008          |                       | 0.437             | -0.019         | 0.985              |
| Year:Dose:FenceWithin  | <b>0.025</b>    |                       | <b>0.010</b>      | <b>2.569</b>   | <b>0.010</b>       |

**Table S11.** Parameter estimates of bryophytes summer cover data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                 |                 | 0.29                  |                   |                |                    |
| ID                    |                 | 0.67                  |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>-1.79</b>    |                       | <b>0.32</b>       | <b>-5.54</b>   | <b>0.00</b>        |
| Year                  | 0.82            |                       | <b>0.11</b>       | <b>7.55</b>    | <b>0.00</b>        |
| Dose                  | 0.03            |                       | 0.02              | 1.85           | 0.06               |
| FenceWithin           | 0.11            |                       | 0.19              | 0.57           | 0.57               |
| HarvestYes            | 0.11            |                       | 0.19              | 0.59           | 0.55               |
| Year:Dose             | <b>-0.02</b>    |                       | <b>0.01</b>       | <b>-2.16</b>   | <b>0.03</b>        |

**Table S12.** Parameter estimates of bryophytes autumn cover data, significant terms are in bold.

| <b>Random effects</b>  | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                  |                 | 0.000                 |                   |                |                    |
| ID                     |                 | 0.868                 |                   |                |                    |
| <b>Fixed effects</b>   |                 |                       |                   |                |                    |
| (Intercept)            | <b>-0.982</b>   |                       | <b>0.334</b>      | <b>-2.943</b>  | <b>0.003</b>       |
| Year                   | <b>-0.272</b>   |                       | <b>0.103</b>      | <b>-2.640</b>  | <b>0.008</b>       |
| Dose                   | 0.006           |                       | 0.023             | 0.271          | 0.787              |
| FenceWithin            | -0.415          |                       | 0.434             | -0.957         | 0.339              |
| HarvestYes             | 0.288           |                       | 0.411             | 0.700          | 0.484              |
| Year:Dose              | -0.006          |                       | 0.007             | -0.833         | 0.405              |
| Year:FenceWithin       | 0.251           |                       | 0.129             | 1.949          | 0.051              |
| Year:HarvestYes        | <b>0.240</b>    |                       | <b>0.089</b>      | <b>2.686</b>   | <b>0.007</b>       |
| Dose:FenceWithin       | 0.049           |                       | 0.027             | 1.806          | 0.071              |
| Dose:HarvestYes        | -0.023          |                       | 0.024             | -0.970         | 0.332              |
| FenceWithin:HarvestYes | -0.100          |                       | 0.440             | -0.227         | 0.821              |
| Year:Dose:FenceWithin  | <b>-0.023</b>   |                       | <b>0.010</b>      | <b>-2.337</b>  | <b>0.019</b>       |

**Table S13.** Parameter estimates of *Pleurozium shreberi* autumn cover data, significant terms are in bold.

| <b>Random effects</b>  | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| Block                  |                 | 0.000                 |                   |                |                    |
| ID                     |                 | 1.213                 |                   |                |                    |
| <b>Fixed effects</b>   |                 |                       |                   |                |                    |
| (Intercept)            | <b>-1.165</b>   |                       | <b>0.427</b>      | <b>-2.726</b>  | <b>0.006</b>       |
| Year                   | <b>-0.250</b>   |                       | <b>0.107</b>      | <b>-2.345</b>  | <b>0.019</b>       |
| Dose                   | -0.027          |                       | 0.030             | -0.899         | 0.369              |
| FenceWithin            | -0.514          |                       | 0.561             | -0.917         | 0.359              |
| HarvestYes             | 0.073           |                       | 0.539             | 0.136          | 0.892              |
| Year:Dose              | -0.009          |                       | 0.008             | -1.125         | 0.260              |
| Year:FenceWithin       | 0.257           |                       | 0.136             | 1.886          | 0.059              |
| Year:HarvestYes        | <b>0.240</b>    |                       | <b>0.094</b>      | <b>2.546</b>   | <b>0.011</b>       |
| Dose:FenceWithin       | <b>0.080</b>    |                       | <b>0.035</b>      | <b>2.256</b>   | <b>0.024</b>       |
| Dose:HarvestYes        | -0.002          |                       | 0.032             | -0.077         | 0.939              |
| FenceWithin:HarvestYes | -0.181          |                       | 0.593             | -0.305         | 0.760              |
| Year:Dose:FenceWithin  | <b>-0.023</b>   |                       | <b>0.011</b>      | <b>-2.148</b>  | <b>0.032</b>       |

**Table S14.** Parameter estimates of *Avenella flexuosa* summer vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 1.090                 |                   |                |                    |
| Block                 |                 | 0.743                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | 0.792           |                       | 0.536             | 1.477          | 0.140              |
| Year                  | <b>0.305</b>    |                       | <b>0.150</b>      | <b>2.033</b>   | <b>0.042</b>       |
| Dose                  | -0.002          |                       | 0.022             | -0.073         | 0.942              |
| FenceWithin           | 0.775           |                       | 0.406             | 1.910          | 0.056              |
| HarvestYes            | -0.757          |                       | 0.405             | -1.871         | 0.061              |
| Year:Dose             | 0.004           |                       | 0.008             | 0.570          | 0.569              |
| Year:FenceWithin      | -0.019          |                       | 0.143             | -0.133         | 0.894              |
| Year:HarvestYes       | <b>0.374</b>    |                       | <b>0.143</b>      | <b>2.626</b>   | <b>0.009</b>       |

**Table S15.** Parameter estimates of *Avenella flexuosa* autumn vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 1.366                 |                   |                |                    |
| Block                 |                 | 0.889                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>1.133</b>    |                       | <b>0.539</b>      | <b>2.100</b>   | <b>0.036</b>       |
| Year                  | 0.166           |                       | 0.089             | 1.869          | 0.062              |
| Dose                  | 0.010           |                       | 0.019             | 0.547          | 0.585              |
| FenceWithin           | 0.572           |                       | 0.353             | 1.622          | 0.105              |
| HarvestYes            | -0.330          |                       | 0.353             | -0.934         | 0.350              |
| Year:Dose             | 0.006           |                       | 0.005             | 1.399          | 0.162              |
| Year:FenceWithin      | -0.010          |                       | 0.085             | -0.120         | 0.904              |
| Year:HarvestYes       | <b>0.332</b>    |                       | <b>0.085</b>      | <b>3.917</b>   | <b>0.000</b>       |

