Manual: Initialization of stands

1. Content

2. Introduction

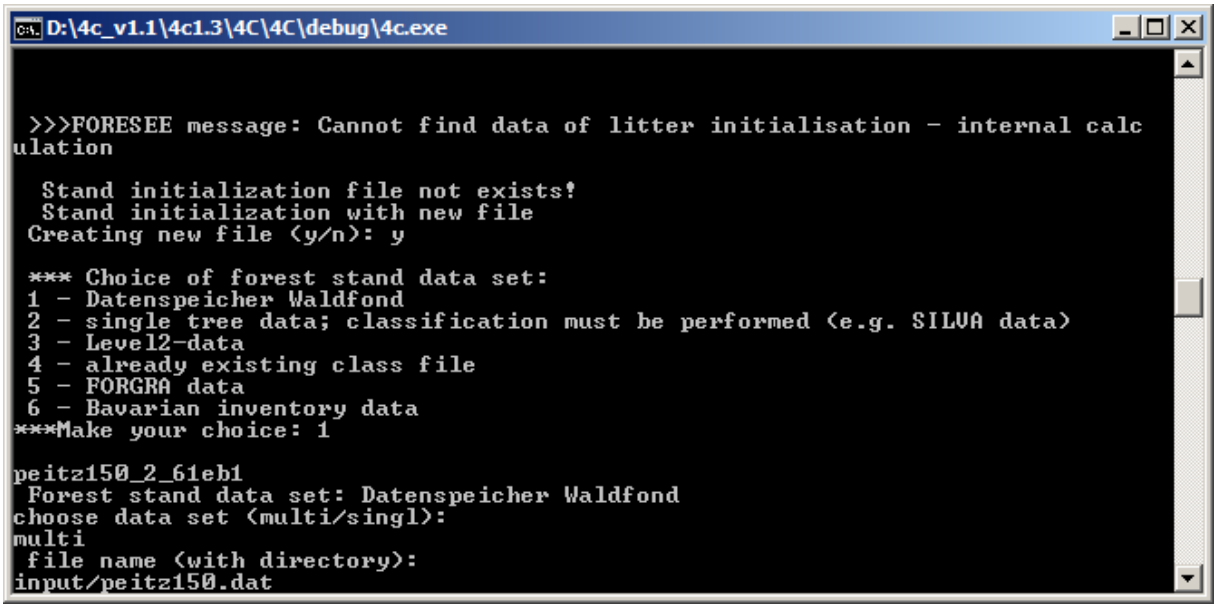
Initialization is separated from simulation. If it is necessary to initialize one stand or several stands then:

a) Simulate the model with an explicit initialization sim-file (flag_stand=2 or flag_stand=0).
   A file <name>.ini and <name>.initctrl (only for information) is generated.
b) Use the generated ini-file in a new sim-file as input for a simulation with flag_stand=1.
c) If an initialization file with several ini-data sets is used and flag_multi = 1, the number of the used initialization is required in the sim-file (row 7 below the row ! ** input).

3. Several stands with averaged stand data (number > 1)

It requires flag_stand = 2 in the simulation control file.

3.1. Dialogue



3.2. Structure of the input file

Example for three stands (txt-file, numbers separated by space):

1	0	0	0	0	0	1	11	62	1.0	9.2	10.4	29.5	0	0
2	0	0	0	0	0	1	11	67	1.0	9.9	11.4	31.01	0	0
3	0	0	0	0	0	1	11	62	1.0	9.0	10.8	21.3	0	0

Column 1: number of the stand
Columns 2 – 6: zero (not used)
Column 7: number of rows per stand, in the case of mono-species stand 1, for a mixed stand >1; the mixed stand is described by one row per species
Column 8: species type (see
Table 1)
Column 9: age
Column 10: patch size (ha)
Column 11: mean height (m)

