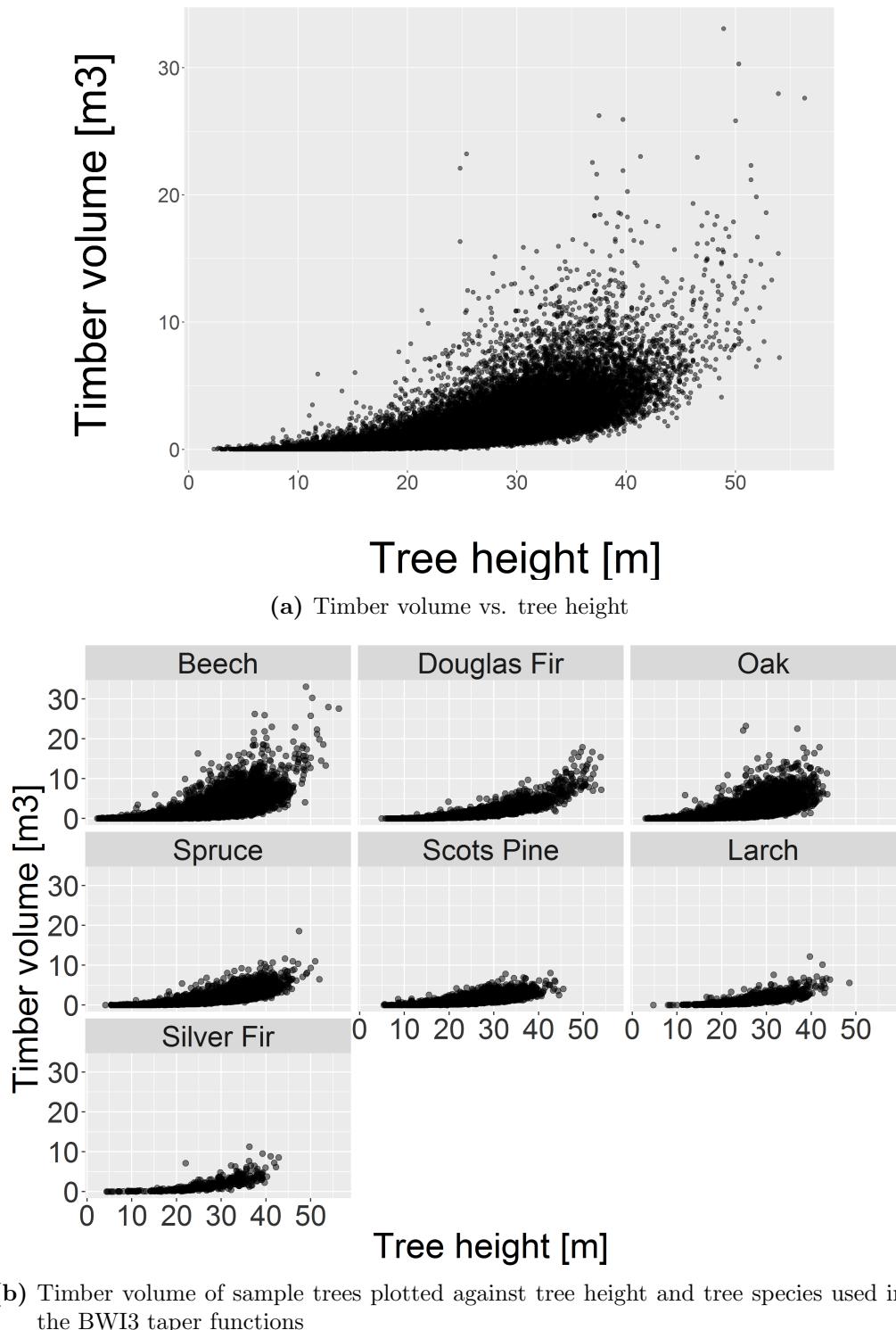


European Journal of Forest Research  
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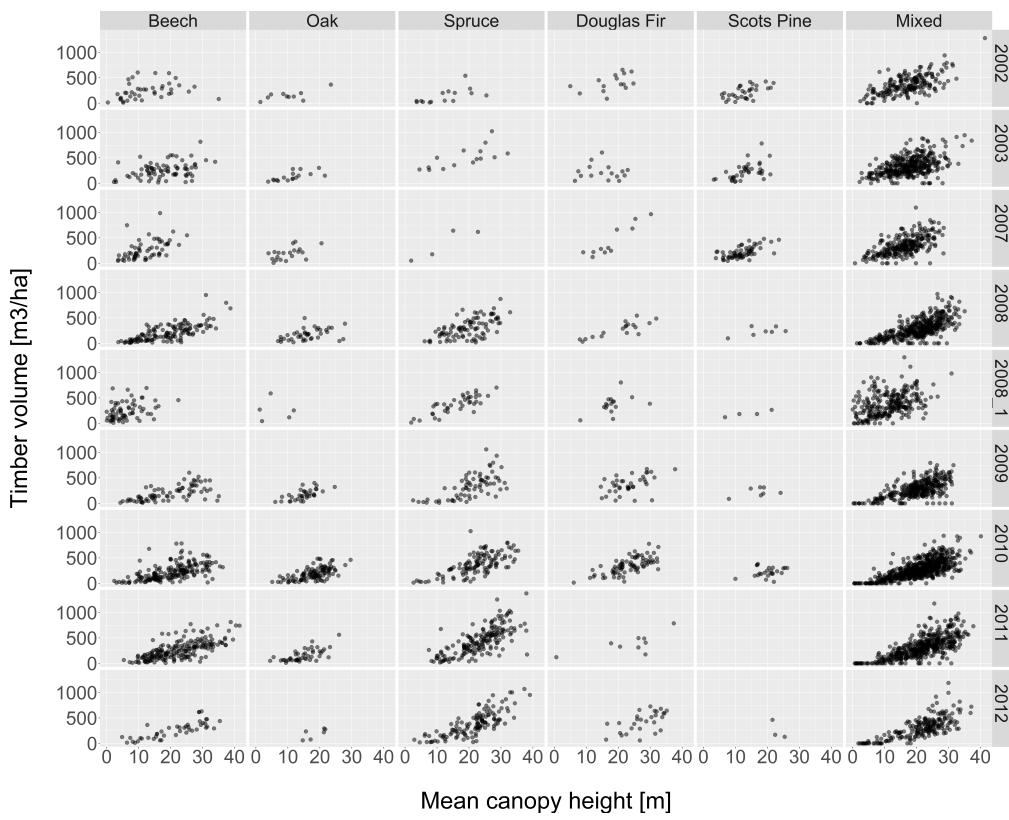
**Combining canopy height and tree species information  
for large scale timber volume estimations under strong  
heterogeneity of auxiliary data and variable sample plot  
sizes**

Andreas Hill\*, Henning Buddenbaum , Daniel Mandallaz

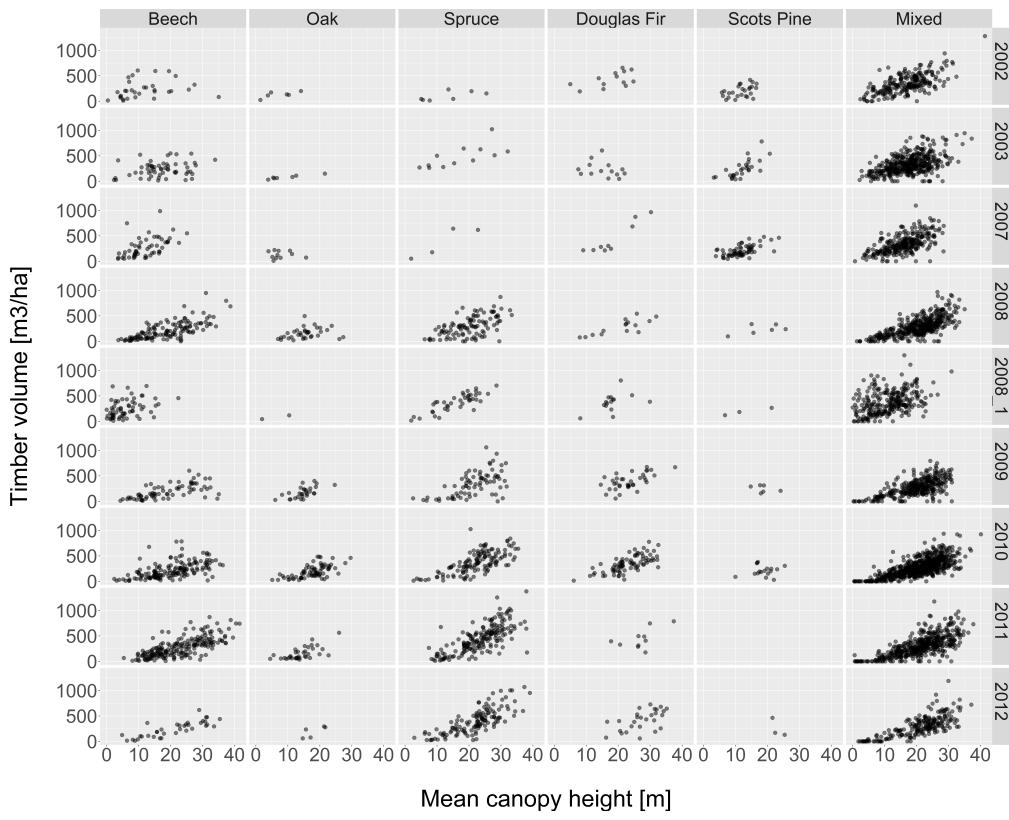
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**1: Timber volume - height relationship on single tree level**