**Table S16.** Parameter estimates of graminoids summer vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 0.985                 |                   |                |                    |
| Block                 |                 | 0.633                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>1.335</b>    |                       | <b>0.460</b>      | <b>2.899</b>   | <b>0.004</b>       |
| Year                  | 0.182           |                       | 0.127             | 1.433          | 0.152              |
| Dose                  | 0.003           |                       | 0.018             | 0.140          | 0.889              |
| FenceWithin           | 0.659           |                       | 0.349             | 1.888          | 0.059              |
| HarvestYes            | <b>-0.768</b>   |                       | <b>0.348</b>      | <b>-2.204</b>  | <b>0.028</b>       |
| Year:Dose             | 0.004           |                       | 0.006             | 0.650          | 0.516              |
| Year:FenceWithin      | 0.050           |                       | 0.120             | 0.417          | 0.677              |
| Year:HarvestYes       | <b>0.336</b>    |                       | <b>0.120</b>      | <b>2.802</b>   | <b>0.005</b>       |

**Table S17.** Parameter estimates of graminoids autumn vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 0.934                 |                   |                |                    |
| Block                 |                 | 0.611                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>2.022</b>    |                       | <b>0.369</b>      | <b>5.473</b>   | <b>0.000</b>       |
| Year                  | 0.128           |                       | 0.066             | 1.950          | 0.051              |
| Dose                  | -0.004          |                       | 0.013             | -0.310         | 0.756              |
| FenceWithin           | 0.407           |                       | 0.243             | 1.671          | 0.095              |
| HarvestYes            | -0.257          |                       | 0.244             | -1.055         | 0.292              |
| Year:Dose             | 0.006           |                       | 0.003             | 1.913          | 0.056              |
| Year:FenceWithin      | 0.097           |                       | 0.063             | 1.546          | 0.122              |
| Year:HarvestYes       | <b>0.235</b>    |                       | <b>0.063</b>      | <b>3.736</b>   | <b>0.000</b>       |

**Table S18.** Parameter estimates of dwarf shrubs autumn vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 0.284                 |                   |                |                    |
| Block                 |                 | 0.142                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>4.290</b>    |                       | <b>0.152</b>      | <b>28.262</b>  | <b>0.000</b>       |
| Year                  | 0.049           |                       | 0.064             | 0.767          | 0.443              |
| Dose                  | -0.005          |                       | 0.007             | -0.733         | 0.463              |
| FenceWithin           | -0.119          |                       | 0.134             | -0.888         | 0.374              |
| HarvestYes            | -0.234          |                       | 0.134             | -1.743         | 0.081              |
| Year:Dose             | 0.001           |                       | 0.003             | 0.220          | 0.826              |
| Year:FenceWithin      | -0.011          |                       | 0.062             | -0.169         | 0.866              |
| Year:HarvestYes       | <b>-0.460</b>   |                       | <b>0.063</b>      | <b>-7.307</b>  | <b>0.000</b>       |



**Table S19.** Parameter estimates of *Empetrum nigrum* summer vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 1.136                 |                   |                |                    |
| Block                 |                 | 0.638                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>2.893</b>    |                       | <b>0.477</b>      | <b>6.060</b>   | <b>0.000</b>       |
| Year                  | -0.098          |                       | 0.129             | -0.761         | 0.446              |
| Dose                  | -0.013          |                       | 0.020             | -0.625         | 0.532              |
| FenceWithin           | -0.333          |                       | 0.384             | -0.869         | 0.385              |
| HarvestYes            | <b>-0.856</b>   |                       | <b>0.385</b>      | <b>-2.225</b>  | <b>0.026</b>       |
| Year:Dose             | 0.002           |                       | 0.007             | 0.314          | 0.754              |
| Year:FenceWithin      | 0.257           |                       | 0.133             | 1.933          | 0.053              |
| Year:HarvestYes       | <b>-0.533</b>   |                       | <b>0.135</b>      | <b>-3.932</b>  | <b>0.000</b>       |

**Table S20.** Parameter estimates of *Empetrum nigrum* autumn vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 1.598                 |                   |                |                    |
| Block                 |                 | 0.778                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>2.814</b>    |                       | <b>0.534</b>      | <b>5.272</b>   | <b>0.000</b>       |
| Year                  | 0.073           |                       | 0.083             | 0.886          | 0.375              |
| Dose                  | -0.005          |                       | 0.021             | -0.241         | 0.809              |
| FenceWithin           | 0.257           |                       | 0.394             | 0.652          | 0.514              |
| HarvestYes            | 0.066           |                       | 0.393             | 0.167          | 0.867              |
| Year:Dose             | -0.002          |                       | 0.004             | -0.473         | 0.636              |
| Year:FenceWithin      | 0.074           |                       | 0.080             | 0.926          | 0.354              |
| Year:HarvestYes       | <b>-0.837</b>   |                       | <b>0.081</b>      | <b>-10.354</b> | <b>0.000</b>       |

**Table S21.** Parameter estimates of *Carex arenaria* summer vertical density data, significant terms are in bold.

| <b>Random effects</b>  | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|------------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                     |                 | 0.951                 |                   |                |                    |
| Block                  |                 | 0.307                 |                   |                |                    |
| <b>Fixed effects</b>   |                 |                       |                   |                |                    |
| (Intercept)            | -0.854          |                       | 0.700             | -1.220         | 0.222              |
| Year                   | 0.096           |                       | 0.266             | 0.359          | 0.719              |
| Dose                   | <b>0.111</b>    |                       | <b>0.042</b>      | <b>2.643</b>   | <b>0.008</b>       |
| FenceWithin            | 1.527           |                       | 0.842             | 1.814          | 0.070              |
| HarvestYes             | -0.149          |                       | 0.685             | -0.218         | 0.828              |
| Year:Dose              | -0.027          |                       | 0.017             | -1.651         | 0.099              |
| Year:FenceWithin       | -0.126          |                       | 0.325             | -0.389         | 0.697              |
| Year:HarvestYes        | 0.176           |                       | 0.219             | 0.805          | 0.421              |
| Dose:FenceWithin       | <b>-0.140</b>   |                       | <b>0.058</b>      | <b>-2.418</b>  | <b>0.016</b>       |
| Dose:HarvestYes        | -0.045          |                       | 0.031             | -1.469         | 0.142              |
| FenceWithin:HarvestYes | -0.815          |                       | 0.579             | -1.407         | 0.159              |
| Year:Dose:FenceWithin  | <b>0.054</b>    |                       | <b>0.024</b>      | <b>2.236</b>   | <b>0.025</b>       |

**Table S22.** Parameter estimates of *Carex arenaria* autumn vertical density data, significant terms are in bold.

| <b>Random effects</b> | <b>Estimate</b> | <b>Std. deviation</b> | <b>Std. Error</b> | <b>z value</b> | <b>Pr(&gt; z )</b> |
|-----------------------|-----------------|-----------------------|-------------------|----------------|--------------------|
| ID                    |                 | 0.830                 |                   |                |                    |
| Block                 |                 | 0.486                 |                   |                |                    |
| <b>Fixed effects</b>  |                 |                       |                   |                |                    |
| (Intercept)           | <b>0.908</b>    |                       | <b>0.340</b>      | <b>2.668</b>   | <b>0.008</b>       |
| Year                  | 0.087           |                       | 0.086             | 1.015          | 0.310              |
| Dose                  | -0.012          |                       | 0.014             | -0.825         | 0.409              |
| FenceWithin           | 0.108           |                       | 0.266             | 0.406          | 0.685              |
| HarvestYes            | -0.249          |                       | 0.218             | -1.141         | 0.254              |
| Year:Dose             | 0.007           |                       | 0.005             | 1.288          | 0.198              |
| Year:FenceWithin      | <b>0.248</b>    |                       | <b>0.095</b>      | <b>2.600</b>   | <b>0.009</b>       |

### Species list

We compiled a list of all vascular species within the plots in 2018. Results are rendered below.

