

# *Biomass partitioning and growth efficiency in four naturally regenerated forest tree species*

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## Appendix A

**Table 1** Site characteristics of selected European beech plots.

| Locality                                         | ŠLP I                  | SLP II                 | Sekier I               | Sekier II              | Hrochot'              | Kráľová               | Zvolen                  |
|--------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|-------------------------|
| Altitude (m a.s.l.)                              | 710                    | 675                    | 670                    | 660                    | 620                   | 550                   | 460                     |
| Longitude (°) (') (")                            | 19°00'23"              | 19°03'17"              | 19°13'26"              | 19°13'18"              | 19°17'01"             | 19°09'36"             | 19°07'36"               |
| Latitude (°) (') (")                             | 48°37'56"              | 48°38'45"              | 48°29'57"              | 48°29'58"              | 48°39'30"             | 48°32'05"             | 48°33'10"               |
| Exposition                                       | W                      | SW                     | N                      | NW                     | NW                    | NW                    | N                       |
| Slope (%)                                        | 15                     | 40                     | 50                     | 50                     | 20                    | 20                    | 20                      |
| Average annual temperature (°C)                  | 6.8                    | 7.0                    | 6.8                    | 6.8                    | 6.9                   | 7.5                   | 7.9                     |
| Annual precipitation (mm)                        | 920                    | 900                    | 826                    | 824                    | 764                   | 766                   | 740                     |
| Soil group (FAO)                                 | Cambisol               | Cambisol               | Cambisol               | Cambisol               | Cambisol              | Cambisol              | Cambisol                |
| Geobiocenological unit                           | <i>Fagetum typicum</i> | <i>Fagetum typicum</i> | <i>Fagetum typicum</i> | <i>Fagetum typicum</i> | <i>Fagetum pauper</i> | <i>Fagetum pauper</i> | <i>Querceto Fagetum</i> |
| Mean age (years)                                 | 9.0                    | 6.0                    | 9.0                    | 4.0                    | 8.0                   | 6.0                   | 3.0                     |
| Mean diameter $d_0$ (mm)                         | 25.0                   | 14.5                   | 20.0                   | 7.0                    | 18.8                  | 12.5                  | 3.5                     |
| Mean height (m)                                  | 1.71                   | 1.32                   | 2.44                   | 0.54                   | 2.23                  | 1.17                  | 0.58                    |
| Canopy closure (%)                               | 75                     | 85                     | 95                     | 70                     | 100                   | 95                    | 95                      |
| Basal area ( $\text{m}^2 \cdot \text{ha}^{-1}$ ) | 15.08                  | 14.46                  | 31.66                  | 4.39                   | 43.72                 | 38.41                 | 29.70                   |
| Number of trees in full canopy (thousand per ha) | 36                     | 92                     | 73                     | 146                    | 121                   | 251                   | 783                     |

**Table 2** Site characteristics of selected Sessile oak plots

| Locality                                         | Antol                   | Ladzany I               | Ladzany II              | Krupina I               | Krupina II              | Žibritov I              | Žibritov II             |
|--------------------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Altitude (m a.s.l.)                              | 560                     | 480                     | 500                     | 460                     | 380                     | 480                     | 480                     |
| Longitude (°) (') (")                            | 18°57'18"               | 18°51'33"               | 18°50'56"               | 19°01'21"               | 19°05'05"               | 19°01'58"               | 19°01'42"               |
| Latitude (°) (') (")                             | 48°22'12"               | 48°17'27"               | 48°17'33"               | 48°20'19"               | 48°22'44"               | 48°22'46"               | 48°22'53"               |
| Exposition                                       | E                       | SW                      | E                       | SE                      | N                       | S                       | S                       |
| Slope (%)                                        | 35                      | 10                      | 5                       | 10                      | 10                      | 20                      | 10                      |
| Average annual temperature (°C)                  | 7.6                     | 7.9                     | 7.7                     | 8.3                     | 8.1                     | 7.8                     | 7.7                     |
| Annual precipitation (mm)                        | 825                     | 801                     | 823                     | 709                     | 692                     | 763                     | 776                     |
| Soil group (FAO)                                 | Cambisol                | Luvisol                 | Cambisol                | Cambisol                | Cambisol                | Cambisol                | Cambisol                |
| Geobiocenological unit                           | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> |
| Mean age (years)                                 | 5.5                     | 12.0                    | 2.5                     | 7.5                     | 1.5                     | 4.0                     | 8.0                     |
| Mean diameter $d_0$ (mm)                         | 13.6                    | 37.9                    | 4.1                     | 18.6                    | 2.7                     | 5.9                     | 17.6                    |
| Mean height (m)                                  | 1.01                    | 5.07                    | 0.26                    | 2.00                    | 0.16                    | 0.47                    | 2.99                    |
| Canopy closure (%)                               | 90                      | 95                      | 75                      | 95                      | 60                      | 80                      | 95                      |
| Basal area ( $\text{m}^2 \cdot \text{ha}^{-1}$ ) | 16.21                   | 16.95                   | 7.20                    | 24.40                   | 2.65                    | 11.43                   | 13.64                   |
| Number of trees in full canopy (thousand per ha) | 84                      | 13                      | 428                     | 64                      | 463                     | 289                     | 46                      |