Column 12: mean DBH [cm]
Column 13: basal area (m²)
Columns 14-15: 0

Table 1 Species type code in column 8

Species type number	species	Taxid in 4C (species.par)	species
1	Abies alba	2	spruce
2	Acer platanoides	1	beech
3	Acer	1	beech
4	Alnus glutinosa	5	birch
5	birch	5	birch
6	Carpinus betulus	1	beech
7	Castanea sativa	4	oak
8	Beech	1	beech
9	Frax. excelsior	4	oak
10	Spruce	2	spruce
11	pine	3	pine
12	Populus tremula	8	aspen
13	Quercus petrea	4	oak
14	Quercus pub.	4	oak
15	oak	4	oak
16	Tilia cordata	1	beech
17	Ulmus glabra	4	oak
21	Douglasie	10	Douglas fir
23	Pinus strobus	7	Pinus ponderosa
24	larix	10	Douglas fir
30	Eucalyptus glob.	12	Eucalyptus glob.
31	Eucalyptus grandis	13	Eucalyptus grandis

3.3. Output

In the input directory the resulting ini-file is stored, in the case of the example it contains three initializations:

```
1       -99. ! = volume function, patch size
! data source= D source file=     input/peitz150.dat
! sapwood fraction and form factor now dynamic per cohort
! 4C Tree Initialization File (Stand)
!
! contains the following data (single tree values):
!
! x_Ahb:   cross sectional area of heartwood at stem base (cm**2)
! height:  tree height (cm)
! x_hbole: bole height (cm)
! x_age:   tree age (years)
! n:       number of trees
! sp:      species (integer number)
! DC:      diameter at crown base
! DBH:     diameter at breast height
!
!    x_fol        x_frt        x_sap        x_hrt      x_Ahb     height   x_hbole   age    n     sp      DC        DBH
        1   10000.00    stand identifier, stand area
    0.70841    0.70841    5.24632    2.82494   40.14457     860.     662.    62   602     3    4.29339    7.48289
    0.90351    0.90351    7.54647    4.06348   48.97933     989.     763.    62   623     3    4.84511    8.45072
    1.12823    1.12823   10.47202    5.63878   59.20908    1118.     865.    62   561     3    5.40435    9.44331
    1.37929    1.37929   14.03830    7.55908   70.64241    1245.     964.    62   419     3    5.96350   10.44129
    1.64671    1.64671   18.12082    9.75737   82.81343    1364.    1056.    62   312     3    6.50443   11.40866
    1.94359    1.94359   22.93710   12.35074   96.31477    1480.    1146.    62   271     3    7.05613   12.39447
    2.27304    2.27304   28.58420   15.39149  111.26393    1595.    1234.    62   208     3    7.62122   13.40385
    2.62625    2.62625   34.95127   18.81991  127.26677    1704.    1317.    62   143     3    8.18532   14.40769
    3.01102    3.01102   42.18682   22.71598  144.67072    1811.    1398.    62    85     3    8.75958   15.42706
    3.41182    3.41182   49.98800   26.91661  162.78668    1909.    1471.    62    46     3    9.32173   16.42174
```

3.81805	3.81805	58.22078	31.34965	181.11896	1998.	1538.	62	32	3	9.86036	17.37187
4.25874	4.25874	67.59649	36.39811	200.97351	2085.	1605.	62	17	3	10.41388	18.34706
4.71262	4.71262	77.52253	41.74290	221.42387	2170.	1665.	62	2	3	10.95478	19.30000
5.16239	5.16239	87.64429	47.19308	241.66017	2250.	1720.	62	1	3	11.46559	20.20000
5.57939	5.57939	97.09858	52.28385	260.43759	2310.	1765.	62	2	3	11.91967	21.00000
6.31979	6.31979	114.74910	61.78798	293.61395	2415.	1845.	62	2	3	12.68594	22.35000
7.10632	7.10632	133.50533	71.88748	328.99533	2510.	1910.	62	1	3	13.45220	23.70000
7.40932	7.40932	141.30211	76.08575	342.49506	2550.	1940.	62	1	3	13.73600	24.20000