**Table S23.** Species list of vascular plants, "1" means present and "0" is not present.

| <b>Species</b>                | <b>Block 1</b> | <b>Block 2</b> | <b>Block 3</b> | <b>Block 4</b> | <b>Block 5</b> | <b>Blocks with the species</b> |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|--------------------------------|
| <i>Antennaria dioica</i>      | 0              | 0              | 1              | 0              | 0              | 1                              |
| <i>Calluna vulgaris</i>       | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Carex arenaria</i>         | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Carex pilulifera</i>       | 0              | 1              | 0              | 0              | 0              | 1                              |
| <i>Deschampsia flexuosa</i>   | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Empetrum nigrum</i>        | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Erica tetralix</i>         | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Festuca ovina</i>          | 0              | 0              | 1              | 0              | 0              | 1                              |
| <i>Genista anglica</i>        | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Hieracium umbellatum</i>   | 0              | 1              | 1              | 1              | 1              | 4                              |
| <i>Hypochoeris radicata</i>   | 0              | 1              | 1              | 1              | 1              | 4                              |
| <i>Luzula campestris</i>      | 1              | 0              | 1              | 1              | 0              | 3                              |
| <i>Myrica gale</i>            | 0              | 0              | 0              | 0              | 1              | 1                              |
| <i>Nardus stricta</i>         | 1              | 1              | 1              | 0              | 0              | 3                              |
| <i>Poa pratensis</i>          | 1              | 0              | 0              | 0              | 0              | 1                              |
| <i>Potentilla erecta</i>      | 1              | 0              | 0              | 0              | 0              | 1                              |
| <i>Prunus serotina</i>        | 1              | 0              | 0              | 0              | 0              | 1                              |
| <i>Quercus robur</i>          | 0              | 0              | 1              | 0              | 0              | 1                              |
| <i>Rumex acetosa</i>          | 1              | 0              | 0              | 0              | 1              | 2                              |
| <i>Salix repens</i>           | 1              | 1              | 1              | 1              | 1              | 5                              |
| <i>Sorbus aucuparia</i>       | 0              | 0              | 1              | 0              | 0              | 1                              |
| <i>Vaccinium uliginosum</i>   | 0              | 0              | 0              | 0              | 1              | 1                              |
| <i>Viola canina</i>           | 1              | 0              | 0              | 0              | 0              | 1                              |
| <b>Total species richness</b> | <b>14</b>      | <b>11</b>      | <b>15</b>      | <b>10</b>      | <b>12</b>      | <b>23</b>                      |

**Table S24.** Species list of some of the lichens and mosses at Vust heath. The invasive *C. introflexus* was only present in one block.

| Species                       | Block 1 | Block 2 | Block 3 | Block 4 | Block 5 | Blocks with the species |
|-------------------------------|---------|---------|---------|---------|---------|-------------------------|
| <i>Campylopus introflexus</i> | 0       | 1       | 0       | 0       | 0       | 1                       |
| <i>Cladina</i> sp.            | 1       | 1       | 1       | 1       | 1       | 5                       |
| <i>Cladonia</i> sp.           | 0       | 1       | 1       | 0       | 0       | 2                       |
| <i>Dicranum</i> sp.           | 1       | 1       | 1       | 1       | 1       | 5                       |
| <i>Hyloconium splendens</i>   | 0       | 0       | 0       | 0       | 1       | 1                       |
| <i>Hypnum cupressiforme</i>   | 1       | 1       | 1       | 1       | 1       | 5                       |
| <i>Pleurocarp Pleurozium</i>  | 1       | 1       | 1       | 1       | 1       | 5                       |
| <i>Ptilidium ciliare</i>      | 0       | 0       | 1       | 0       | 0       | 1                       |

**Table S25.** The number of pin-presence observations in the data set per species.

| Species                       | Number of observations |
|-------------------------------|------------------------|
| <i>Campylopus introflexus</i> | 5                      |
| <i>Dicranum</i> ssp.          | 124                    |
| <i>Calluna vulgaris</i>       | 239                    |
| <i>Campanula rotundifolia</i> | 2                      |
| <i>Carex arenaria</i>         | 357                    |
| <i>Cladina</i> ssp.           | 136                    |
| <i>Cladonia portentosa</i>    | 1                      |
| <i>Cladonia</i> ssp.          | 87                     |
| <i>Deschampsia flexuosa</i>   | 448                    |
| <i>Empetrum nigrum</i>        | 433                    |
| <i>Erica tetralix</i>         | 33                     |
| <i>Festuca ovina</i>          | 23                     |
| <i>Genista anglica</i>        | 15                     |
| <i>Hieracium pilosella</i>    | 1                      |
| <i>Hieracium umbellatum</i>   | 13                     |
| <i>Hylocomium splendens</i>   | 7                      |
| <i>Hypochoeris radicata</i>   | 7                      |
| <i>Luzula campestris</i>      | 1                      |
| <i>Myrica gale</i>            | 7                      |
| <i>Nardus stricta</i>         | 5                      |
| <i>Hylocomium splendens</i>   | 1                      |
| <i>Hypnum</i> ssp.            | 160                    |
| <i>Pleurozium schreberi</i>   | 457                    |
| <i>Ptilidium ciliare</i>      | 17                     |
| <i>Salix repens</i>           | 96                     |
| <i>Scleropodium purum</i>     | 1                      |
| Sum                           | 2676                   |

Tables of means and standard error of the means from the different years.