**Table 3** Site characteristics of selected Scots pine plots

| Locality                                         | Kopčany I                  | Zolná                   | Kováčová                | Kišovce                           | Žiar n/Hr.              | Levoča                              | Kopčany II                 |
|--------------------------------------------------|----------------------------|-------------------------|-------------------------|-----------------------------------|-------------------------|-------------------------------------|----------------------------|
| Altitude (m a.s.l.)                              | 165                        | 430                     | 380                     | 640                               | 380                     | 620                                 | 165                        |
| Longitude (°) ( ' ) ( " )                        | 17°04'55"                  | 19°13'21"               | 19°04'24"               | 20°22'24"                         | 18°52'33"               | 20°30'52"                           | 17°04'50"                  |
| Latitude (°) ( ' ) ( " )                         | 48°45'16"                  | 48°37'11"               | 48°35'38"               | 49°01'43"                         | 48°36'11"               | 49°01'07"                           | 48°45'19"                  |
| Exposition                                       | flat                       | SE                      | E                       | S                                 | E                       | NE                                  | flat                       |
| Slope (%)                                        | 0                          | 5                       | 15                      | 20                                | 15                      | 10                                  | 0                          |
| Average annual temperature (°C)                  | 9.9                        | 7.7                     | 8.0                     | 6.2                               | 8.2                     | 6.2                                 | 9.9                        |
| Annual precipitation (mm)                        | 606                        | 714                     | 744                     | 639                               | 776                     | 644                                 | 606                        |
| Soil group (FAO)                                 | Regosol                    | Luvisol                 | Luvisol                 | Leptosol                          | Cambisol                | Cambisol                            | Regosol                    |
| Geobiocenological unit                           | <i>Carpineto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Fageto Quercetum</i> | <i>Piceeto Pinetum inferiorum</i> | <i>Fageto Quercetum</i> | <i>Pinetum dealpinum superiorum</i> | <i>Carpineto Quercetum</i> |
| Mean age (years)                                 | 3.0                        | 5.0                     | 5.0                     | 6.0                               | 6.0                     | 8.0                                 | 8.0                        |
| Mean diameter $d_0$ (mm)                         | 14.9                       | 28.6                    | 37.4                    | 21.2                              | 43.6                    | 41.3                                | 36.9                       |
| Mean height (m)                                  | 0.68                       | 1.33                    | 1.50                    | 1.31                              | 2.20                    | 2.63                                | 3.02                       |
| Canopy closure (%)                               | 82                         | 92                      | 75                      | 77                                | 85                      | 90                                  | 100                        |
| Basal area ( $m^2 \cdot ha^{-1}$ )               | 12.56                      | 23.99                   | 18.23                   | 14.77                             | 26.47                   | 31.14                               | 55.66                      |
| Number of trees in full canopy (thousand per ha) | 70                         | 31                      | 16                      | 36                                | 18                      | 19                                  | 43                         |