## 2: Timber volume on plot level vs. predictor variables



(a) Timber volume on plot level vs. LiDAR *meanheight* stratified by the error-free *treespecies* variable



(b) Timber volume on plot level vs. LiDAR *meanheight* stratified by calibrated *treespecies* variable

**Figure 2:** Timber volume on sample plot level stratified by the *lidaryears* and *treespecies*

### 3: Classification accuracies of *treespecies* variable

**Table 1:** User's accuracies realized under various support choices for deriving the major tree species of a sample location. *class*: major tree species class of sample plot, *prod.acc*: producer's accuracy, *use.acc*: user's accuracy, *oaa*: overall accuracy, *prod.acc<sub>cal</sub>*: producer's accuracy after calibration (*use.acc* and *oaa* respectively), *n.ref*: number of validation data per tree species.

| class       | support | threshold | prod.acc | prod.acc <sub>cal</sub> | use.acc | use.acc <sub>cal</sub> | oaa   | oaa <sub>cal</sub> | n.ref |
|-------------|---------|-----------|----------|-------------------------|---------|------------------------|-------|--------------------|-------|
| Beech       | ind     | 0%        | 51.00    | 69.95                   | 66.36   | 58.02                  | 52.20 | 56.67              | 1857  |
| Douglas Fir | ind     | 0%        | 54.66    | 44.33                   | 43.75   | 50.00                  | 52.20 | 56.67              | 397   |
| Oak         | ind     | 0%        | 65.53    | 39.20                   | 41.67   | 47.57                  | 52.20 | 56.67              | 824   |
| Spruce      | ind     | 0%        | 58.92    | 68.66                   | 64.38   | 62.35                  | 52.20 | 56.67              | 1037  |
| Scots pine  | ind     | 0%        | 67.45    | 62.06                   | 45.51   | 59.93                  | 52.20 | 56.67              | 593   |
| Mixed       | ind     | 0%        | 2.87     | 16.48                   | 8.20    | 42.16                  | 52.20 | 56.67              | 522   |
| Beech       | ind     | 50%       | 51.60    | 69.30                   | 64.14   | 55.93                  | 50.31 | 54.07              | 1723  |
| Douglas Fir | ind     | 50%       | 56.45    | 45.97                   | 44.21   | 49.71                  | 50.31 | 54.07              | 372   |
| Oak         | ind     | 50%       | 66.24    | 39.95                   | 40.70   | 46.90                  | 50.31 | 54.07              | 776   |
| Spruce      | ind     | 50%       | 58.87    | 67.64                   | 63.48   | 60.83                  | 50.31 | 54.07              | 992   |
| Scots pine  | ind     | 50%       | 67.95    | 60.44                   | 44.32   | 59.67                  | 50.31 | 54.07              | 546   |
| Mixed       | ind     | 50%       | 7.67     | 18.51                   | 18.05   | 35.02                  | 50.31 | 54.07              | 821   |
| Beech       | ind     | 60%       | 48.56    | 68.79                   | 62.12   | 54.52                  | 47.55 | 52.33              | 1631  |
| Douglas Fir | ind     | 60%       | 53.74    | 43.49                   | 44.29   | 47.29                  | 47.55 | 52.33              | 361   |
| Oak         | ind     | 60%       | 64.20    | 39.51                   | 39.56   | 46.15                  | 47.55 | 52.33              | 729   |
| Spruce      | ind     | 60%       | 57.90    | 68.19                   | 63.95   | 61.54                  | 47.55 | 52.33              | 962   |
| Scots pine  | ind     | 60%       | 66.53    | 55.92                   | 41.69   | 58.17                  | 47.55 | 52.33              | 490   |
| Mixed       | ind     | 60%       | 14.19    | 22.71                   | 22.03   | 35.35                  | 47.55 | 52.33              | 1057  |
| Beech       | ind     | 80%       | 44.16    | 37.47                   | 50.15   | 50.24                  | 45.45 | 53.77              | 1121  |
| Douglas Fir | ind     | 80%       | 48.32    | 37.25                   | 42.99   | 48.47                  | 45.45 | 53.77              | 298   |
| Oak         | ind     | 80%       | 63.61    | 21.45                   | 28.06   | 40.45                  | 45.45 | 53.77              | 415   |
| Spruce      | ind     | 80%       | 54.70    | 61.17                   | 60.70   | 64.78                  | 45.45 | 53.77              | 788   |
| Scots pine  | ind     | 80%       | 65.70    | 35.74                   | 30.33   | 55.00                  | 45.45 | 53.77              | 277   |
| Mixed       | ind     | 80%       | 36.94    | 69.11                   | 51.96   | 53.33                  | 45.45 | 53.77              | 2331  |
| Beech       | ind     | 100%      | 38.58    | 19.90                   | 41.42   | 48.80                  | 50.82 | 63.86              | 819   |
| Douglas Fir | ind     | 100%      | 46.70    | 23.35                   | 38.13   | 49.53                  | 50.82 | 63.86              | 227   |
| Oak         | ind     | 100%      | 61.69    | 10.73                   | 21.73   | 40.00                  | 50.82 | 63.86              | 261   |
| Spruce      | ind     | 100%      | 50.86    | 49.45                   | 55.38   | 65.22                  | 50.82 | 63.86              | 637   |
| Scots pine  | ind     | 100%      | 60.11    | 22.47                   | 22.96   | 50.00                  | 50.82 | 63.86              | 178   |
| Mixed       | ind     | 100%      | 52.90    | 88.19                   | 68.59   | 65.95                  | 50.82 | 63.86              | 3108  |
| Beech       | q25     | 0%        | 50.03    | 72.02                   | 66.99   | 58.83                  | 52.14 | 56.88              | 1919  |
| Douglas Fir | q25     | 0%        | 55.36    | 43.39                   | 42.37   | 50.00                  | 52.14 | 56.88              | 401   |
| Oak         | q25     | 0%        | 65.69    | 40.49                   | 41.77   | 49.22                  | 52.14 | 56.88              | 857   |
| Spruce      | q25     | 0%        | 59.16    | 67.75                   | 63.85   | 61.42                  | 52.14 | 56.88              | 1048  |
| Scots pine  | q25     | 0%        | 68.35    | 61.11                   | 45.52   | 59.51                  | 52.14 | 56.88              | 594   |
| Mixed       | q25     | 0%        | 3.75     | 12.92                   | 10.81   | 37.30                  | 52.14 | 56.88              | 534   |
| Beech       | q25     | 50%       | 51.07    | 73.54                   | 65.07   | 56.94                  | 50.36 | 55.56              | 1784  |
| Douglas Fir | q25     | 50%       | 56.65    | 46.54                   | 42.43   | 49.72                  | 50.36 | 55.56              | 376   |
| Oak         | q25     | 50%       | 66.38    | 40.17                   | 40.53   | 50.00                  | 50.36 | 55.56              | 809   |
| Spruce      | q25     | 50%       | 59.80    | 69.45                   | 63.40   | 61.44                  | 50.36 | 55.56              | 1005  |
| Scots pine  | q25     | 50%       | 68.74    | 60.88                   | 43.87   | 60.22                  | 50.36 | 55.56              | 547   |
| Mixed       | q25     | 50%       | 6.97     | 15.75                   | 18.07   | 36.59                  | 50.36 | 55.56              | 832   |
| Beech       | q25     | 60%       | 49.62    | 72.71                   | 62.27   | 54.04                  | 47.97 | 52.55              | 1693  |
| Douglas Fir | q25     | 60%       | 55.07    | 41.92                   | 42.49   | 47.96                  | 47.97 | 52.55              | 365   |
| Oak         | q25     | 60%       | 65.49    | 36.35                   | 38.77   | 47.59                  | 47.97 | 52.55              | 762   |
| Spruce      | q25     | 60%       | 59.49    | 68.51                   | 63.46   | 59.86                  | 47.97 | 52.55              | 975   |
| Scots pine  | q25     | 60%       | 68.02    | 56.62                   | 40.78   | 59.53                  | 47.97 | 52.55              | 491   |
| Mixed       | q25     | 60%       | 10.68    | 19.31                   | 22.31   | 34.86                  | 47.97 | 52.55              | 1067  |
| Beech       | q25     | 80%       | 43.39    | 36.95                   | 50.05   | 47.86                  | 43.98 | 51.93              | 1180  |
| Douglas Fir | q25     | 80%       | 48.01    | 36.75                   | 42.27   | 54.41                  | 43.98 | 51.93              | 302   |
| Oak         | q25     | 80%       | 63.12    | 22.40                   | 27.79   | 40.74                  | 43.98 | 51.93              | 442   |
| Spruce      | q25     | 80%       | 55.12    | 62.25                   | 60.66   | 62.09                  | 43.98 | 51.93              | 800   |
| Scots pine  | q25     | 80%       | 65.11    | 35.97                   | 29.05   | 55.25                  | 43.98 | 51.93              | 278   |
| Mixed       | q25     | 80%       | 33.86    | 65.33                   | 48.74   | 51.00                  | 43.98 | 51.93              | 2351  |
| Beech       | q25     | 100%      | 36.72    | 16.42                   | 41.55   | 48.81                  | 48.65 | 62.58              | 877   |
| Douglas Fir | q25     | 100%      | 42.17    | 21.74                   | 40.25   | 48.54                  | 48.65 | 62.58              | 230   |
| Oak         | q25     | 100%      | 57.14    | 8.01                    | 20.53   | 46.94                  | 48.65 | 62.58              | 287   |
| Spruce      | q25     | 100%      | 52.16    | 54.17                   | 56.05   | 62.68                  | 48.65 | 62.58              | 648   |
| Scots pine  | q25     | 100%      | 60.34    | 20.67                   | 22.69   | 60.66                  | 48.65 | 62.58              | 179   |
| Mixed       | q25     | 100%      | 50.29    | 87.64                   | 64.05   | 64.06                  | 48.65 | 62.58              | 3132  |
| Beech       | q50     | 0%        | 50.75    | 73.17                   | 67.31   | 59.42                  | 52.89 | 58.36              | 1931  |
| Douglas Fir | q50     | 0%        | 54.98    | 47.01                   | 42.02   | 56.08                  | 52.89 | 58.36              | 402   |