**Table S26.** Shows means and the standard error of the mean of the cover from the different treatments for *Avenella flexuosa* in summer.

| Harvest | Fence   | Dose | Year | Mean  | Std.Error |
|---------|---------|------|------|-------|-----------|
| No      | Outside | 0    | 2    | 0.152 | 0.070     |
| No      | Outside | 0    | 4    | 0.208 | 0.112     |
| No      | Outside | 5    | 2    | 0.256 | 0.152     |
| No      | Outside | 5    | 4    | 0.336 | 0.093     |
| No      | Outside | 10   | 2    | 0.112 | 0.061     |
| No      | Outside | 10   | 4    | 0.320 | 0.110     |
| No      | Outside | 25   | 2    | 0.096 | 0.037     |
| No      | Outside | 25   | 4    | 0.304 | 0.111     |
| No      | Within  | 0    | 2    | 0.184 | 0.154     |
| No      | Within  | 0    | 4    | 0.400 | 0.148     |
| No      | Within  | 5    | 2    | 0.104 | 0.066     |
| No      | Within  | 5    | 4    | 0.128 | 0.077     |
| No      | Within  | 10   | 2    | 0.288 | 0.054     |
| No      | Within  | 10   | 4    | 0.504 | 0.151     |
| No      | Within  | 25   | 2    | 0.280 | 0.154     |
| No      | Within  | 25   | 4    | 0.296 | 0.097     |
| Yes     | Outside | 0    | 2    | 0.144 | 0.081     |
| Yes     | Outside | 0    | 4    | 0.256 | 0.114     |
| Yes     | Outside | 5    | 2    | 0.136 | 0.066     |
| Yes     | Outside | 5    | 4    | 0.288 | 0.110     |
| Yes     | Outside | 10   | 2    | 0.120 | 0.049     |
| Yes     | Outside | 10   | 4    | 0.336 | 0.111     |
| Yes     | Outside | 25   | 2    | 0.056 | 0.039     |
| Yes     | Outside | 25   | 4    | 0.296 | 0.161     |
| Yes     | Within  | 0    | 2    | 0.248 | 0.146     |
| Yes     | Within  | 0    | 4    | 0.392 | 0.129     |
| Yes     | Within  | 5    | 2    | 0.120 | 0.036     |
| Yes     | Within  | 5    | 4    | 0.560 | 0.111     |
| Yes     | Within  | 10   | 2    | 0.176 | 0.093     |
| Yes     | Within  | 10   | 4    | 0.392 | 0.098     |
| Yes     | Within  | 25   | 2    | 0.256 | 0.117     |
| Yes     | Within  | 25   | 4    | 0.520 | 0.096     |

### Area photos

**Figure S4.** Area photo from 1954. The darker areas display dwarf shrub communities, albeit the darkest areas are plantations ('Danmark set fra Luften - Det Kgl. Bibliotek', 2022).



**Figure S5.** Recent orthophoto of the site. Light brown colours display grasses that have expanded in these seventy years on behalf of the dwarf shrub communities (darker brown colours); notice the newly afforested areas (dark green) ('Danmark set fra Luften - Det Kgl. Bibliotek', 2022).





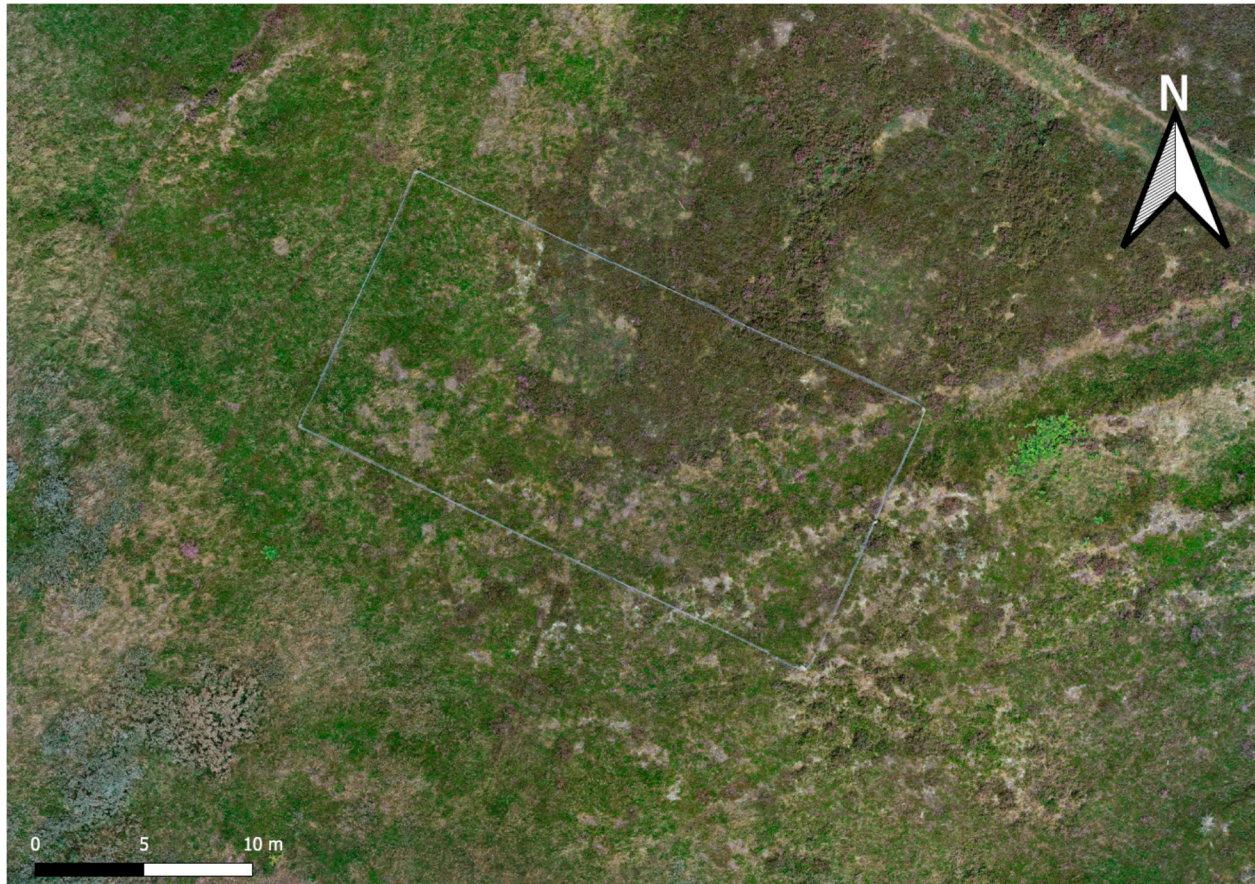
**Figure S6.** Shows the block design with a fence dividing the block. The picture is from block five and shows a significant coverage of dwarf shrubs outside the fence to the left from a viewer.