**Table 4** Site characteristics of selected Norway spruce plots

| Locality                                         | Poľana I               | Poľana II              | Drakšiar I                       | Drakšiar II                      | Bacúch                           | Č. Váh I                         | Č. Váh II                        |
|--------------------------------------------------|------------------------|------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Altitude (m a.s.l.)                              | 985                    | 790                    | 625                              | 635                              | 840                              | 820                              | 830                              |
| Longitude (°) ( ' ) ( " )                        | 19°31'05"              | 19°32'15"              | 19°47'29"                        | 19°47'37"                        | 19°49'00"                        | 19°57'52"                        | 19°57'54"                        |
| Latitude (°) ( ' ) ( " )                         | 48°38'31"              | 48°38'32"              | 48°50'58"                        | 48°50'59"                        | 48°54'05"                        | 48°59'04"                        | 48°59'03"                        |
| Exposition                                       | E                      | SW                     | SW                               | SW                               | S                                | NE                               | NE                               |
| Average annual temperature (°C)                  | 5.3                    | 6.0                    | 6.3                              | 6.3                              | 4.8                              | 5.0                              | 5.0                              |
| Annual precipitation (mm)                        | 982                    | 902                    | 865                              | 867                              | 1021                             | 865                              | 865                              |
| Slope (%)                                        | 20                     | 10                     | 5                                | 5                                | 45                               | 60                               | 20                               |
| Soil group (FAO)                                 | Cambisol               | Cambisol               | Cambisol                         | Cambisol                         | Cambisol                         | Cambisol                         | Podsol                           |
| Geobiocenological unit                           | <i>Fagetum typicum</i> | <i>Fagetum typicum</i> | <i>Abieto Fagetum inferiorum</i> | <i>Abieto Fagetum inferiorum</i> | <i>Abieto Fagetum superiorum</i> | <i>Fagetum abietino-piceosum</i> | <i>Fagetum abietino-piceosum</i> |
| Mean age (years)                                 | 9.0                    | 4.0                    | 4.5                              | 7.0                              | 1.5                              | 9.5                              | 8.5                              |
| Mean diameter $d_0$ (mm)                         | 25.7                   | 5.2                    | 11.6                             | 15.6                             | 4.6                              | 24.5                             | 17.2                             |
| Mean height (m)                                  | 2.13                   | 0.34                   | 0.68                             | 0.92                             | 0.22                             | 1.81                             | 1.29                             |
| Canopy closure (%)                               | 95                     | 80                     | 80                               | 70                               | 30                               | 90                               | 95                               |
| Basal area ( $m^2 \cdot ha^{-1}$ )               | 28.5                   | 4.7                    | 8.8                              | 10.7                             | 1.5                              | 28.4                             | 34.2                             |
| Number of trees in full canopy (thousand per ha) | 58                     | 279                    | 104                              | 80                               | 293                              | 67                               | 155                              |

**Table 5** European beech; regression coefficients  $b_0$ ,  $b_1$ ,  $b_2$ , their standard errors (S.E.), p-value (P), coefficient of determination ( $R^2$ ), mean squared error (MSE), logarithmic transformation bias  $\lambda$  and its standard deviation (S.D.) for Eqs. (1)-(3)