Continued on next page

| class       | support | threshold | prod.acc | <i>prod.acc<sub>cal</sub></i> | use.acc | <i>use.acc<sub>cal</sub></i> | oaa   | <i>oaa<sub>cal</sub></i> | n.ref |
|-------------|---------|-----------|----------|-------------------------------|---------|------------------------------|-------|--------------------------|-------|
| Oak         | q50     | 0%        | 67.44    | 43.49                         | 41.76   | 52.31                        | 52.89 | 58.36                    | 860   |
| Spruce      | q50     | 0%        | 59.83    | 68.38                         | 64.95   | 63.21                        | 52.89 | 58.36                    | 1053  |
| Scots pine  | q50     | 0%        | 70.25    | 62.86                         | 45.39   | 59.37                        | 52.89 | 58.36                    | 595   |
| Mixed       | q50     | 0%        | 2.80     | 12.69                         | 13.04   | 38.20                        | 52.89 | 58.36                    | 536   |
| Beech       | q50     | 50%       | 51.28    | 73.39                         | 65.60   | 57.96                        | 50.85 | 55.81                    | 1796  |
| Douglas Fir | q50     | 50%       | 55.17    | 47.48                         | 42.80   | 53.92                        | 50.85 | 55.81                    | 377   |
| Oak         | q50     | 50%       | 67.36    | 44.83                         | 40.85   | 52.53                        | 50.85 | 55.81                    | 812   |
| Spruce      | q50     | 50%       | 60.12    | 69.15                         | 64.81   | 62.12                        | 50.85 | 55.81                    | 1008  |
| Scots pine  | q50     | 50%       | 70.44    | 58.58                         | 44.99   | 57.42                        | 50.85 | 55.81                    | 548   |
| Mixed       | q50     | 50%       | 7.89     | 14.59                         | 18.59   | 30.73                        | 50.85 | 55.81                    | 836   |
| Beech       | q50     | 60%       | 48.47    | 69.84                         | 64.63   | 55.79                        | 48.58 | 53.45                    | 1704  |
| Douglas Fir | q50     | 60%       | 51.91    | 44.26                         | 45.56   | 51.59                        | 48.58 | 53.45                    | 366   |
| Oak         | q50     | 60%       | 64.31    | 45.75                         | 40.13   | 50.58                        | 48.58 | 53.45                    | 765   |
| Spruce      | q50     | 60%       | 58.18    | 69.33                         | 66.32   | 63.25                        | 48.58 | 53.45                    | 978   |
| Scots pine  | q50     | 60%       | 67.48    | 55.89                         | 43.12   | 56.47                        | 48.58 | 53.45                    | 492   |
| Mixed       | q50     | 60%       | 18.94    | 20.43                         | 24.52   | 32.25                        | 48.58 | 53.45                    | 1072  |
| Beech       | q50     | 80%       | 40.91    | 43.69                         | 53.00   | 52.11                        | 46.48 | 54.34                    | 1188  |
| Douglas Fir | q50     | 80%       | 45.21    | 39.27                         | 48.07   | 60.10                        | 46.48 | 54.34                    | 303   |
| Oak         | q50     | 80%       | 60.67    | 24.04                         | 29.61   | 39.78                        | 46.48 | 54.34                    | 445   |
| Spruce      | q50     | 80%       | 52.18    | 62.39                         | 63.20   | 63.66                        | 46.48 | 54.34                    | 803   |
| Scots pine  | q50     | 80%       | 62.95    | 41.37                         | 31.59   | 62.50                        | 46.48 | 54.34                    | 278   |
| Mixed       | q50     | 80%       | 42.88    | 66.14                         | 49.46   | 53.04                        | 46.48 | 54.34                    | 2360  |
| Beech       | q50     | 100%      | 30.39    | 20.75                         | 45.58   | 46.10                        | 53.58 | 61.82                    | 882   |
| Douglas Fir | q50     | 100%      | 35.22    | 21.74                         | 46.29   | 44.25                        | 53.58 | 61.82                    | 230   |
| Oak         | q50     | 100%      | 49.65    | 11.46                         | 23.25   | 44.00                        | 53.58 | 61.82                    | 288   |
| Spruce      | q50     | 100%      | 43.47    | 53.61                         | 58.11   | 60.70                        | 53.58 | 61.82                    | 651   |
| Scots pine  | q50     | 100%      | 58.10    | 26.26                         | 28.42   | 52.22                        | 53.58 | 61.82                    | 179   |
| Mixed       | q50     | 100%      | 63.62    | 84.59                         | 63.64   | 64.50                        | 53.58 | 61.82                    | 3147  |
| Beech       | q80     | 0%        | 51.16    | 73.41                         | 67.05   | 59.67                        | 53.33 | 58.52                    | 1937  |
| Douglas Fir | q80     | 0%        | 55.45    | 47.52                         | 42.83   | 56.80                        | 53.33 | 58.52                    | 404   |
| Oak         | q80     | 0%        | 67.82    | 43.75                         | 41.74   | 52.07                        | 53.33 | 58.52                    | 864   |
| Spruce      | q80     | 0%        | 60.95    | 68.63                         | 65.75   | 63.34                        | 53.33 | 58.52                    | 1055  |
| Scots pine  | q80     | 0%        | 71.19    | 60.97                         | 45.95   | 58.43                        | 53.33 | 58.52                    | 597   |
| Mixed       | q80     | 0%        | 2.03     | 14.73                         | 11.96   | 42.78                        | 53.33 | 58.52                    | 543   |
| Beech       | q80     | 50%       | 51.17    | 72.42                         | 66.05   | 57.90                        | 51.70 | 56.06                    | 1802  |
| Douglas Fir | q80     | 50%       | 55.94    | 46.44                         | 45.11   | 53.99                        | 51.70 | 56.06                    | 379   |
| Oak         | q80     | 50%       | 67.52    | 45.10                         | 41.43   | 51.90                        | 51.70 | 56.06                    | 816   |
| Spruce      | q80     | 50%       | 60.99    | 69.50                         | 66.17   | 62.46                        | 51.70 | 56.06                    | 1010  |
| Scots pine  | q80     | 50%       | 70.67    | 59.20                         | 46.75   | 59.74                        | 51.70 | 56.06                    | 549   |
| Mixed       | q80     | 50%       | 12.20    | 17.89                         | 23.25   | 34.09                        | 51.70 | 56.06                    | 844   |
| Beech       | q80     | 60%       | 47.25    | 70.23                         | 65.69   | 56.78                        | 48.76 | 54.59                    | 1710  |
| Douglas Fir | q80     | 60%       | 51.90    | 46.47                         | 49.61   | 52.29                        | 48.76 | 54.59                    | 368   |
| Oak         | q80     | 60%       | 63.98    | 47.33                         | 41.80   | 49.66                        | 48.76 | 54.59                    | 769   |
| Spruce      | q80     | 60%       | 56.94    | 69.59                         | 67.55   | 63.44                        | 48.76 | 54.59                    | 980   |
| Scots pine  | q80     | 60%       | 66.53    | 55.58                         | 44.99   | 60.22                        | 48.76 | 54.59                    | 493   |
| Mixed       | q80     | 60%       | 23.70    | 23.70                         | 24.31   | 36.83                        | 48.76 | 54.59                    | 1080  |
| Beech       | q80     | 80%       | 37.80    | 39.90                         | 55.68   | 51.63                        | 47.91 | 53.67                    | 1193  |
| Douglas Fir | q80     | 80%       | 40.33    | 37.70                         | 51.46   | 60.21                        | 47.91 | 53.67                    | 305   |
| Oak         | q80     | 80%       | 57.49    | 25.73                         | 30.85   | 41.52                        | 47.91 | 53.67                    | 447   |
| Spruce      | q80     | 80%       | 49.00    | 60.57                         | 64.27   | 63.99                        | 47.91 | 53.67                    | 804   |
| Scots pine  | q80     | 80%       | 62.01    | 40.86                         | 35.97   | 66.28                        | 47.91 | 53.67                    | 279   |
| Mixed       | q80     | 80%       | 50.13    | 67.07                         | 49.05   | 51.71                        | 47.91 | 53.67                    | 2372  |
| Beech       | q80     | 100%      | 25.54    | 22.94                         | 50.45   | 49.88                        | 57.41 | 62.61                    | 885   |
| Douglas Fir | q80     | 100%      | 29.13    | 23.91                         | 53.17   | 52.88                        | 57.41 | 62.61                    | 230   |
| Oak         | q80     | 100%      | 40.83    | 13.49                         | 25.76   | 52.70                        | 57.41 | 62.61                    | 289   |
| Spruce      | q80     | 100%      | 36.96    | 48.16                         | 61.95   | 60.15                        | 57.41 | 62.61                    | 652   |
| Scots pine  | q80     | 100%      | 51.67    | 30.00                         | 34.19   | 60.00                        | 57.41 | 62.61                    | 180   |
| Mixed       | q80     | 100%      | 74.43    | 85.84                         | 63.53   | 64.62                        | 57.41 | 62.61                    | 3164  |
| Beech       | q100    | 0%        | 53.73    | 72.96                         | 67.46   | 59.55                        | 55.24 | 58.53                    | 1945  |
| Douglas Fir | q100    | 0%        | 55.88    | 47.30                         | 45.97   | 54.21                        | 55.24 | 58.53                    | 408   |
| Oak         | q100    | 0%        | 71.35    | 47.18                         | 43.27   | 53.25                        | 55.24 | 58.53                    | 869   |
| Spruce      | q100    | 0%        | 62.70    | 66.29                         | 66.14   | 63.02                        | 55.24 | 58.53                    | 1059  |
| Scots pine  | q100    | 0%        | 73.83    | 65.67                         | 46.98   | 63.14                        | 55.24 | 58.53                    | 600   |
| Mixed       | q100    | 0%        | 0.18     | 11.23                         | 12.50   | 33.33                        | 55.24 | 58.53                    | 552   |
| Beech       | q100    | 50%       | 48.45    | 71.66                         | 68.95   | 57.49                        | 51.87 | 56.27                    | 1810  |
| Douglas Fir | q100    | 50%       | 49.74    | 48.69                         | 55.39   | 56.02                        | 51.87 | 56.27                    | 382   |
| Oak         | q100    | 50%       | 68.21    | 49.45                         | 46.40   | 53.63                        | 51.87 | 56.27                    | 821   |
| Spruce      | q100    | 50%       | 57.69    | 67.85                         | 68.74   | 62.77                        | 51.87 | 56.27                    | 1014  |
| Scots pine  | q100    | 50%       | 68.78    | 63.70                         | 54.85   | 61.69                        | 51.87 | 56.27                    | 551   |
| Mixed       | q100    | 50%       | 26.55    | 15.09                         | 21.23   | 30.50                        | 51.87 | 56.27                    | 855   |
| Beech       | q100    | 60%       | 40.98    | 68.45                         | 69.02   | 55.84                        | 48.56 | 52.81                    | 1718  |