-99.9

2 10000.00 stand identifier, stand area

0.67687	0.67687	5.24507	2.82427	40.99206	860.	662.	67	654	3	4.22645	7.48226
0.86314	0.86314	7.54202	4.06109	50.00311	989.	763.	67	674	3	4.77069	8.44926
1.07978	1.07978	10.49826	5.65291	60.53798	1119.	865.	67	588	3	5.32513	9.45034
1.31929	1.31929	14.05975	7.57063	72.20179	1246.	964.	67	459	3	5.87192	10.44597
1.58098	1.58098	18.24033	9.82172	84.94003	1367.	1058.	67	330	3	6.41174	11.43515
1.86308	1.86308	23.03374	12.40278	98.65436	1482.	1148.	67	296	3	6.94448	12.41351
2.17683	2.17683	28.67710	15.44151	113.88295	1597.	1235.	67	210	3	7.49293	13.41810
2.50081	2.50081	34.77378	18.72434	129.58844	1701.	1315.	67	139	3	8.01875	14.38201
2.85424	2.85424	41.70235	22.45511	146.69318	1803.	1393.	67	85	3	8.55520	15.36471
3.25111	3.25111	49.77486	26.80185	165.87625	1906.	1470.	67	54	3	9.12054	16.39815
3.68089	3.68089	58.89715	31.71385	186.61624	2007.	1545.	67	31	3	9.69815	17.44839
4.05919	4.05919	67.07206	36.11573	204.88364	2085.	1602.	67	13	3	10.17947	18.32308
4.62100	4.62100	79.73067	42.93190	231.93358	2195.	1680.	67	2	3	10.85624	19.55000
5.15564	5.15564	91.83128	49.44761	257.67346	2280.	1745.	67	2	3	11.46149	20.65000
5.79870	5.79870	107.07757	57.65715	288.50201	2380.	1820.	67	1	3	12.15216	21.90000
5.90509	5.90509	109.40089	58.90817	293.62674	2390.	1830.	67	1	3	12.26268	22.10000
6.64856	6.64856	127.80443	68.81777	329.31650	2495.	1900.	67	2	3	13.01173	23.45000

-99.9

3 10000.00 stand identifier, stand area

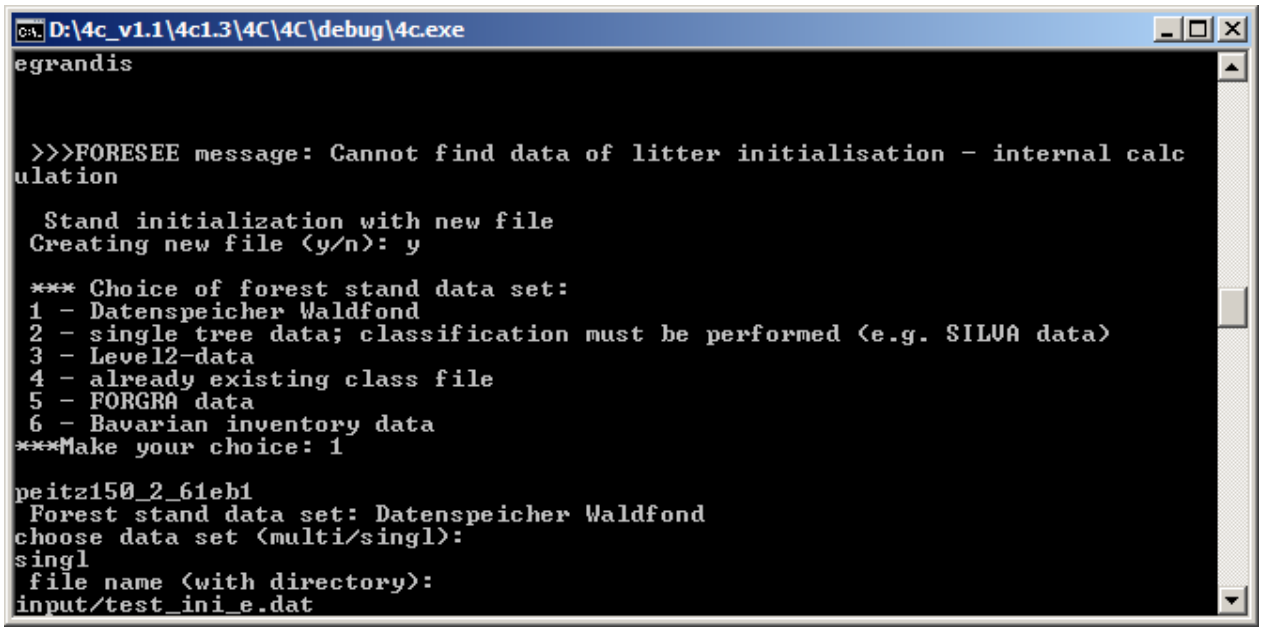
0.70968	0.70968	5.25960	2.83209	40.20183	860.	662.	62	451	3	4.29688	7.48958
0.90324	0.90324	7.54253	4.06136	48.96976	989.	763.	62	449	3	4.84466	8.44944
1.13088	1.13088	10.50996	5.65921	59.32653	1120.	866.	62	395	3	5.41045	9.45443
1.37846	1.37846	14.02761	7.55333	70.60268	1245.	963.	62	299	3	5.96177	10.43812
1.65127	1.65127	18.19434	9.79695	83.02018	1366.	1057.	62	225	3	6.51336	11.42445