| Eq. | Tree compartment | $b_0$  | S.E.  | P      | $b_1$ | S.E.  | P      | $b_2$ | S.E.  | P      | $R^2$ | MSE   | $\lambda$ | S.D.  |
|-----|------------------|--------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|-----------|-------|
| (1) | Stem             | -4.034 | 0.164 | <0.001 | 2.852 | 0.063 | <0.001 |       |       |        | 0.923 | 0.167 | 1.0836    | 0.438 |
|     | Branches         | -5.982 | 0.218 | <0.001 | 3.117 | 0.084 | <0.001 |       |       |        | 0.891 | 0.295 | 1.142     | 0.592 |
|     | Leaves           | -3.750 | 0.183 | <0.001 | 2.375 | 0.071 | <0.001 |       |       |        | 0.871 | 0.207 | 1.102     | 0.486 |
|     | Roots            | -2.960 | 0.179 | <0.001 | 2.361 | 0.069 | <0.001 |       |       |        | 0.874 | 0.199 | 1.098     | 0.495 |
|     | Aboveground      | -3.288 | 0.144 | <0.001 | 2.777 | 0.056 | <0.001 |       |       |        | 0.937 | 0.129 | 1.063     | 0.364 |
|     | Whole tree       | -2.521 | 0.132 | <0.001 | 2.639 | 0.051 | <0.001 |       |       |        | 0.941 | 0.108 | 1.053     | 0.336 |
| (2) | Stem             | 3.108  | 0.043 | <0.001 | 2.302 | 0.073 | <0.001 |       |       |        | 0.854 | 0.318 | 1.166     | 0.672 |
|     | Branches         | 1.833  | 0.069 | <0.001 | 2.324 | 0.117 | <0.001 |       |       |        | 0.703 | 0.803 | 1.474     | 1.671 |
|     | Leaves           | 2.206  | 0.058 | <0.001 | 1.712 | 0.098 | <0.001 |       |       |        | 0.643 | 0.573 | 1.308     | 1.068 |
|     | Roots            | 2.964  | 0.061 | <0.001 | 1.651 | 0.102 | <0.001 |       |       |        | 0.607 | 0.620 | 1.298     | 0.949 |
|     | Aboveground      | 3.669  | 0.048 | <0.001 | 2.161 | 0.082 | <0.001 |       |       |        | 0.806 | 0.396 | 1.216     | 0.855 |
|     | Whole tree       | 4.094  | 0.050 | <0.001 | 2.000 | 0.085 | <0.001 |       |       |        | 0.767 | 0.427 | 1.226     | 0.853 |
| (3) | Stem             | -1.530 | 0.163 | <0.001 | 1.848 | 0.065 | <0.001 | 1.015 | 0.054 | <0.001 | 0.975 | 0.054 | 1.026     | 0.222 |
|     | Branches         | -4.768 | 0.364 | <0.001 | 2.630 | 0.144 | <0.001 | 0.423 | 0.121 | <0.001 | 0.901 | 0.270 | 1.130     | 0.560 |
|     | Leaves           | -3.286 | 0.317 | <0.001 | 2.188 | 0.126 | <0.001 | 0.188 | 0.105 | 0.076  | 0.873 | 0.205 | 1.100     | 0.479 |
|     | Roots            | -2.898 | 0.314 | <0.001 | 2.336 | 0.124 | <0.001 | 0.025 | 0.104 | 0.809  | 0.874 | 0.200 | 1.098     | 0.493 |
|     | Aboveground      | -1.486 | 0.186 | <0.001 | 2.054 | 0.074 | <0.001 | 0.731 | 0.062 | <0.001 | 0.966 | 0.070 | 1.034     | 0.266 |
|     | Whole tree       | -1.236 | 0.197 | <0.001 | 2.124 | 0.078 | <0.001 | 0.521 | 0.065 | <0.001 | 0.957 | 0.079 | 1.038     | 0.285 |

**Table 6** Sessile oak; regression coefficients  $b_0$ ,  $b_1$ ,  $b_2$ , their standard errors (S.E.), p-value (P), coefficient of determination ( $R^2$ ), mean squared error (MSE), logarithmic transformation bias  $\lambda$  and its standard deviation (S.D.) for Eqs. (1)-(3)