Continued on next page

| class       | support | threshold | prod.acc | <i>prod.acc<sub>cal</sub></i> | use.acc | <i>use.acc<sub>cal</sub></i> | oaa   | <i>oaa<sub>cal</sub></i> | n.ref |
|-------------|---------|-----------|----------|-------------------------------|---------|------------------------------|-------|--------------------------|-------|
| Douglas Fir | q100    | 60%       | 40.70    | 42.86                         | 57.85   | 51.79                        | 48.56 | 52.81                    | 371   |
| Oak         | q100    | 60%       | 61.24    | 46.64                         | 48.12   | 50.35                        | 48.56 | 52.81                    | 774   |
| Spruce      | q100    | 60%       | 51.12    | 67.78                         | 70.75   | 61.93                        | 48.56 | 52.81                    | 984   |
| Scots pine  | q100    | 60%       | 63.03    | 58.18                         | 57.78   | 60.00                        | 48.56 | 52.81                    | 495   |
| Mixed       | q100    | 60%       | 45.28    | 19.98                         | 25.78   | 29.22                        | 48.56 | 52.81                    | 1091  |
| Beech       | q100    | 80%       | 27.55    | 40.15                         | 63.22   | 51.06                        | 51.15 | 53.49                    | 1198  |
| Douglas Fir | q100    | 80%       | 26.30    | 28.57                         | 63.78   | 58.67                        | 51.15 | 53.49                    | 308   |
| Oak         | q100    | 80%       | 47.12    | 26.55                         | 36.47   | 44.12                        | 51.15 | 53.49                    | 452   |
| Spruce      | q100    | 80%       | 36.80    | 60.35                         | 69.72   | 62.92                        | 51.15 | 53.49                    | 807   |
| Scots pine  | q100    | 80%       | 57.35    | 44.09                         | 52.29   | 64.06                        | 51.15 | 53.49                    | 279   |
| Mixed       | q100    | 80%       | 71.08    | 67.27                         | 48.96   | 51.79                        | 51.15 | 53.49                    | 2389  |
| Beech       | q100    | 100%      | 5.29     | 19.69                         | 55.29   | 40.98                        | 59.36 | 59.51                    | 889   |
| Douglas Fir | q100    | 100%      | 7.79     | 10.39                         | 69.23   | 40.68                        | 59.36 | 59.51                    | 231   |
| Oak         | q100    | 100%      | 11.26    | 7.85                          | 27.73   | 30.26                        | 59.36 | 59.51                    | 293   |
| Spruce      | q100    | 100%      | 11.81    | 43.87                         | 77.78   | 52.87                        | 59.36 | 59.51                    | 652   |
| Scots pine  | q100    | 100%      | 20.56    | 25.00                         | 50.68   | 52.94                        | 59.36 | 59.51                    | 180   |
| Mixed       | q100    | 100%      | 94.51    | 84.07                         | 59.89   | 63.13                        | 59.36 | 59.51                    | 3188  |

## 4: Model accuracies

**Table 2:** Model accuracies realized under various support choices for the CHM- and **uncalibrated treespecies** explanatory variables