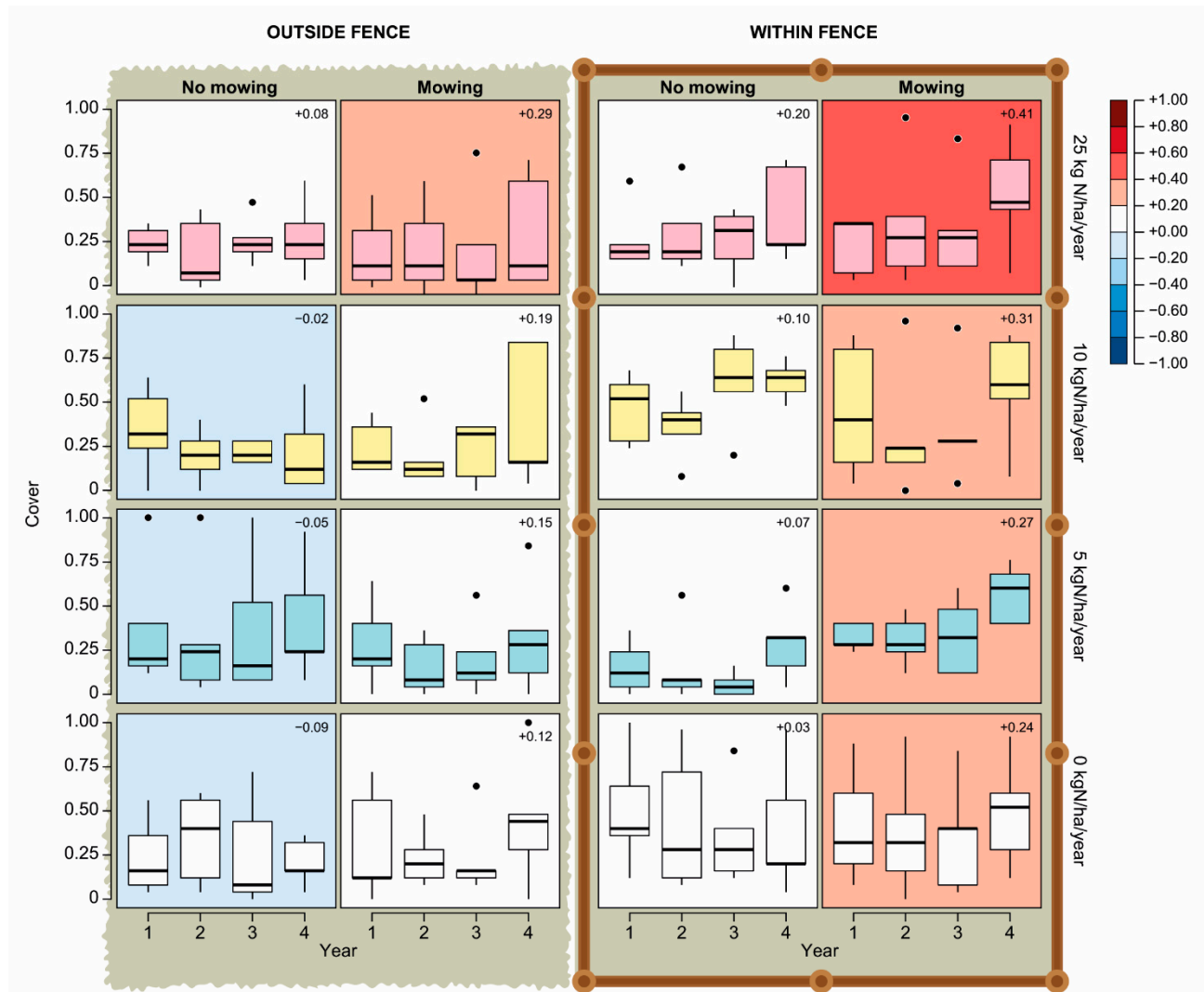


### Plots of treatments, results and photos from the site

**Figure S7.** Illustrates an aerial view of block two with the exclosure visible as a grey rectangular square. Graminoids are visible as a dark green coloured or light brown; the light green spots to the right are *Rosa rugosa* – an invasive species, while the *Calluna*-dominated areas in the centre have a more brownish colour centre in the photo. The mowed plots are visible as squares in the vegetation.