1.93902	1.93902	22.86356	12.31115	96.10162	1479.	1145.	62	209	3	7.04762	12.37990
2.26848	2.26848	28.52081	15.35736	111.04946	1594.	1233.	62	146	3	7.61392	13.39041
2.63195	2.63195	35.04168	18.86860	127.53353	1705.	1318.	62	103	3	8.19414	14.42330
2.99481	2.99481	41.85144	22.53539	143.93817	1805.	1395.	62	62	3	8.73573	15.38548
3.43399	3.43399	50.43755	27.15868	163.76839	1914.	1476.	62	40	3	9.35170	16.47500
3.86293	3.86293	59.12800	31.83815	183.15358	2006.	1545.	62	19	3	9.91815	17.47368
4.26010	4.26010	67.60942	36.40507	201.04858	2087.	1604.	62	10	3	10.41555	18.35000
4.66391	4.66391	76.51435	41.20004	219.21188	2165.	1660.	62	2	3	10.89802	19.20000
5.11140	5.11140	86.68941	46.67892	239.27341	2240.	1720.	62	1	3	11.40883	20.10000
6.17920	6.17920	111.26530	59.91208	287.32614	2390.	1830.	62	1	3	12.54404	22.10000
6.98688	6.98688	130.64087	70.34509	323.63596	2500.	1900.	62	1	3	13.33868	23.50000

4. Single stand with averaged stand data

Flag_stand = 2 in the simulation control file

4.1. Dialogue



4.2. Input file

Example, similar to the structure of multi stand file, but only one row, and 14 columns (txt-file, numbers separated by space):

1 0 0 0 0 0 1 8 30 11.2 11.6 7.0 0 0

Column 1: number of the stand
Columns 2 – 6: zero (not used)
Column 7: number of rows per stand, in the case of mono-species stand 1, for a mixed stand >1; the mixed stand is described by one row per species
Column 8: species type (see
Table 1)
Column 9: age
Column 10: mean height (m)
Column 11: mean DBH [cm]
Column 12: basal area (m^2)
Columns 14-15: 0

Without explicit information on patch size, patch size is assumed 1 ha.

In the case of two species:

1 0 0 0 0 0 2 5 17 8.60 7.50 2.05 0.00 0.00 11 17 8.60 7.50 2.05 0.00 0.00

Column 7: 2 (means 2 species)
Column 8: 5 (first species birch)
Column 15: 11 (second species pine)
…..