| $support_{chm}$ | $support_{tspc}$ | $threshold$ | $R^2_{adj}$ | $rmse_{cv}$ | $RMSE_{cv}[\%]$ | $AIC$    | $R^2_{adj,ref}$ | $RMSE_{cv,ref}$ | $RMSE_{cv,ref}[\%]$ | $AIC_{ref}$ |
|-----------------|------------------|-------------|-------------|-------------|-----------------|----------|-----------------|-----------------|---------------------|-------------|
| ind             | ind              | 0%          | 0.44        | 142.03      | 44.20           | 64408.57 | 0.45            | 139.71          | 43.48               | 64256.93    |
| ind             | ind              | 50%         | 0.44        | 141.74      | 44.11           | 64401.58 | 0.45            | 139.85          | 43.52               | 64268.78    |
| ind             | ind              | 60%         | 0.44        | 141.95      | 44.18           | 64405.91 | 0.45            | 139.48          | 43.41               | 64255.23    |
| ind             | ind              | 80%         | 0.44        | 141.68      | 44.09           | 64384.81 | 0.46            | 138.92          | 43.23               | 64225.80    |
| ind             | ind              | 100%        | 0.44        | 141.97      | 44.18           | 64385.38 | 0.46            | 138.85          | 43.21               | 64204.65    |
| ind             | q25              | 0%          | 0.44        | 140.67      | 44.21           | 64927.75 | 0.46            | 139.25          | 43.77               | 64780.23    |
| ind             | q25              | 50%         | 0.44        | 140.56      | 44.18           | 64912.21 | 0.46            | 139.37          | 43.81               | 64795.25    |
| ind             | q25              | 60%         | 0.44        | 140.63      | 44.20           | 64914.25 | 0.46            | 139.23          | 43.76               | 64783.04    |
| ind             | q25              | 80%         | 0.45        | 140.77      | 44.25           | 64906.60 | 0.46            | 138.57          | 43.56               | 64749.77    |
| ind             | q25              | 100%        | 0.44        | 140.72      | 44.23           | 64909.56 | 0.46            | 138.14          | 43.42               | 64725.81    |
| ind             | q50              | 0%          | 0.44        | 141.62      | 44.71           | 65195.36 | 0.46            | 139.36          | 44.00               | 65057.03    |
| ind             | q50              | 50%         | 0.44        | 141.58      | 44.70           | 65186.32 | 0.46            | 139.60          | 44.07               | 65072.06    |
| ind             | q50              | 60%         | 0.45        | 141.55      | 44.69           | 65184.31 | 0.46            | 139.53          | 44.05               | 65060.08    |
| ind             | q50              | 80%         | 0.44        | 141.61      | 44.70           | 65197.21 | 0.46            | 138.90          | 43.85               | 65026.35    |
| ind             | q50              | 100%        | 0.44        | 142.05      | 44.85           | 65230.07 | 0.46            | 138.60          | 43.75               | 65002.79    |
| ind             | q80              | 0%          | 0.45        | 140.73      | 44.58           | 65392.45 | 0.46            | 139.43          | 44.16               | 65282.95    |
| ind             | q80              | 50%         | 0.45        | 140.75      | 44.58           | 65391.12 | 0.46            | 139.71          | 44.25               | 65297.81    |
| ind             | q80              | 60%         | 0.44        | 141.25      | 44.74           | 65414.38 | 0.46            | 139.58          | 44.21               | 65286.72    |
| ind             | q80              | 80%         | 0.45        | 141.20      | 44.72           | 65397.48 | 0.46            | 138.97          | 44.02               | 65252.00    |
| ind             | q80              | 100%        | 0.44        | 142.03      | 44.98           | 65482.59 | 0.46            | 138.84          | 43.98               | 65227.79    |
| ind             | q100             | 0%          | 0.45        | 140.81      | 44.34           | 65701.65 | 0.46            | 138.83          | 43.72               | 65570.10    |
| ind             | q100             | 50%         | 0.45        | 140.58      | 44.27           | 65688.26 | 0.46            | 139.13          | 43.81               | 65585.38    |
| ind             | q100             | 60%         | 0.44        | 140.87      | 44.36           | 65708.90 | 0.46            | 139.14          | 43.81               | 65575.20    |
| ind             | q100             | 80%         | 0.44        | 141.69      | 44.62           | 65772.71 | 0.46            | 138.39          | 43.58               | 65541.28    |
| ind             | q100             | 100%        | 0.42        | 143.37      | 45.14           | 65885.80 | 0.46            | 138.25          | 43.53               | 65513.09    |
| q25             | ind              | 0%          | 0.44        | 142.57      | 44.60           | 64938.10 | 0.46            | 140.09          | 43.82               | 64776.64    |
| q25             | ind              | 50%         | 0.44        | 142.53      | 44.59           | 64935.55 | 0.46            | 140.28          | 43.88               | 64790.59    |
| q25             | ind              | 60%         | 0.44        | 142.64      | 44.62           | 64936.98 | 0.46            | 139.96          | 43.78               | 64778.10    |
| q25             | ind              | 80%         | 0.44        | 142.39      | 44.54           | 64908.14 | 0.46            | 139.43          | 43.62               | 64756.67    |
| q25             | ind              | 100%        | 0.44        | 142.06      | 44.44           | 64895.64 | 0.46            | 138.92          | 43.46               | 64729.99    |
| q25             | q25              | 0%          | 0.45        | 141.99      | 45.44           | 65965.52 | 0.47            | 139.91          | 44.78               | 65808.37    |
| q25             | q25              | 50%         | 0.45        | 141.87      | 45.40           | 65955.14 | 0.47            | 140.07          | 44.82               | 65822.64    |
| q25             | q25              | 60%         | 0.45        | 141.89      | 45.41           | 65957.07 | 0.47            | 139.77          | 44.73               | 65809.39    |
| q25             | q25              | 80%         | 0.45        | 141.91      | 45.42           | 65944.31 | 0.47            | 139.33          | 44.59               | 65783.19    |
| q25             | q25              | 100%        | 0.45        | 142.05      | 45.46           | 65955.03 | 0.48            | 138.53          | 44.33               | 65747.03    |
| q25             | q50              | 0%          | 0.45        | 139.70      | 44.82           | 66237.98 | 0.47            | 138.15          | 44.33               | 66087.78    |
| q25             | q50              | 50%         | 0.45        | 139.61      | 44.80           | 66229.45 | 0.47            | 138.31          | 44.38               | 66101.77    |
| q25             | q50              | 60%         | 0.45        | 139.71      | 44.83           | 66226.29 | 0.47            | 138.09          | 44.31               | 66088.89    |
| q25             | q50              | 80%         | 0.45        | 139.87      | 44.88           | 66241.23 | 0.47            | 137.55          | 44.13               | 66062.63    |
| q25             | q50              | 100%        | 0.45        | 140.32      | 45.02           | 66280.18 | 0.47            | 136.83          | 43.90               | 66026.09    |
| q25             | q80              | 0%          | 0.46        | 140.42      | 45.24           | 66429.54 | 0.47            | 139.34          | 44.89               | 66311.89    |
| q25             | q80              | 50%         | 0.46        | 140.36      | 45.22           | 66432.75 | 0.47            | 139.72          | 45.02               | 66325.46    |
| q25             | q80              | 60%         | 0.45        | 140.78      | 45.36           | 66453.60 | 0.47            | 139.52          | 44.95               | 66313.60    |
| q25             | q80              | 80%         | 0.46        | 140.53      | 45.27           | 66439.86 | 0.47            | 139.07          | 44.80               | 66286.42    |
| q25             | q80              | 100%        | 0.45        | 142.02      | 45.75           | 66532.00 | 0.48            | 138.48          | 44.61               | 66249.45    |
| q25             | q100             | 0%          | 0.45        | 142.36      | 45.55           | 66767.76 | 0.47            | 140.09          | 44.83               | 66626.46    |
| q25             | q100             | 50%         | 0.46        | 141.92      | 45.41           | 66755.71 | 0.47            | 140.32          | 44.90               | 66640.38    |
| q25             | q100             | 60%         | 0.45        | 142.18      | 45.49           | 66783.49 | 0.47            | 140.42          | 44.93               | 66629.48    |
| q25             | q100             | 80%         | 0.45        | 143.32      | 45.86           | 66854.10 | 0.47            | 140.16          | 44.85               | 66602.55    |
| q25             | q100             | 100%        | 0.43        | 145.09      | 46.43           | 66974.26 | 0.48            | 139.97          | 44.79               | 66563.15    |
| q50             | ind              | 0%          | 0.45        | 141.43      | 44.24           | 64854.59 | 0.47            | 138.82          | 43.42               | 64686.53    |
| q50             | ind              | 50%         | 0.45        | 141.41      | 44.24           | 64850.86 | 0.47            | 138.93          | 43.46               | 64698.27    |
| q50             | ind              | 60%         | 0.45        | 141.50      | 44.27           | 64853.84 | 0.47            | 138.70          | 43.39               | 64689.17    |
| q50             | ind              | 80%         | 0.45        | 141.33      | 44.21           | 64827.37 | 0.47            | 138.27          | 43.25               | 64672.63    |
| q50             | ind              | 100%        | 0.45        | 141.16      | 44.16           | 64827.16 | 0.47            | 137.91          | 43.14               | 64652.47    |
| q50             | q25              | 0%          | 0.46        | 140.61      | 45.00           | 65874.22 | 0.48            | 138.36          | 44.28               | 65710.42    |
| q50             | q25              | 50%         | 0.46        | 140.45      | 44.95           | 65862.51 | 0.48            | 138.43          | 44.30               | 65722.03    |
| q50             | q25              | 60%         | 0.46        | 140.49      | 44.96           | 65864.18 | 0.48            | 138.19          | 44.22               | 65711.95    |
| q50             | q25              | 80%         | 0.46        | 140.59      | 44.99           | 65854.77 | 0.48            | 137.97          | 44.15               | 65691.89    |
| q50             | q25              | 100%        | 0.46        | 140.58      | 44.99           | 65860.14 | 0.48            | 137.41          | 43.98               | 65664.81    |
| q50             | q50              | 0%          | 0.46        | 138.57      | 44.46           | 66145.64 | 0.48            | 136.89          | 43.92               | 65989.18    |
| q50             | q50              | 50%         | 0.46        | 138.52      | 44.44           | 66138.78 | 0.48            | 137.05          | 43.97               | 66001.00    |
| q50             | q50              | 60%         | 0.46        | 138.62      | 44.48           | 66134.47 | 0.48            | 136.89          | 43.92               | 65991.20    |
| q50             | q50              | 80%         | 0.46        | 138.78      | 44.53           | 66146.85 | 0.48            | 136.48          | 43.79               | 65971.13    |
| q50             | q50              | 100%        | 0.46        | 139.30      | 44.70           | 66189.99 | 0.48            | 135.98          | 43.63               | 65943.10    |
| q50             | q80              | 0%          | 0.47        | 138.34      | 44.57           | 66333.05 | 0.48            | 137.22          | 44.21               | 66211.70    |
| q50             | q80              | 50%         | 0.47        | 138.35      | 44.57           | 66341.81 | 0.48            | 137.60          | 44.33               | 66223.75    |
| q50             | q80              | 60%         | 0.46        | 138.77      | 44.71           | 66361.90 | 0.48            | 137.43          | 44.28               | 66214.72    |
| q50             | q80              | 80%         | 0.46        | 138.54      | 44.63           | 66347.78 | 0.48            | 137.11          | 44.17               | 66193.69    |
| q50             | q80              | 100%        | 0.45        | 140.08      | 45.13           | 66444.51 | 0.48            | 136.63          | 44.02               | 66165.28    |
| q50             | q100             | 0%          | 0.46        | 141.39      | 45.24           | 66681.45 | 0.48            | 138.94          | 44.46               | 66528.70    |
| q50             | q100             | 50%         | 0.47        | 140.88      | 45.08           | 66665.99 | 0.48            | 139.14          | 44.52               | 66540.96    |
| q50             | q100             | 60%         | 0.46        | 141.14      | 45.16           | 66693.59 | 0.48            | 139.27          | 44.56               | 66532.93    |
| q50             | q100             | 80%         | 0.45        | 142.17      | 45.49           | 66764.60 | 0.48            | 139.15          | 44.52               | 66511.93    |
| q50             | q100             | 100%        | 0.44        | 143.86      | 46.03           | 66879.02 | 0.48            | 138.81          | 44.42               | 66480.34    |
| q80             | ind              | 0%          | 0.45        | 141.92      | 44.40           | 64868.26 | 0.47            | 139.22          | 43.55               | 64695.13    |
| q80             | ind              | 50%         | 0.45        | 141.87      | 44.38           | 64862.40 | 0.47            | 139.41          | 43.61               | 64711.20    |
| q80             | ind              | 60%         | 0.45        | 142.00      | 44.42           | 64866.26 | 0.47            | 139.20          | 43.54               | 64701.77    |
| q80             | ind              | 80%         | 0.45        | 141.89      | 44.39           | 64847.05 | 0.47            | 138.77          | 43.41               | 64681.35    |
| q80             | ind              | 100%        | 0.45        | 141.79      | 44.35           | 64851.41 | 0.47            | 138.41          | 43.30               | 64658.70    |