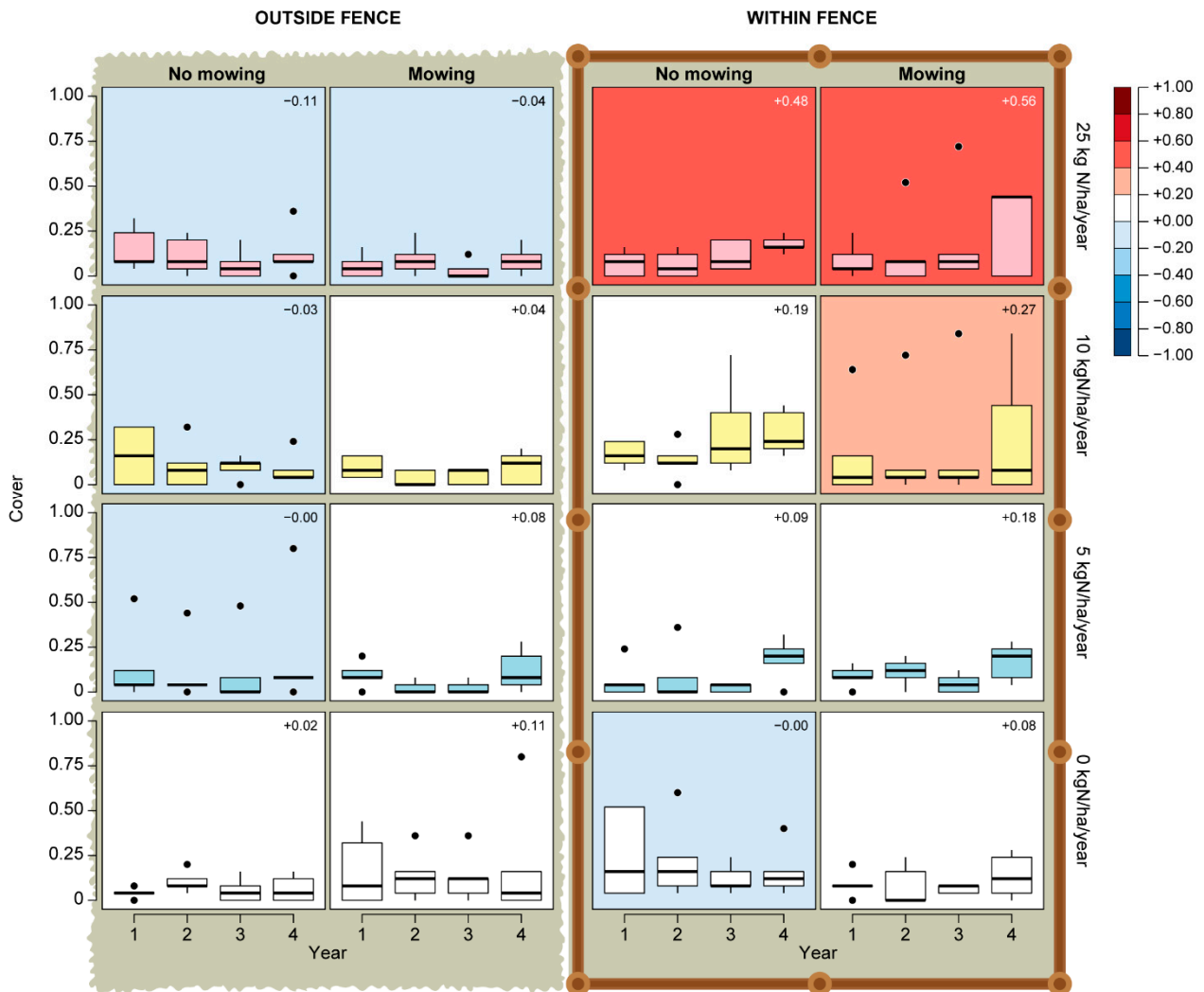


**Figure S8.** Shows the calculated slope of the cover of graminoids in autumn and the raw data presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots ( $25 \text{ kg N ha}^{-1} \text{ year}^{-1}$ ), yellow boxplots designate a dose of  $10 \text{ kg N ha}^{-1} \text{ year}^{-1}$ , blue boxplots are a low dose with  $5 \text{ kg N ha}^{-1} \text{ year}^{-1}$  while white is the control or  $0 \text{ kg N ha}^{-1} \text{ year}^{-1}$ . The legend indicates the value of the average slope shown to the right.