| Eq. | Tree compartment | $b_0$  | S.E.  | P      | $b_1$ | S.E.  | P      | $b_2$ | S.E.  | P      | $R^2$ | MSE   | $\lambda$ | S.D.  |
|-----|------------------|--------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|-----------|-------|
| (1) | Stem             | -4.311 | 0.224 | <0.001 | 2.959 | 0.071 | <0.001 |       |       |        | 0.942 | 0.240 | 1.121     | 0.544 |
|     | Branches         | -6.025 | 0.215 | <0.001 | 2.963 | 0.068 | <0.001 |       |       |        | 0.947 | 0.221 | 1.107     | 0.496 |
|     | Leaves           | -5.954 | 0.221 | <0.001 | 2.768 | 0.070 | <0.001 |       |       |        | 0.936 | 0.234 | 1.106     | 0.459 |
|     | Roots            | -1.954 | 0.150 | <0.001 | 2.066 | 0.046 | <0.001 |       |       |        | 0.941 | 0.124 | 1.065     | 0.401 |
|     | Aboveground      | -3.952 | 0.206 | <0.001 | 2.931 | 0.065 | <0.001 |       |       |        | 0.950 | 0.203 | 1.099     | 0.469 |
|     | Whole tree       | -2.612 | 0.175 | <0.001 | 2.646 | 0.005 | <0.001 |       |       |        | 0.956 | 0.146 | 1.070     | 0.382 |
| (2) | Stem             | 3.471  | 0.045 | <0.001 | 2.516 | 0.046 | <0.001 |       |       |        | 0.965 | 0.147 | 1.074     | 0.419 |
|     | Branches         | 1.839  | 0.086 | <0.001 | 2.388 | 0.089 | <0.001 |       |       |        | 0.871 | 0.535 | 1.271     | 0.896 |
|     | Leaves           | 1.370  | 0.074 | <0.001 | 2.269 | 0.077 | <0.001 |       |       |        | 0.891 | 0.398 | 1.190     | 0.700 |
|     | Roots            | 3.511  | 0.053 | <0.001 | 1.719 | 0.051 | <0.001 |       |       |        | 0.898 | 0.213 | 1.112     | 0.553 |
|     | Aboveground      | 3.769  | 0.050 | <0.001 | 2.468 | 0.052 | <0.001 |       |       |        | 0.954 | 0.186 | 1.095     | 0.483 |
|     | Whole tree       | 4.369  | 0.051 | <0.001 | 2.207 | 0.053 | <0.001 |       |       |        | 0.942 | 0.189 | 1.099     | 0.503 |
| (3) | Stem             | -0.066 | 0.170 | 0.698  | 1.324 | 0.063 | <0.001 | 1.491 | 0.053 | <0.001 | 0.993 | 0.029 | 1.014     | 0.171 |
|     | Branches         | -4.263 | 0.432 | <0.001 | 2.284 | 0.161 | <0.001 | 0.619 | 0.135 | <0.001 | 0.956 | 0.186 | 1.092     | 0.473 |
|     | Leaves           | -3.577 | 0.412 | <0.001 | 1.852 | 0.153 | <0.001 | 0.835 | 0.129 | <0.001 | 0.954 | 0.169 | 1.077     | 0.399 |
|     | Roots            | -0.226 | 0.289 | 0.436  | 1.398 | 0.107 | <0.001 | 0.611 | 0.091 | <0.001 | 0.956 | 0.092 | 1.047     | 0.333 |
|     | Aboveground      | -0.201 | 0.194 | 0.303  | 1.486 | 0.072 | <0.001 | 1.317 | 0.061 | <0.001 | 0.991 | 0.038 | 1.019     | 0.199 |
|     | Whole tree       | 0.389  | 0.201 | 0.056  | 1.490 | 0.075 | <0.001 | 1.054 | 0.063 | <0.001 | 0.989 | 0.040 | 1.020     | 0.209 |

**Table 7** Scots pine; regression coefficients  $b_0$ ,  $b_1$ ,  $b_2$ , their standard errors (S.E.),  $p$ -value ( $P$ ), coefficient of determination ( $R^2$ ), mean squared error (MSE), logarithmic transformation bias  $\lambda$  and its standard deviation (S.D.) for Eqs. (1)-(3)