Continued on next page

| $support_{chm}$ | $support_{tspec}$ | $threshold$ | $R^2_{adj}$ | $RMSE_{cv}$ | $RMSE_{cv}[\%]$ | $AIC$    | $R^2_{adj,ref}$ | $RMSE_{cv,ref}$ | $RMSE_{cv,ref}[\%]$ | $AIC_{ref}$ |
|-----------------|-------------------|-------------|-------------|-------------|-----------------|----------|-----------------|-----------------|---------------------|-------------|
| q80             | q25               | 0%          | 0.46        | 140.65      | 45.01           | 65888.64 | 0.48            | 138.44          | 44.30               | 65720.92    |
| q80             | q25               | 50%         | 0.46        | 140.50      | 44.96           | 65877.65 | 0.48            | 138.60          | 44.35               | 65737.10    |
| q80             | q25               | 60%         | 0.46        | 140.54      | 44.98           | 65878.63 | 0.48            | 138.46          | 44.31               | 65726.72    |
| q80             | q25               | 80%         | 0.46        | 140.65      | 45.01           | 65869.87 | 0.48            | 138.20          | 44.23               | 65703.95    |
| q80             | q25               | 100%        | 0.46        | 140.70      | 45.03           | 65878.28 | 0.48            | 137.46          | 43.99               | 65674.03    |
| q80             | q50               | 0%          | 0.46        | 138.78      | 44.53           | 66159.84 | 0.48            | 137.07          | 43.98               | 66000.20    |
| q80             | q50               | 50%         | 0.46        | 138.74      | 44.51           | 66154.54 | 0.48            | 137.26          | 44.04               | 66016.68    |
| q80             | q50               | 60%         | 0.46        | 138.88      | 44.56           | 66151.52 | 0.48            | 136.96          | 43.94               | 66005.75    |
| q80             | q50               | 80%         | 0.46        | 139.03      | 44.61           | 66162.48 | 0.48            | 136.59          | 43.82               | 65982.82    |
| q80             | q50               | 100%        | 0.46        | 139.62      | 44.80           | 66209.86 | 0.48            | 136.14          | 43.68               | 65952.40    |
| q80             | q80               | 0%          | 0.46        | 138.03      | 44.47           | 66348.58 | 0.48            | 136.86          | 44.09               | 66222.79    |
| q80             | q80               | 50%         | 0.46        | 138.08      | 44.48           | 66357.36 | 0.48            | 137.28          | 44.23               | 66239.71    |
| q80             | q80               | 60%         | 0.46        | 138.50      | 44.62           | 66378.68 | 0.48            | 137.06          | 44.16               | 66229.36    |
| q80             | q80               | 80%         | 0.46        | 138.41      | 44.59           | 66367.72 | 0.48            | 136.71          | 44.04               | 66205.47    |
| q80             | q80               | 100%        | 0.45        | 139.94      | 45.09           | 66461.68 | 0.48            | 136.34          | 43.93               | 66174.95    |
| q80             | q100              | 0%          | 0.46        | 141.52      | 45.28           | 66698.65 | 0.48            | 138.91          | 44.45               | 66542.06    |
| q80             | q100              | 50%         | 0.46        | 140.95      | 45.10           | 66684.27 | 0.48            | 139.16          | 44.53               | 66558.80    |
| q80             | q100              | 60%         | 0.46        | 141.31      | 45.22           | 66715.73 | 0.48            | 139.20          | 44.54               | 66550.13    |
| q80             | q100              | 80%         | 0.45        | 142.29      | 45.53           | 66783.55 | 0.48            | 139.01          | 44.48               | 66527.02    |
| q80             | q100              | 100%        | 0.44        | 143.91      | 46.05           | 66895.38 | 0.48            | 138.74          | 44.39               | 66492.22    |
| q100            | ind               | 0%          | 0.39        | 149.44      | 46.75           | 65391.23 | 0.41            | 147.18          | 46.04               | 65241.42    |
| q100            | ind               | 50%         | 0.39        | 149.34      | 46.72           | 65379.90 | 0.40            | 147.32          | 46.08               | 65260.46    |
| q100            | ind               | 60%         | 0.39        | 149.43      | 46.75           | 65382.54 | 0.41            | 147.10          | 46.01               | 65249.02    |
| q100            | ind               | 80%         | 0.39        | 149.50      | 46.77           | 65377.00 | 0.41            | 146.57          | 45.85               | 65224.48    |
| q100            | ind               | 100%        | 0.39        | 149.15      | 46.65           | 65366.75 | 0.41            | 146.01          | 45.67               | 65194.50    |
| q100            | q25               | 0%          | 0.40        | 147.61      | 47.24           | 66442.67 | 0.42            | 145.59          | 46.59               | 66291.14    |
| q100            | q25               | 50%         | 0.40        | 147.46      | 47.19           | 66430.07 | 0.41            | 145.73          | 46.63               | 66310.71    |
| q100            | q25               | 60%         | 0.40        | 147.36      | 47.16           | 66428.18 | 0.42            | 145.51          | 46.56               | 66299.12    |
| q100            | q25               | 80%         | 0.40        | 147.39      | 47.17           | 66416.52 | 0.42            | 145.21          | 46.47               | 66271.49    |
| q100            | q25               | 100%        | 0.40        | 147.60      | 47.23           | 66426.82 | 0.42            | 144.46          | 46.23               | 66233.99    |
| q100            | q50               | 0%          | 0.40        | 146.76      | 47.09           | 66720.28 | 0.42            | 145.07          | 46.54               | 66572.83    |
| q100            | q50               | 50%         | 0.40        | 146.63      | 47.05           | 66712.95 | 0.41            | 145.32          | 46.62               | 66592.86    |
| q100            | q50               | 60%         | 0.40        | 146.85      | 47.11           | 66708.05 | 0.41            | 145.14          | 46.57               | 66581.36    |
| q100            | q50               | 80%         | 0.40        | 147.27      | 47.25           | 66722.92 | 0.42            | 144.59          | 46.39               | 66553.52    |
| q100            | q50               | 100%        | 0.39        | 147.64      | 47.37           | 66759.50 | 0.42            | 144.08          | 46.23               | 66516.11    |
| q100            | q80               | 0%          | 0.40        | 145.20      | 46.78           | 66917.50 | 0.42            | 144.07          | 46.42               | 66796.64    |
| q100            | q80               | 50%         | 0.40        | 145.12      | 46.76           | 66917.72 | 0.41            | 144.47          | 46.55               | 66816.62    |
| q100            | q80               | 60%         | 0.40        | 145.58      | 46.90           | 66935.84 | 0.42            | 144.29          | 46.49               | 66805.78    |
| q100            | q80               | 80%         | 0.40        | 145.62      | 46.92           | 66932.29 | 0.42            | 143.97          | 46.39               | 66776.81    |
| q100            | q80               | 100%        | 0.39        | 147.12      | 47.40           | 67015.72 | 0.42            | 143.54          | 46.25               | 66739.98    |
| q100            | q100              | 0%          | 0.40        | 148.90      | 47.65           | 67272.02 | 0.42            | 146.01          | 46.72               | 67121.18    |
| q100            | q100              | 50%         | 0.40        | 148.28      | 47.45           | 67258.42 | 0.41            | 146.33          | 46.82               | 67140.71    |
| q100            | q100              | 60%         | 0.40        | 148.59      | 47.55           | 67283.11 | 0.42            | 146.45          | 46.86               | 67130.60    |
| q100            | q100              | 80%         | 0.39        | 149.75      | 47.92           | 67353.11 | 0.42            | 146.13          | 46.76               | 67102.80    |
| q100            | q100              | 100%        | 0.38        | 151.55      | 48.49           | 67469.16 | 0.42            | 145.80          | 46.66               | 67062.13    |

**Table 3:** Model accuracies realized under various support choices for the CHM- and calibrated *treespecies* explanatory variables