4.3. Output file

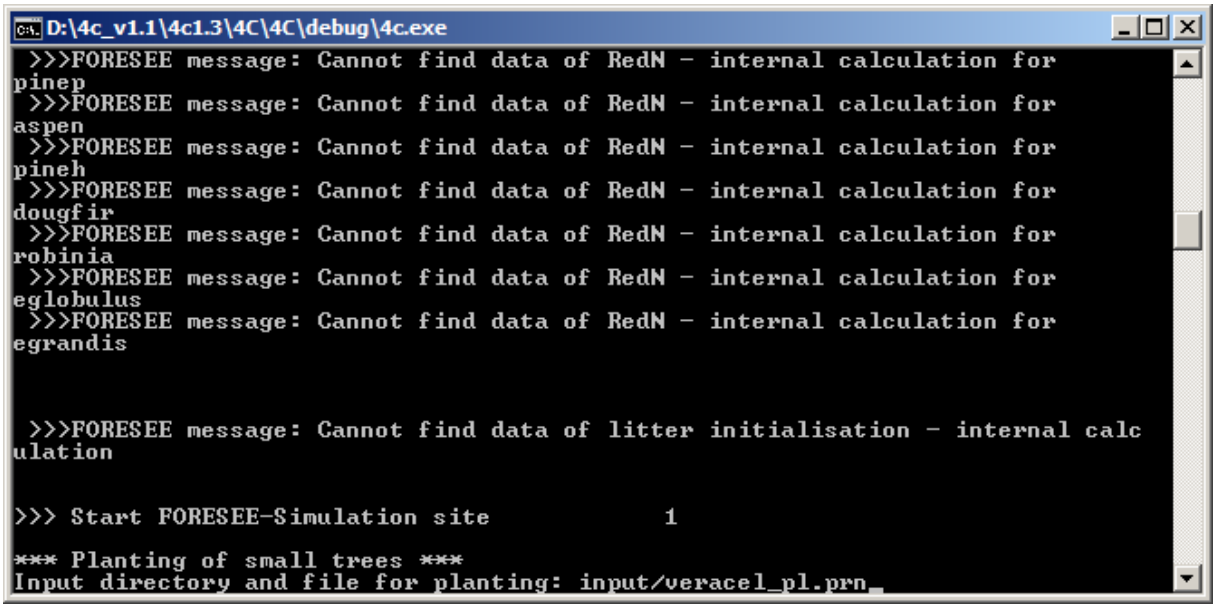
Similar to the multi stand ini-file with only one initialization data set.

5. Initialization by planting using stand data

This method should be applied for stands with low DBH and age. The method of generating tree with Weibull distributions, used for initialization from averaged stand data, does not work very well in this case. Therefore an easier approach is recommended, which assumed planting of tree cohorts with fixed DBH but varying height.

Flags: flag_reg=20; flag_stand = 0

5.1. Dialogue



5.2. Input file

Example for a single stand (texfile, numbers separated by space):

1 1111 13 16.6 7 13.3 -99.9

Column 1: number of stand
Column 2: number of plants per ha
Column 3: species type – corresponds to the taxid number in 4C
Column 4: mean sapling height (m)
Column 5: age
Column 6: mean DBH (cm)
Column 7: bole height, if not available -99.9

It is also possible to plant several stands by a number of rows > 1

5.3. Output file

10 cohorts are intialised with varying height and equal DBH. In the case of a single stand initialization the first row (1 10000) should be removed.

Example:

```
1     10000. ! = volume function, patch size
! data source=   source file=     input/veracel_pl.prn
! sapwood fraction and form factor now dynamic per cohort
! 4C Tree Initialization File (Stand)
!
! contains the following data (single tree values):
!
```

! x_fol: foliage biomass (kg)
! x_frt: fine root biomass (kg)
! x_sap: sapwood biomass (kg)
! x_hrt: heartwood biomass (kg)
! x_Ahb: cross sectional area of heartwood at stem base (cm**2)
! height: tree height (cm)
! x_hbole: bole height (cm)
! x_age: tree age (years)
! n: number of trees
! sp: species (integer number)
! DC: diameter at crown base
! DBH: diameter at breast height
!

!	x_fol	x_frt	x_sap	x_hrt	x_Ahb	height	x_hbole	x_age	n	sp	DC	DBH
	1	10000.00										
	4.96394	4.96394	32.95486	7.02160	79.13116	1328.	531.	7	111	13	10.26346	13.30000
	4.96394	4.96394	34.89244	7.41983	76.48411	1370.	581.	7	111	13	10.26346	13.30000
	4.96394	4.96394	36.83001	7.83187	74.38439	1411.	630.	7	111	13	10.26346	13.30000
	4.96394	4.96394	38.76759	8.25384	72.67826	1452.	680.	7	111	13	10.26346	13.30000
	4.96394	4.96394	40.70516	8.68320	71.26458	1494.	729.	7	111	13	10.26346	13.30000
	4.96394	4.96394	42.64274	9.11819	70.07415	1536.	779.	7	111	13	10.26346	13.30000
	4.96394	4.96394	44.58032	9.55760	69.05796	1577.	828.	7	111	13	10.26346	13.30000
	4.96394	4.96394	46.51789	10.00051	68.18037	1619.	878.	7	111	13	10.26346	13.30000
	4.96394	4.96394	48.45547	10.44625	67.41488	1660.	927.	7	111	13	10.26346	13.30000
	4.96394	4.96394	50.39305	10.89434	66.74127	1702.	977.	7	111	13	10.26346	13.30000

6. Initialization with single tree data

6.1. Simulation file

The initialisation flag is set flag_stand = 2.