| Eq. | Tree compartment | $b_0$  | S.E.  | P      | $b_1$ | S.E.  | P      | $b_2$  | S.E.  | P      | $R^2$ | MSE   | $\lambda$ | S.D.  |
|-----|------------------|--------|-------|--------|-------|-------|--------|--------|-------|--------|-------|-------|-----------|-------|
| (1) | Stem             | -3.143 | 0.122 | <0.001 | 2.480 | 0.038 | <0.001 |        |       |        | 0.960 | 0.131 | 1.067     | 0.395 |
|     | Branches         | -3.985 | 0.125 | <0.001 | 2.515 | 0.039 | <0.001 |        |       |        | 0.960 | 0.138 | 1.072     | 0.435 |
|     | Needles          | -1.961 | 0.144 | <0.001 | 2.014 | 0.045 | <0.001 |        |       |        | 0.920 | 0.183 | 1.089     | 0.456 |
|     | Roots            | -3.628 | 0.130 | <0.001 | 2.236 | 0.041 | <0.001 |        |       |        | 0.946 | 0.149 | 1.079     | 0.479 |
|     | Aboveground      | -1.698 | 0.097 | <0.001 | 2.290 | 0.030 | <0.001 |        |       |        | 0.970 | 0.083 | 1.041     | 0.306 |
|     | Whole tree       | -1.531 | 0.089 | <0.001 | 2.278 | 0.028 | <0.001 |        |       |        | 0.975 | 0.069 | 1.035     | 0.282 |
| (2) | Stem             | 3.958  | 0.043 | <0.001 | 2.389 | 0.057 | <0.001 |        |       |        | 0.912 | 0.293 | 1.156     | 0.648 |
|     | Branches         | 3.246  | 0.062 | <0.001 | 2.304 | 0.081 | <0.001 |        |       |        | 0.824 | 0.601 | 1.323     | 1.003 |
|     | Needles          | 3.843  | 0.060 | <0.001 | 1.805 | 0.078 | <0.001 |        |       |        | 0.755 | 0.560 | 1.273     | 0.852 |
|     | Roots            | 2.824  | 0.067 | <0.001 | 1.965 | 0.087 | <0.001 |        |       |        | 0.745 | 0.694 | 1.387     | 1.173 |
|     | Aboveground      | 4.880  | 0.050 | <0.001 | 2.134 | 0.065 | <0.001 |        |       |        | 0.862 | 0.388 | 1.200     | 0.725 |
|     | Whole tree       | 5.013  | 0.051 | <0.001 | 2.108 | 0.066 | <0.001 |        |       |        | 0.854 | 0.402 | 1.209     | 0.752 |
| (3) | Stem             | -0.702 | 0.152 | <0.001 | 1.618 | 0.052 | <0.001 | 0.944  | 0.052 | <0.001 | 0.987 | 0.045 | 1.023     | 0.231 |
|     | Branches         | -3.184 | 0.257 | <0.001 | 2.232 | 0.089 | <0.001 | 0.310  | 0.088 | <0.001 | 0.962 | 0.129 | 1.066     | 0.403 |
|     | Needles          | -1.901 | 0.307 | <0.001 | 1.993 | 0.106 | <0.001 | 0.024  | 0.105 | 0.822  | 0.920 | 0.184 | 1.089     | 0.457 |
|     | Roots            | -4.105 | 0.273 | <0.001 | 2.405 | 0.094 | <0.001 | -0.184 | 0.093 | 0.050  | 0.947 | 0.146 | 1.078     | 0.487 |
|     | Aboveground      | -0.466 | 0.177 | 0.009  | 1.856 | 0.061 | <0.001 | 0.476  | 0.060 | <0.001 | 0.978 | 0.061 | 1.031     | 0.269 |
|     | Whole tree       | -0.502 | 0.167 | 0.003  | 1.914 | 0.057 | <0.001 | 0.398  | 0.057 | <0.001 | 0.980 | 0.054 | 1.028     | 0.253 |

**Table 8** Norway spruce; regression coefficients  $b_0$ ,  $b_1$ ,  $b_2$ , their standard errors (S.E.),  $p$ -value ( $P$ ), coefficient of determination ( $R^2$ ), mean squared error (MSE), logarithmic transformation bias  $\lambda$  and its standard deviation (S.D.) for Eqs. (1)-(3)