| <i>support<sub>chm</sub></i> | <i>support<sub>tspc</sub></i> | <i>threshold</i> | $R^2_{adj}$ | $RMSE_{cv}$ | $RMSE_{cv} [\%]$ | <i>AIC</i> | $R^2_{adj,ref}$ | $RMSE_{cv,ref}$ | $RMSE_{cv,ref} [\%]$ | <i>AIC<sub>ref</sub></i> |
|------------------------------|-------------------------------|------------------|-------------|-------------|------------------|------------|-----------------|-----------------|----------------------|--------------------------|
| ind                          | ind                           | 0%               | 0.45        | 140.12      | 43.61            | 64291.15   | 0.45            | 139.71          | 43.48                | 64256.93                 |
| ind                          | ind                           | 50%              | 0.45        | 140.60      | 43.75            | 64317.74   | 0.45            | 139.85          | 43.52                | 64268.78                 |
| ind                          | ind                           | 60%              | 0.45        | 140.13      | 43.61            | 64294.65   | 0.45            | 139.48          | 43.41                | 64255.23                 |
| ind                          | ind                           | 80%              | 0.46        | 139.10      | 43.29            | 64236.04   | 0.46            | 138.92          | 43.23                | 64225.80                 |
| ind                          | ind                           | 100%             | 0.45        | 139.92      | 43.54            | 64280.23   | 0.46            | 138.85          | 43.21                | 64204.65                 |
| ind                          | q25                           | 0%               | 0.45        | 139.90      | 43.97            | 64835.11   | 0.46            | 139.25          | 43.77                | 64780.23                 |
| ind                          | q25                           | 50%              | 0.45        | 140.06      | 44.02            | 64852.35   | 0.46            | 139.37          | 43.81                | 64795.25                 |
| ind                          | q25                           | 60%              | 0.45        | 139.97      | 43.99            | 64846.98   | 0.46            | 139.23          | 43.76                | 64783.04                 |
| ind                          | q25                           | 80%              | 0.46        | 139.17      | 43.74            | 64792.34   | 0.46            | 138.57          | 43.56                | 64749.77                 |
| ind                          | q25                           | 100%             | 0.46        | 139.16      | 43.74            | 64792.06   | 0.46            | 138.14          | 43.42                | 64725.81                 |
| ind                          | q50                           | 0%               | 0.45        | 139.91      | 44.17            | 65093.04   | 0.46            | 139.36          | 44.00                | 65057.03                 |
| ind                          | q50                           | 50%              | 0.45        | 140.25      | 44.28            | 65113.44   | 0.46            | 139.60          | 44.07                | 65072.06                 |
| ind                          | q50                           | 60%              | 0.45        | 139.89      | 44.16            | 65094.92   | 0.46            | 139.53          | 44.05                | 65060.08                 |
| ind                          | q50                           | 80%              | 0.46        | 139.02      | 43.89            | 65033.71   | 0.46            | 138.90          | 43.85                | 65026.35                 |
| ind                          | q50                           | 100%             | 0.46        | 139.19      | 43.94            | 65040.22   | 0.46            | 138.60          | 43.75                | 65002.79                 |
| ind                          | q80                           | 0%               | 0.46        | 139.68      | 44.24            | 65309.58   | 0.46            | 139.43          | 44.16                | 65282.95                 |
| ind                          | q80                           | 50%              | 0.45        | 139.97      | 44.33            | 65336.21   | 0.46            | 139.71          | 44.25                | 65297.81                 |
| ind                          | q80                           | 60%              | 0.46        | 139.97      | 44.33            | 65319.59   | 0.46            | 139.58          | 44.21                | 65286.72                 |
| ind                          | q80                           | 80%              | 0.46        | 139.25      | 44.11            | 65283.08   | 0.46            | 138.97          | 44.02                | 65252.00                 |
| ind                          | q80                           | 100%             | 0.46        | 139.09      | 44.05            | 65251.61   | 0.46            | 138.84          | 43.98                | 65227.79                 |
| ind                          | q100                          | 0%               | 0.46        | 138.89      | 43.73            | 65577.54   | 0.46            | 138.83          | 43.72                | 65570.10                 |
| ind                          | q100                          | 50%              | 0.46        | 139.18      | 43.82            | 65589.23   | 0.46            | 139.13          | 43.81                | 65585.38                 |
| ind                          | q100                          | 60%              | 0.46        | 139.21      | 43.83            | 65580.00   | 0.46            | 139.14          | 43.81                | 65575.20                 |
| ind                          | q100                          | 80%              | 0.46        | 138.43      | 43.59            | 65543.72   | 0.46            | 138.39          | 43.58                | 65541.28                 |
| ind                          | q100                          | 100%             | 0.46        | 138.34      | 43.56            | 65521.67   | 0.46            | 138.25          | 43.53                | 65513.09                 |
| q25                          | ind                           | 0%               | 0.45        | 140.80      | 44.04            | 64815.81   | 0.46            | 140.09          | 43.82                | 64776.64                 |
| q25                          | ind                           | 50%              | 0.45        | 140.79      | 44.04            | 64815.82   | 0.46            | 140.28          | 43.88                | 64790.59                 |
| q25                          | ind                           | 60%              | 0.45        | 140.73      | 44.02            | 64812.34   | 0.46            | 139.96          | 43.78                | 64778.10                 |
| q25                          | ind                           | 80%              | 0.46        | 139.93      | 43.77            | 64780.19   | 0.46            | 139.43          | 43.62                | 64756.67                 |
| q25                          | ind                           | 100%             | 0.45        | 140.61      | 43.99            | 64846.27   | 0.46            | 138.92          | 43.46                | 64729.99                 |
| q25                          | q25                           | 0%               | 0.46        | 141.17      | 45.18            | 65882.42   | 0.47            | 139.91          | 44.78                | 65808.37                 |
| q25                          | q25                           | 50%              | 0.46        | 140.96      | 45.11            | 65878.58   | 0.47            | 140.07          | 44.82                | 65822.64                 |
| q25                          | q25                           | 60%              | 0.46        | 140.82      | 45.07            | 65871.86   | 0.47            | 139.77          | 44.73                | 65809.39                 |
| q25                          | q25                           | 80%              | 0.47        | 139.69      | 44.70            | 65814.08   | 0.47            | 139.33          | 44.59                | 65783.19                 |
| q25                          | q25                           | 100%             | 0.47        | 139.64      | 44.69            | 65826.77   | 0.48            | 138.53          | 44.33                | 65747.03                 |
| q25                          | q50                           | 0%               | 0.46        | 138.51      | 44.44            | 66122.18   | 0.47            | 138.15          | 44.33                | 66087.78                 |
| q25                          | q50                           | 50%              | 0.46        | 138.65      | 44.49            | 66132.92   | 0.47            | 138.31          | 44.38                | 66101.77                 |
| q25                          | q50                           | 60%              | 0.46        | 138.51      | 44.44            | 66140.26   | 0.47            | 138.09          | 44.31                | 66088.89                 |
| q25                          | q50                           | 80%              | 0.47        | 137.57      | 44.14            | 66087.41   | 0.47            | 137.55          | 44.13                | 66062.63                 |
| q25                          | q50                           | 100%             | 0.47        | 137.32      | 44.06            | 66076.87   | 0.47            | 136.83          | 43.90                | 66026.09                 |
| q25                          | q80                           | 0%               | 0.46        | 139.64      | 44.99            | 66345.17   | 0.47            | 139.34          | 44.89                | 66311.89                 |
| q25                          | q80                           | 50%              | 0.46        | 139.99      | 45.10            | 66355.29   | 0.47            | 139.72          | 45.02                | 66325.46                 |
| q25                          | q80                           | 60%              | 0.46        | 139.57      | 44.97            | 66349.49   | 0.47            | 139.52          | 44.95                | 66313.60                 |
| q25                          | q80                           | 80%              | 0.47        | 139.47      | 44.93            | 66318.88   | 0.47            | 139.07          | 44.80                | 66286.42                 |
| q25                          | q80                           | 100%             | 0.47        | 139.12      | 44.82            | 66310.46   | 0.48            | 138.48          | 44.61                | 66249.45                 |
| q25                          | q100                          | 0%               | 0.47        | 140.12      | 44.83            | 66631.70   | 0.47            | 140.09          | 44.83                | 66626.46                 |
| q25                          | q100                          | 50%              | 0.47        | 140.34      | 44.90            | 66642.41   | 0.47            | 140.32          | 44.90                | 66640.38                 |
| q25                          | q100                          | 60%              | 0.47        | 140.46      | 44.94            | 66633.43   | 0.47            | 140.42          | 44.93                | 66629.48                 |
| q25                          | q100                          | 80%              | 0.47        | 140.20      | 44.86            | 66606.19   | 0.47            | 140.16          | 44.85                | 66602.55                 |
| q25                          | q100                          | 100%             | 0.47        | 140.13      | 44.84            | 66576.55   | 0.48            | 139.97          | 44.79                | 66563.15                 |
| q50                          | ind                           | 0%               | 0.46        | 140.05      | 43.81            | 64745.65   | 0.47            | 138.82          | 43.42                | 64686.53                 |
| q50                          | ind                           | 50%              | 0.46        | 139.97      | 43.79            | 64748.33   | 0.47            | 138.93          | 43.46                | 64698.27                 |
| q50                          | ind                           | 60%              | 0.46        | 139.64      | 43.68            | 64731.81   | 0.47            | 138.70          | 43.39                | 64689.17                 |
| q50                          | ind                           | 80%              | 0.47        | 139.05      | 43.50            | 64712.28   | 0.47            | 138.27          | 43.25                | 64672.63                 |
| q50                          | ind                           | 100%             | 0.46        | 139.66      | 43.69            | 64771.24   | 0.47            | 137.91          | 43.14                | 64652.47                 |
| q50                          | q25                           | 0%               | 0.47        | 139.57      | 44.67            | 65788.59   | 0.48            | 138.36          | 44.28                | 65710.42                 |
| q50                          | q25                           | 50%              | 0.47        | 139.75      | 44.72            | 65802.74   | 0.48            | 138.43          | 44.30                | 65722.03                 |
| q50                          | q25                           | 60%              | 0.47        | 139.60      | 44.68            | 65789.21   | 0.48            | 138.19          | 44.22                | 65711.95                 |
| q50                          | q25                           | 80%              | 0.48        | 138.54      | 44.34            | 65728.34   | 0.48            | 137.97          | 44.15                | 65691.89                 |
| q50                          | q25                           | 100%             | 0.48        | 138.42      | 44.30            | 65735.17   | 0.48            | 137.41          | 43.98                | 65664.81                 |
| q50                          | q50                           | 0%               | 0.47        | 137.47      | 44.11            | 66034.28   | 0.48            | 136.89          | 43.92                | 65989.18                 |
| q50                          | q50                           | 50%              | 0.47        | 137.59      | 44.15            | 66037.77   | 0.48            | 137.05          | 43.97                | 66001.00                 |
| q50                          | q50                           | 60%              | 0.47        | 137.33      | 44.06            | 66033.77   | 0.48            | 136.89          | 43.92                | 65991.20                 |
| q50                          | q50                           | 80%              | 0.48        | 136.78      | 43.89            | 66003.35   | 0.48            | 136.48          | 43.79                | 65971.13                 |
| q50                          | q50                           | 100%             | 0.48        | 136.62      | 43.84            | 66002.02   | 0.48            | 135.98          | 43.63                | 65943.10                 |
| q50                          | q80                           | 0%               | 0.48        | 137.80      | 44.39            | 66248.74   | 0.48            | 137.22          | 44.21                | 66211.70                 |
| q50                          | q80                           | 50%              | 0.47        | 137.94      | 44.44            | 66261.63   | 0.48            | 137.60          | 44.33                | 66223.75                 |
| q50                          | q80                           | 60%              | 0.47        | 137.77      | 44.39            | 66256.59   | 0.48            | 137.43          | 44.28                | 66214.72                 |
| q50                          | q80                           | 80%              | 0.47        | 137.69      | 44.36            | 66250.53   | 0.48            | 137.11          | 44.17                | 66193.69                 |
| q50                          | q80                           | 100%             | 0.48        | 137.13      | 44.18            | 66202.85   | 0.48            | 136.63          | 44.02                | 66165.28                 |
| q50                          | q100                          | 0%               | 0.48        | 138.91      | 44.45            | 66527.59   | 0.48            | 138.94          | 44.46                | 66528.70                 |
| q50                          | q100                          | 50%              | 0.48        | 139.18      | 44.53            | 66542.04   | 0.48            | 139.14          | 44.52                | 66540.96                 |
| q50                          | q100                          | 60%              | 0.48        | 139.30      | 44.57            | 66535.91   | 0.48            | 139.27          | 44.56                | 66532.93                 |
| q50                          | q100                          | 80%              | 0.48        | 139.17      | 44.53            | 66513.80   | 0.48            | 139.15          | 44.52                | 66511.93                 |
| q50                          | q100                          | 100%             | 0.48        | 138.82      | 44.42            | 66479.85   | 0.48            | 138.81          | 44.42                | 66480.34                 |
| q80                          | ind                           | 0%               | 0.46        | 140.31      | 43.89            | 64746.39   | 0.47            | 139.22          | 43.55                | 64695.13                 |
| q80                          | ind                           | 50%              | 0.46        | 140.23      | 43.87            | 64748.57   | 0.47            | 139.41          | 43.61                | 64711.20                 |
| q80                          | ind                           | 60%              | 0.46        | 140.00      | 43.80            | 64737.02   | 0.47            | 139.20          | 43.54                | 64701.77                 |
| q80                          | ind                           | 80%              | 0.47        | 139.16      | 43.53            | 64702.03   | 0.47            | 138.77          | 43.41                | 64681.35                 |
| q80                          | ind                           | 100%             | 0.46        | 140.13      | 43.84            | 64782.06   | 0.47            | 138.41          | 43.30                | 64658.70                 |
| q80                          | q25                           | 0%               | 0.47        | 139.67      | 44.70            | 65812.79   | 0.48            | 138.44          | 44.30                | 65720.92                 |
| q80                          | q25                           | 50%              | 0.47        | 139.78      | 44.73            | 65816.46   | 0.48            | 138.60          | 44.35                | 65737.10                 |
| q80                          | q25                           | 60%              | 0.47        | 139.63      | 44.68            | 65803.87   | 0.48            | 138.46          | 44.31                | 65726.72                 |
| q80                          | q25                           | 80%              | 0.48        | 138.66      | 44.37            | 65740.91   | 0.48            | 138.20          | 44.23                | 65703.95                 |