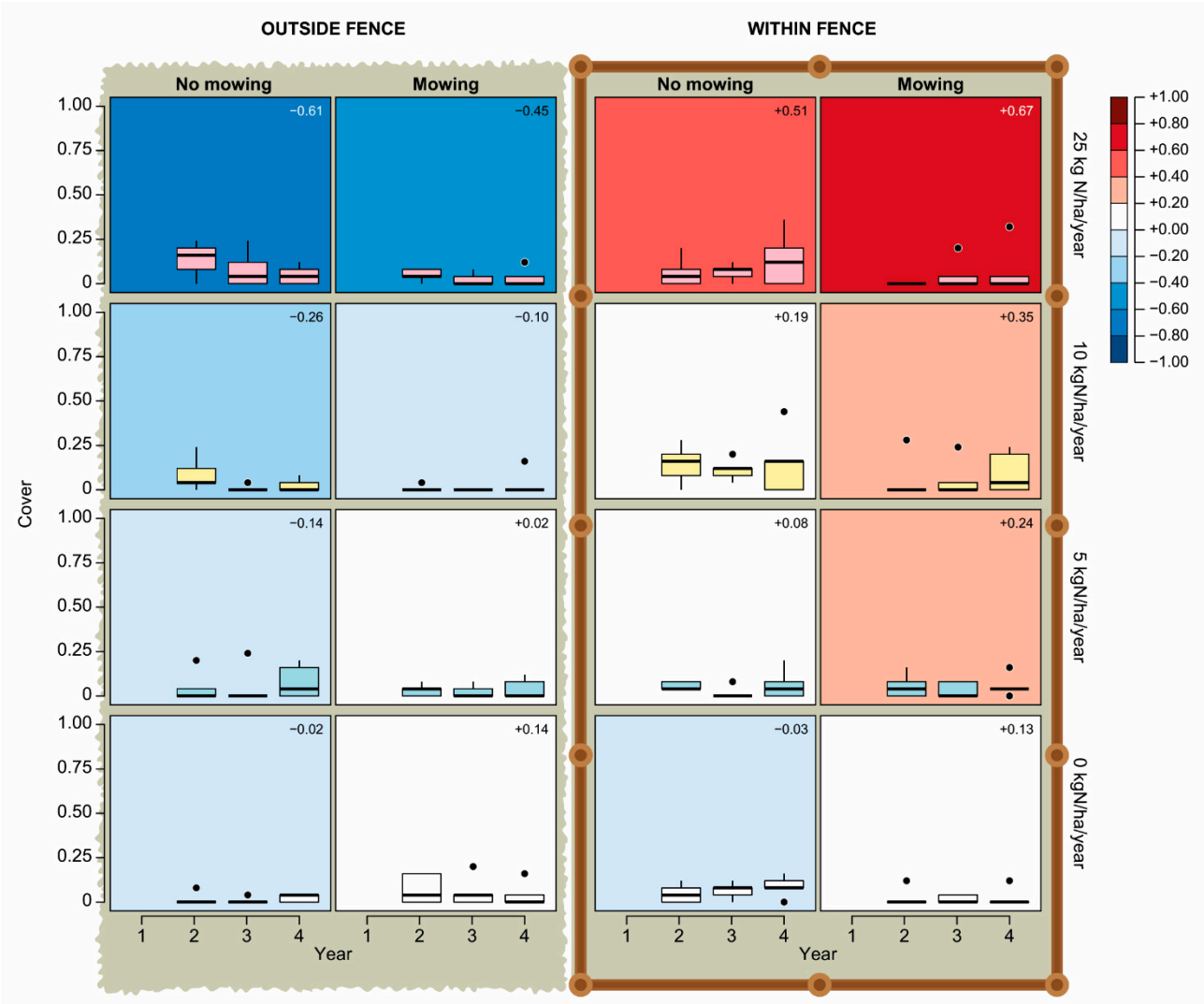




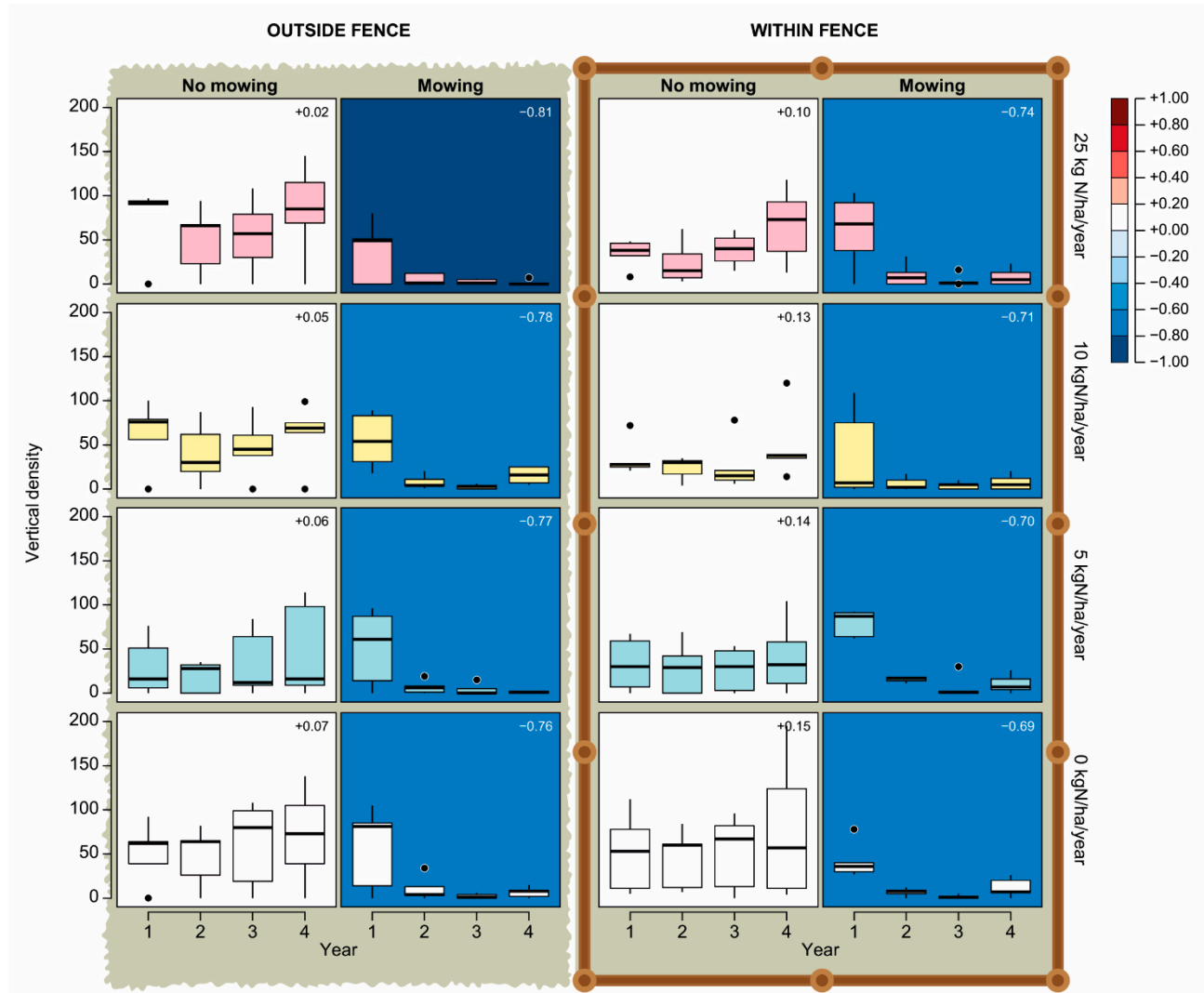
**Figure S9.** Shows the calculated slope of the coverage of *Carex arenaria* in autumn and the raw data presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots ( $25 \text{ kg N ha}^{-1} \text{ year}^{-1}$ ), yellow boxplots designate a dose of  $10 \text{ kg N ha}^{-1} \text{ year}^{-1}$ , blue boxplots are a low dose with  $5 \text{ kg N ha}^{-1} \text{ year}^{-1}$  while white is the control or  $0 \text{ kg N ha}^{-1} \text{ year}^{-1}$ . The legend indicates the value of the average slope shown to the right.



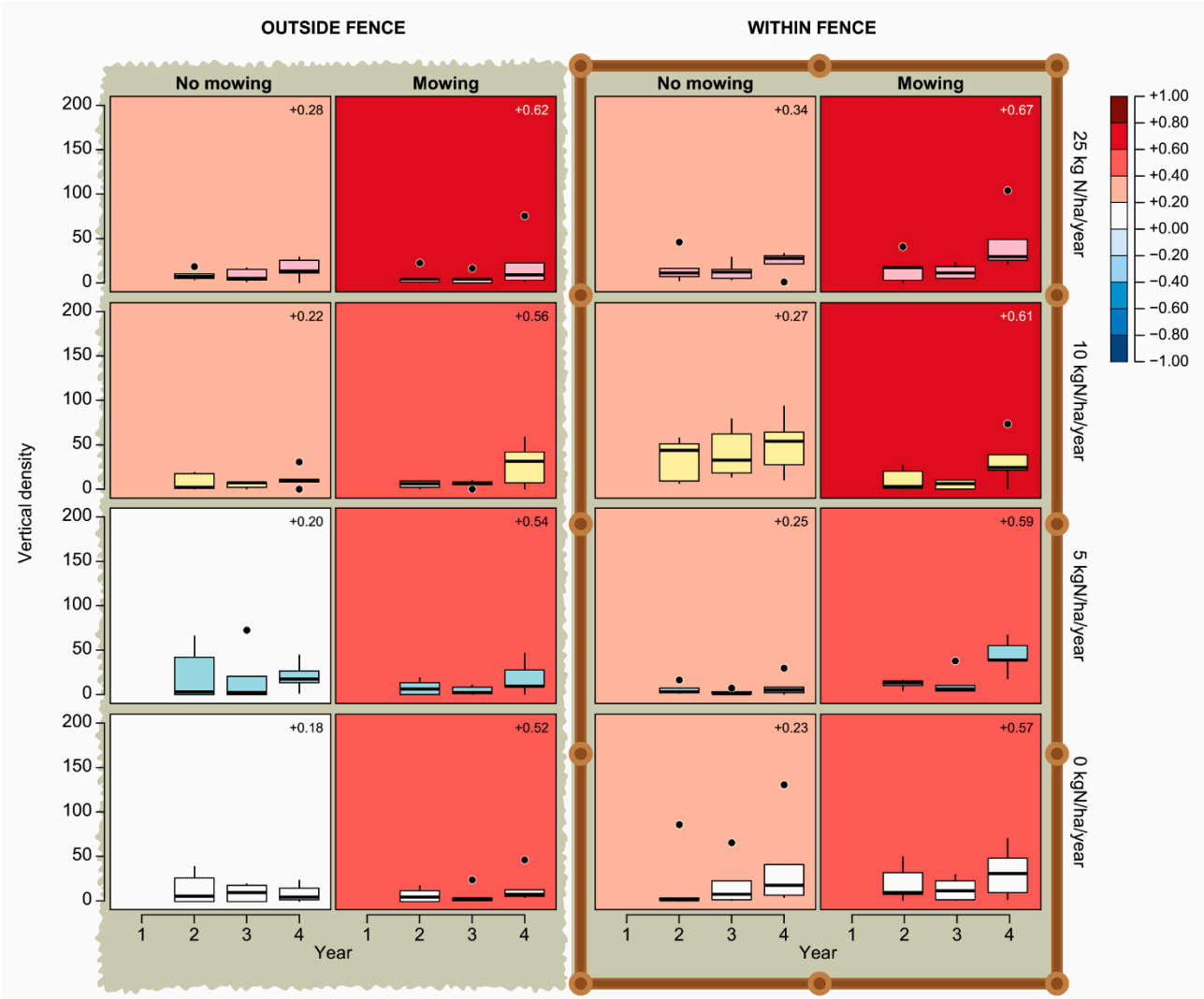
**Figure S10.** Shows the calculated slope of the cover of *Carex arenaria* in summer and the raw data presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots ( $25 \text{ kg N ha}^{-1} \text{ year}^{-1}$ ), yellow boxplots designate a dose of  $10 \text{ kg N ha}^{-1} \text{ year}^{-1}$ , blue boxplots are a low dose with  $5 \text{ kg N ha}^{-1} \text{ year}^{-1}$  while white is the control or  $0 \text{ kg N ha}^{-1} \text{ year}^{-1}$ . The legend indicates the value of the average slope shown to the right.