| Eq. | Tree compartment | $b_0$  | S.E.  | P      | $b_1$ | S.E.  | P      | $b_2$  | S.E.  | P      | $R^2$ | MSE   | $\lambda$ | S.D.  |
|-----|------------------|--------|-------|--------|-------|-------|--------|--------|-------|--------|-------|-------|-----------|-------|
| (1) | Stem             | -3.084 | 0.069 | <0.001 | 2.459 | 0.024 | <0.001 |        |       |        | 0.986 | 0.090 | 1.046     | 0.324 |
|     | Branches         | -3.452 | 0.099 | <0.001 | 2.482 | 0.035 | <0.001 |        |       |        | 0.971 | 0.185 | 1.093     | 0.488 |
|     | Needles          | -2.589 | 0.099 | <0.001 | 2.317 | 0.035 | <0.001 |        |       |        | 0.967 | 0.185 | 1.082     | 0.397 |
|     | Roots            | -2.460 | 0.070 | <0.001 | 2.114 | 0.025 | <0.001 |        |       |        | 0.980 | 0.095 | 1.046     | 0.309 |
|     | Aboveground      | -1.842 | 0.069 | <0.001 | 2.398 | 0.024 | <0.001 |        |       |        | 0.985 | 0.088 | 1.043     | 0.296 |
|     | Whole tree       | -1.432 | 0.060 | <0.001 | 2.333 | 0.021 | <0.001 |        |       |        | 0.988 | 0.067 | 1.033     | 0.258 |
| (2) | Stem             | 4.010  | 0.035 | <0.001 | 2.398 | 0.033 | <0.001 |        |       |        | 0.972 | 0.178 | 1.092     | 0.484 |
|     | Branches         | 3.704  | 0.056 | <0.001 | 2.376 | 0.054 | <0.001 |        |       |        | 0.930 | 0.453 | 1.245     | 0.921 |
|     | Needles          | 4.090  | 0.058 | <0.001 | 2.200 | 0.055 | <0.001 |        |       |        | 0.914 | 0.486 | 1.232     | 0.816 |
|     | Roots            | 3.640  | 0.052 | <0.001 | 2.004 | 0.049 | <0.001 |        |       |        | 0.919 | 0.386 | 1.198     | 0.748 |
|     | Aboveground      | 5.072  | 0.047 | <0.001 | 2.307 | 0.044 | <0.001 |        |       |        | 0.949 | 0.308 | 1.160     | 0.684 |
|     | Whole tree       | 5.304  | 0.047 | <0.001 | 2.239 | 0.044 | <0.001 |        |       |        | 0.948 | 0.300 | 1.157     | 0.676 |
| (3) | Stem             | -0.469 | 0.201 |        | 1.555 | 0.070 | <0.001 | 0.913  | 0.068 | <0.001 | 0.994 | 0.041 | 1.020     | 0.205 |
|     | Branches         | -2.553 | 0.417 | <0.001 | 2.171 | 0.144 | <0.001 | 0.313  | 0.141 | 0.028  | 0.972 | 0.180 | 1.089     | 0.460 |
|     | Needles          | -2.487 | 0.426 | <0.001 | 2.282 | 0.147 | <0.001 | 0.036  | 0.144 | 0.805  | 0.967 | 0.186 | 1.082     | 0.396 |
|     | Roots            | -2.869 | 0.304 | <0.001 | 2.254 | 0.105 | <0.001 | -0.142 | 0.103 | 0.169  | 0.980 | 0.094 | 1.045     | 0.306 |
|     | Aboveground      | -0.696 | 0.281 | 0.014  | 2.002 | 0.097 | <0.001 | 0.400  | 0.095 | <0.001 | 0.987 | 0.079 | 1.037     | 0.274 |
|     | Whole tree       | -0.579 | 0.251 | 0.023  | 2.039 | 0.087 | <0.001 | 0.297  | 0.085 | <0.001 | 0.989 | 0.062 | 1.030     | 0.248 |

**Fig. 1** Biomass allocation coefficients based on tree height (m) at three levels of height increment of 0.1, 0.3 and 0.5 m per annum.

**Fig. 2** Inter-specific comparison of growth efficiency of stem (GE I,  $\text{g g}^{-1}$ ) and woody biomass (GE II,  $\text{g g}^{-1}$ ) at medium range height increment ( $0.3 \text{ m y}^{-1}$ ).

**Fig. 3** Growth efficiency of stem (GE I,  $\text{g g}^{-1}$ ) and woody biomass (GE II,  $\text{g g}^{-1}$ , left axis) at three levels height (h, m) increment and dry foliage biomass (DW, g, right axis).