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| <i>support<sub>chm</sub></i> | <i>support<sub>tspec</sub></i> | <i>threshold</i> | $R^2_{adj}$ | $RMSE_{cv}$ | $RMSE_{cv}[\%]$ | <i>AIC</i> | $R^2_{adj,ref}$ | $RMSE_{cv,ref}$ | $RMSE_{cv,ref}[\%]$ | $AIC_{ref}$ |
|------------------------------|--------------------------------|------------------|-------------|-------------|-----------------|------------|-----------------|-----------------|---------------------|-------------|
| q80                          | q25                            | 100%             | 0.48        | 138.48      | 44.32           | 65747.54   | 0.48            | 137.46          | 43.99               | 65674.03    |
| q80                          | q50                            | 0%               | 0.47        | 137.55      | 44.13           | 66041.96   | 0.48            | 137.07          | 43.98               | 66000.20    |
| q80                          | q50                            | 50%              | 0.47        | 137.67      | 44.17           | 66057.53   | 0.48            | 137.26          | 44.04               | 66016.68    |
| q80                          | q50                            | 60%              | 0.47        | 137.33      | 44.06           | 66042.83   | 0.48            | 136.96          | 43.94               | 66005.75    |
| q80                          | q50                            | 80%              | 0.48        | 136.92      | 43.93           | 66016.64   | 0.48            | 136.59          | 43.82               | 65982.82    |
| q80                          | q50                            | 100%             | 0.48        | 136.83      | 43.90           | 66016.69   | 0.48            | 136.14          | 43.68               | 65952.40    |
| q80                          | q80                            | 0%               | 0.47        | 137.32      | 44.24           | 66254.83   | 0.48            | 136.86          | 44.09               | 66222.79    |
| q80                          | q80                            | 50%              | 0.47        | 137.49      | 44.30           | 66267.03   | 0.48            | 137.28          | 44.23               | 66239.71    |
| q80                          | q80                            | 60%              | 0.47        | 137.41      | 44.27           | 66262.63   | 0.48            | 137.06          | 44.16               | 66229.36    |
| q80                          | q80                            | 80%              | 0.47        | 137.17      | 44.19           | 66247.32   | 0.48            | 136.71          | 44.04               | 66205.47    |
| q80                          | q80                            | 100%             | 0.48        | 137.14      | 44.18           | 66237.84   | 0.48            | 136.34          | 43.93               | 66174.95    |
| q80                          | q100                           | 0%               | 0.48        | 139.02      | 44.48           | 66548.99   | 0.48            | 138.91          | 44.45               | 66542.06    |
| q80                          | q100                           | 50%              | 0.48        | 139.28      | 44.56           | 66566.73   | 0.48            | 139.16          | 44.53               | 66558.80    |
| q80                          | q100                           | 60%              | 0.48        | 139.23      | 44.55           | 66553.30   | 0.48            | 139.20          | 44.54               | 66550.13    |
| q80                          | q100                           | 80%              | 0.48        | 139.00      | 44.48           | 66526.64   | 0.48            | 139.01          | 44.48               | 66527.02    |
| q80                          | q100                           | 100%             | 0.48        | 138.84      | 44.43           | 66501.70   | 0.48            | 138.74          | 44.39               | 66492.22    |
| q100                         | ind                            | 0%               | 0.40        | 147.90      | 46.26           | 65284.59   | 0.41            | 147.18          | 46.04               | 65241.42    |
| q100                         | ind                            | 50%              | 0.40        | 147.96      | 46.28           | 65287.17   | 0.40            | 147.32          | 46.08               | 65260.46    |
| q100                         | ind                            | 60%              | 0.40        | 147.88      | 46.26           | 65290.73   | 0.41            | 147.10          | 46.01               | 65249.02    |
| q100                         | ind                            | 80%              | 0.40        | 147.33      | 46.09           | 65256.46   | 0.41            | 146.57          | 45.85               | 65224.48    |
| q100                         | ind                            | 100%             | 0.40        | 147.94      | 46.28           | 65310.65   | 0.41            | 146.01          | 45.67               | 65194.50    |
| q100                         | q25                            | 0%               | 0.41        | 146.40      | 46.85           | 66352.97   | 0.42            | 145.59          | 46.59               | 66291.14    |
| q100                         | q25                            | 50%              | 0.41        | 146.37      | 46.84           | 66364.04   | 0.41            | 145.73          | 46.63               | 66310.71    |
| q100                         | q25                            | 60%              | 0.41        | 146.44      | 46.86           | 66359.76   | 0.42            | 145.51          | 46.56               | 66299.12    |
| q100                         | q25                            | 80%              | 0.41        | 145.80      | 46.66           | 66319.25   | 0.42            | 145.21          | 46.47               | 66271.49    |
| q100                         | q25                            | 100%             | 0.41        | 145.44      | 46.54           | 66311.30   | 0.42            | 144.46          | 46.23               | 66233.99    |
| q100                         | q50                            | 0%               | 0.41        | 145.73      | 46.76           | 66629.70   | 0.42            | 145.07          | 46.54               | 66572.83    |
| q100                         | q50                            | 50%              | 0.41        | 145.90      | 46.81           | 66641.20   | 0.41            | 145.32          | 46.62               | 66592.86    |
| q100                         | q50                            | 60%              | 0.41        | 145.50      | 46.68           | 66621.92   | 0.41            | 145.14          | 46.57               | 66581.36    |
| q100                         | q50                            | 80%              | 0.41        | 145.08      | 46.55           | 66597.85   | 0.42            | 144.59          | 46.39               | 66553.52    |
| q100                         | q50                            | 100%             | 0.42        | 144.76      | 46.45           | 66570.46   | 0.42            | 144.08          | 46.23               | 66516.11    |
| q100                         | q80                            | 0%               | 0.41        | 144.43      | 46.53           | 66840.17   | 0.42            | 144.07          | 46.42               | 66796.64    |
| q100                         | q80                            | 50%              | 0.41        | 144.61      | 46.59           | 66852.78   | 0.41            | 144.47          | 46.55               | 66816.62    |
| q100                         | q80                            | 60%              | 0.41        | 144.50      | 46.56           | 66831.91   | 0.42            | 144.29          | 46.49               | 66805.78    |
| q100                         | q80                            | 80%              | 0.41        | 144.40      | 46.52           | 66819.43   | 0.42            | 143.97          | 46.39               | 66776.81    |
| q100                         | q80                            | 100%             | 0.42        | 144.23      | 46.47           | 66799.38   | 0.42            | 143.54          | 46.25               | 66739.98    |
| q100                         | q100                           | 0%               | 0.42        | 146.18      | 46.78           | 67128.38   | 0.42            | 146.01          | 46.72               | 67121.18    |
| q100                         | q100                           | 50%              | 0.41        | 146.48      | 46.87           | 67147.05   | 0.41            | 146.33          | 46.82               | 67140.71    |
| q100                         | q100                           | 60%              | 0.42        | 146.49      | 46.88           | 67131.35   | 0.42            | 146.45          | 46.86               | 67130.60    |
| q100                         | q100                           | 80%              | 0.42        | 146.17      | 46.77           | 67105.03   | 0.42            | 146.13          | 46.76               | 67102.80    |
| q100                         | q100                           | 100%             | 0.42        | 145.81      | 46.66           | 67064.03   | 0.42            | 145.80          | 46.66               | 67062.13    |