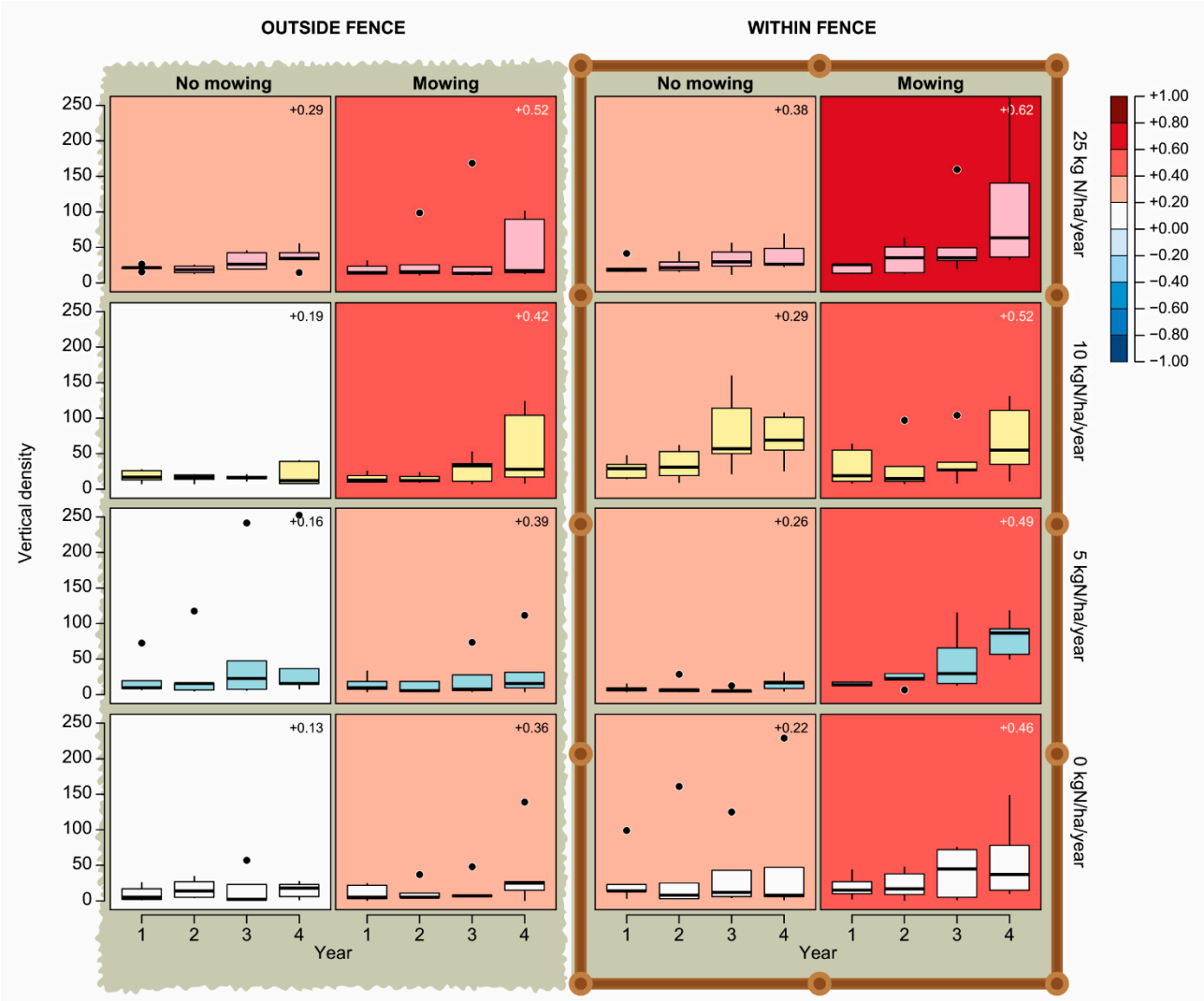
**Figure S11.** Shows the calculated slope of the vertical density of *Empetrum nigrum* in autumn and the raw data presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots ( $25 \text{ kg N ha}^{-1} \text{ year}^{-1}$ ), yellow boxplots designate a dose of  $10 \text{ kg N ha}^{-1} \text{ year}^{-1}$ , blue boxplots are a low dose with  $5 \text{ kg N ha}^{-1} \text{ year}^{-1}$  while white is the control or  $0 \text{ kg N ha}^{-1} \text{ year}^{-1}$ . The legend indicates the value of the average slope shown to the right.



**Figure S12.** Shows the calculated slope of the vertical density of graminoids in summer, and the raw data are presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots (25 kg N ha<sup>-1</sup> year<sup>-1</sup>), yellow boxplots designate a dose of 10 kg N ha<sup>-1</sup> year<sup>-1</sup>, blue boxplots are a low dose with 5 kg N ha<sup>-1</sup> year<sup>-1</sup> while white is the control or 0 kg N ha<sup>-1</sup> year<sup>-1</sup>. The legend indicates the value of the average slope shown to the right.



**Figure S13.** Shows the calculated slope of the vertical density of graminoids in autumn and the raw data presented in boxplots. The average slope is in the top right corner of each plot, with red being a positive slope and blue a negative average slope. The brown rectangle on the right side of the graph is the fence surrounding eight plots (i.e. plots without deer grazing). The different colours of the boxplots refer to the given dose, where the red boxplots designate a high dose of nitrogen added to the plots (25 kg N ha<sup>-1</sup> year<sup>-1</sup>), yellow boxplots designate a dose of 10 kg N ha<sup>-1</sup> year<sup>-1</sup>, blue boxplots are a low dose with 5 kg N ha<sup>-1</sup> year<sup>-1</sup> while white is the control or 0 kg N ha<sup>-1</sup> year<sup>-1</sup>. The legend indicates the value of the average slope shown to the right.



**Figure S14.** Vust heath has a wide variety of lichens species, where this photo displays a typical *Cladonia* spp. community at the site.



**Figure S15.** Shows a diverse heathland shrub community on Vust heath with *Calluna vulgaris*, *Erica tetralix*, *Salix repens*, *Empetrum nigrum*, and *Carex arenaria*. Many pollinators visit ericoid species, e.g. this *Bombus* sp., possibly a worker of *Bombus pascorum*.



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