Fig. 1

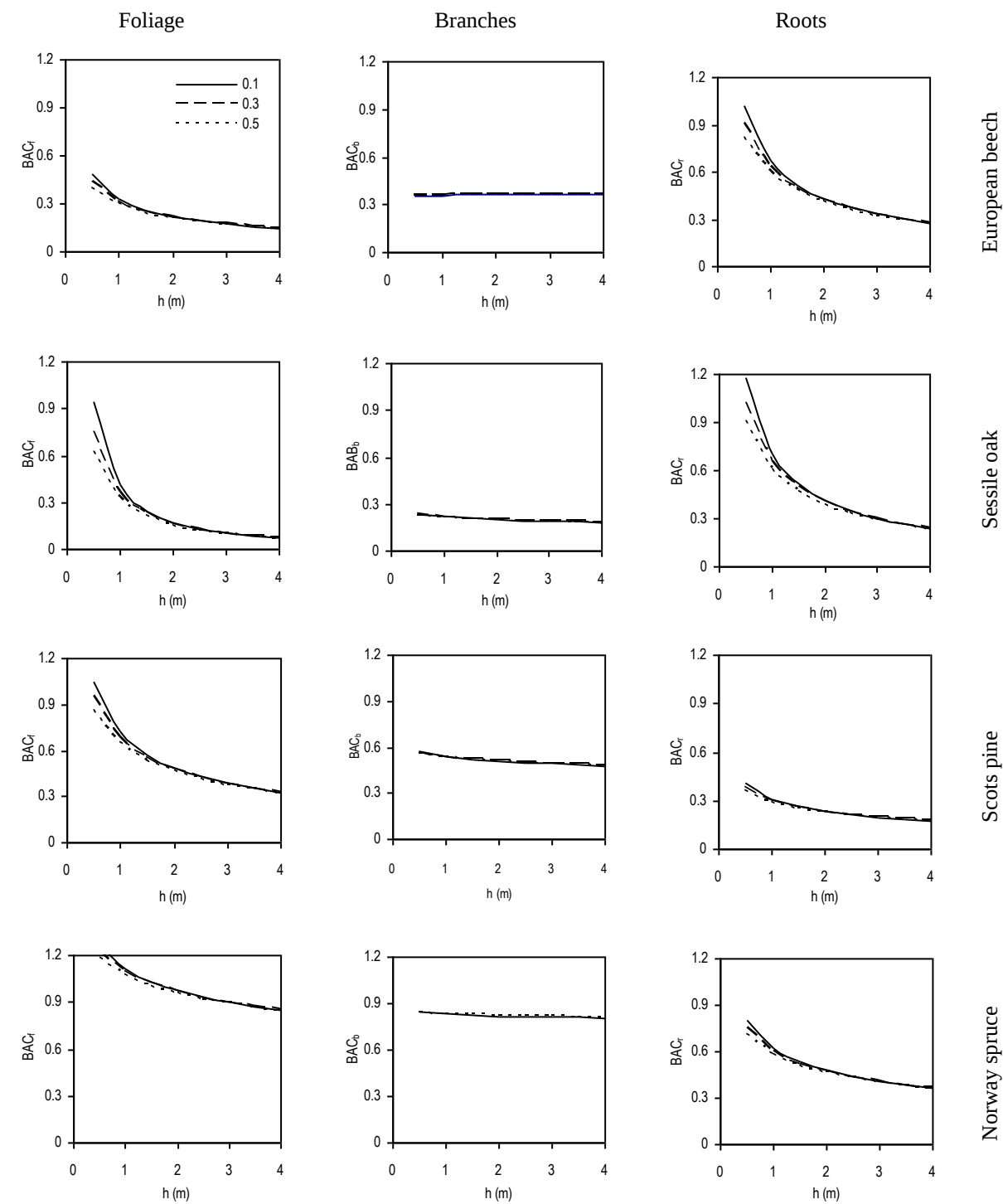


Fig. 2

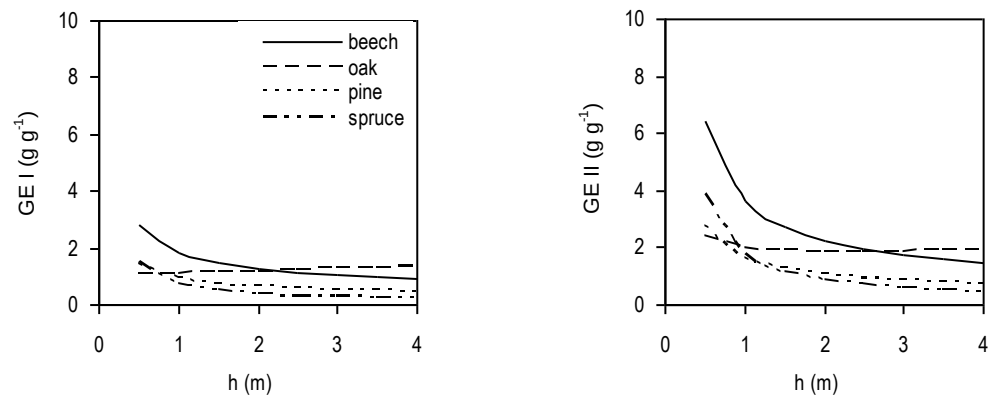


Fig. 3