Example:

```
  1  ! Run option 0 = single run, 1-6 multi run
  1  !
 ! *** simulation specifications  ************************************
  1  ! number of simulation years
1990  ! start year for simulation
2500.0 ! patch size [m²]
 50.0 ! thickness of foliage layers [cm]
  7  ! time step photosynthesis calculations [d]
 ! *** choice of model options ****************************************
  1  ! mortality flag (flag_mort)
  0   ! regeneration flag (flag_reg)
  0  ! use FORSKA environmental factors and regeneration (flag_forska)
  2  ! initialization flag (flag_stand)
  0  ! soil vegetation flag (flag_sveg)    !!! new !!!
  0  ! management flag (flag_mg)
  0  ! disturbance flag (flag_dis)
  4  ! light algorithm number (flag_light)
  1  ! foliage-height relationship (flag_folhei)
  1  ! volume function (flag_volfunc)
  0  ! respiration flag (flag_resp)
 15  ! limitation flag (flag_limi)
  1  ! decomposition model (flag_decomp)
  0  ! root activity function flag (flag_sign)
  1  ! soil water uptake flag (flag_wred)
  1  ! root distribution flag (flag_wurz)
  0  ! heat conductance flag (flag_cond)
  0  ! interception flag (flag_int)
  0  ! evapotranspiration flag (flag_eva)
  0  ! CO2 flag (flag_CO2)
  0  ! dummy flag (flag_dum1)
  0  ! dummy flag (flag_dum2)
  0  ! dummy flag (flag_dum3)
 ! *** output specifications ******************************************
  1  ! Yearly output flag
end
  0  ! Daily output flag
end
  0  ! cohort output flag
```

```
end
  2  ! summation output flag
!******
input/species_neu.par
Zvirgzde11
input/Liep.cli
input/Zvir.sop
input/Ebw1617.soi
input/zvirgzde11.ini                    ! name of the new generated initialization file
9999
input/ebw03_h95.man
input/dummy.dep
input/dummy.red
input/dummy.lit
```

6.2. File with tree data

Example of an initialization file (txt-file with space separated numbers). If the bole height is not available (-99.9) it is estimated by a function in 4C.

```
Liepaja
26880 m²      ! plot size
NR      BA      BHD      H     KA      AL   ! tree number, species type, BHD (mm), H (m), bole
                                               height (m), age
1       3       27       2.3   -99.9   10
2       3       8        1.62  -99.9   10
5       3       22       1.7   -99.9   10
7       3       5        1.35  -99.9   10
9       3       6        1.4   -99.9   10
  .
  .
  .
```

The species number in this file corresponds to the species number in species_neu.par.

If the stand consists of several species, the tree must be sorted according to the species type and the trees must be separated by a line starting with -9999.

Example:

```
Patchsize  [m²]
3200
   nr     BA     BHD     H       KA       Al
.
    229      3    301    24.3   -99.9     77
    230      3    220    21.2   -99.9     77
  -9999      3      0      0       0       77
      7      5    253    23.4   -99.9     77
```

19 5 324 24.2 -99.9 77

.....

6.3. Initialisation dialog

Answers are necessary to the following questions:

1.question: Y

2. question: 2

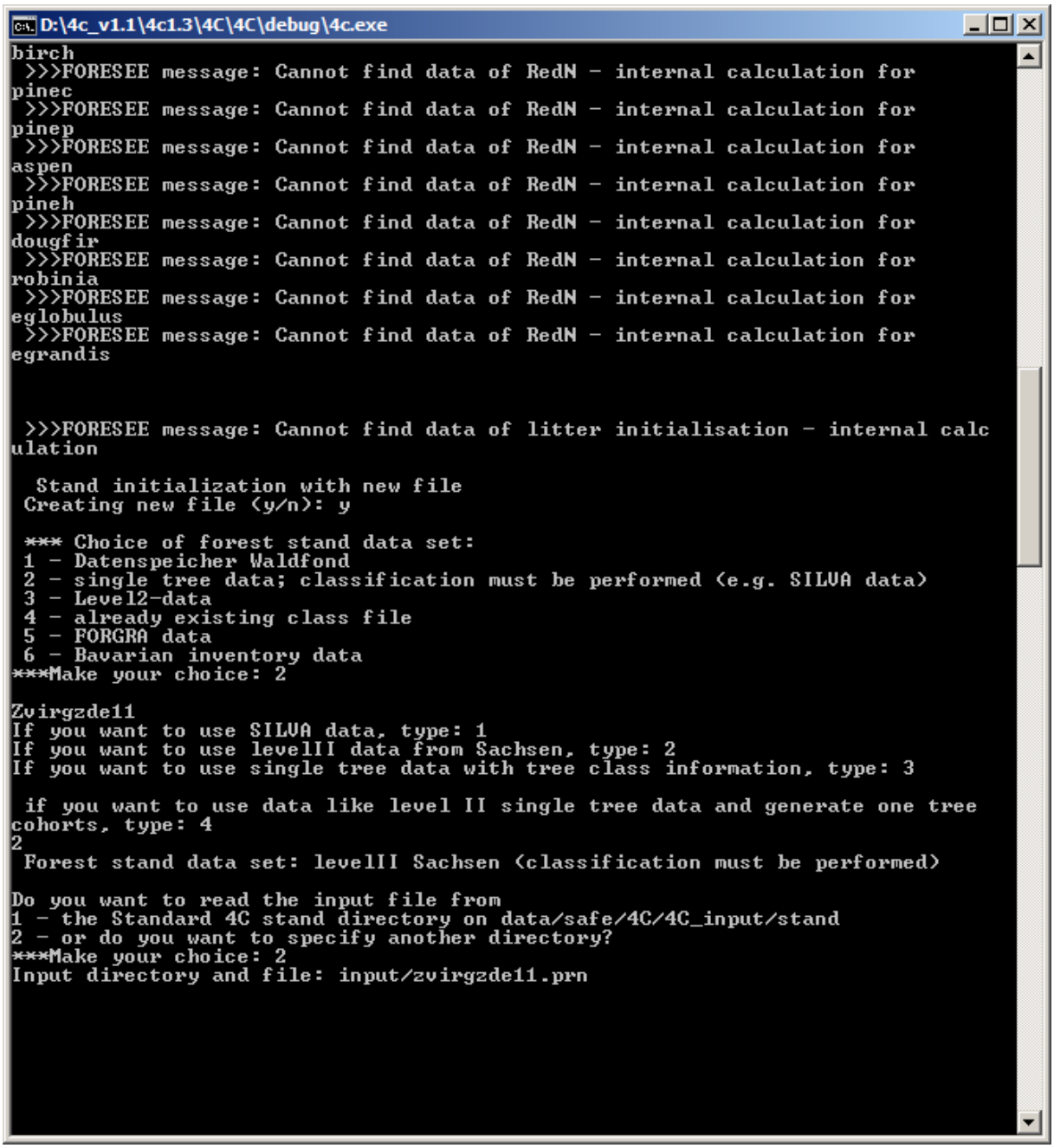
3.question: 2

4. question: 2

Input directory and file: input/<name>.prn

See

The prn-file is placed in the input directory



6.4. Result

A file <name>.ini file is produced in the input directory.

In the case of the example the file zvirgzde11.ini is produced.

7. Initialization with dbh class data

7.1. Simulation file

The initialisation flag is set flag_stand = 2.

The sim-file has the same structure as described in 6.1.

7.2. File with dbh class data

Example of an initialisation file (Brasschaat, Cermak 1998)

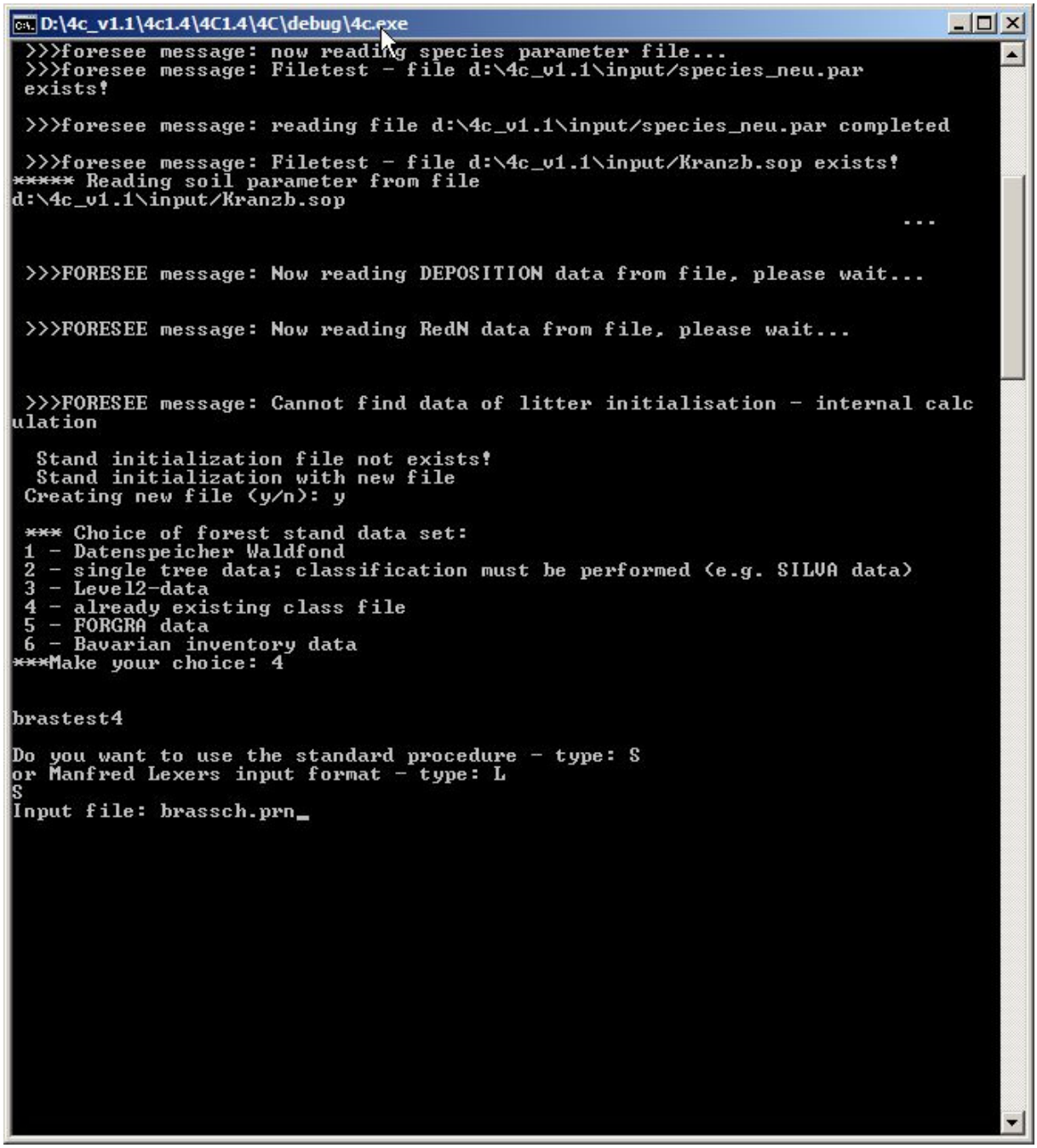
```
S          3   0.300                  ! code S species type (pine), rsap (estimate)
  10000                               ! patch size (m²)
   542     17     66                  !number of trees, number of classes, age
   166   17.5  0.004   15.4           ! dbh (mm), Height (m), share, bole height
   186   18.3  0.026   15.7
   203   19.3  0.081   16.5
   222   19.6  0.116   16.5
   242   20.1  0.170   16.7
   261   20.5  0.173   16.8
   280   20.8  0.153    17
   300   21.1  0.118    17
   315   22.3  0.037   17.5
   339   22.3  0.052   17.4
   361     22  0.035    17
   381   22.8  0.020   17.2
   394   21.9  0.006   17.1
   420   23.2  0.004   15.9
   438   22.2  0.002   17.6
   460   20.9  0.002   16.8
   484   23.3  0.002   15.4
```

Share: 0. < value <1 share of dbh class on the whole stem number

7.3. Initialisation dialog

1. Question: y
2. Question: 4
3. Question: S

4. Question: filename



7.4. Result

A file <name>.ini file is produced in the input directory.