



# Manual: Initialization of stands

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## 2. Introduction

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

- 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.
- Use the generated ini-file in a new sim-file as input for a simulation with flag\_stand=1.
- 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

```
C:\D:\4c_v1.1\4c1.3\4C\4C\debug\4c.exe

>>>FORESEE message: Cannot find data of litter initialisation - internal calc
ulation

Stand initialization file not exists!
Stand initialization with new file
Creating new file (y/n): y

*** Choice of forest stand data set:
1 - Datenspeicher Waldfond
2 - single tree data; classification must be performed (e.g. SILVA data)
3 - Level2-data
4 - already existing class file
5 - FORGRA data
6 - Bavarian inventory data
***Make your choice: 1

peitz150_2_61eb1
Forest stand data set: Datenspeicher Waldfond
choose data set (multi/singl):
multi
file name (with directory):
input/peitz150.dat
```

### 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 (m<sup>2</sup>)

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	14	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

```
CA: D:\4c_v1.1\4c1.3\4C\4C\debug\4c.exe
egrandis

>>>FORESEE message: Cannot find data of litter initialisation - internal calc
ulation

Stand initialization with new file
Creating new file (y/n): y

*** Choice of forest stand data set:
1 - Datenspeicher Waldfond
2 - single tree data; classification must be performed (e.g. SILVA data)
3 - Level2-data
4 - already existing class file
5 - FORGRA data
6 - Bavarian inventory data
***Make your choice: 1

peitz150_2_61eb1
Forest stand data set: Datenspeicher Waldfond
choose data set (multi/singl):
singl
file name (with directory):
input/test_ini_e.dat
```

### 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 2)

Column 9: age

Column 10: mean height (m)

Column 11: mean DBH [cm]

Column 12: basal area (m<sup>2</sup>)

Columns 14-15: 0



**Table 2 Species type code in column 8 (single initialization)**

Species type number	species	Taxid in 4C (species.par)	species
14	Silver fir	14	Silver fir
8	Beech	1	beech
10	Spruce	2	spruce
11	pine	3	pine
12	Douglasie	10	Douglas fir
15	oak	4	oak
30	Eucalyptus glob.	12	Eucalyptus glob.
31	Eucalyptus grandis	13	Eucalyptus grandis

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

In the case of two species:

1 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

```
C:\D:\4c_v1.1\4c1.3\4C\4C\debug\4c.exe
>>>FORESEE message: Cannot find data of RedN - internal calculation for
pinep
>>>FORESEE message: Cannot find data of RedN - internal calculation for
aspen
>>>FORESEE message: Cannot find data of RedN - internal calculation for
pineh
>>>FORESEE message: Cannot find data of RedN - internal calculation for
dougfir
>>>FORESEE message: Cannot find data of RedN - internal calculation for
robinia
>>>FORESEE message: Cannot find data of RedN - internal calculation for
eglobulus
>>>FORESEE message: Cannot find data of RedN - internal calculation for
egrandis

>>>FORESEE message: Cannot find data of litter initialisation - internal calc
ulation

>>> Start FORESEE-Simulation site          1

*** Planting of small trees ***
Input directory and file for planting: input/veracel_pl.prn_
```

## 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 initialised 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

```
D:\4c_v1.1\4c1.3\4C\4C\debug\4c.exe
birch
>>>FORESEE message: Cannot find data of RedN - internal calculation for
pinet
>>>FORESEE message: Cannot find data of RedN - internal calculation for
pinet
>>>FORESEE message: Cannot find data of RedN - internal calculation for
aspen
>>>FORESEE message: Cannot find data of RedN - internal calculation for
pinet
>>>FORESEE message: Cannot find data of RedN - internal calculation for
dougfir
>>>FORESEE message: Cannot find data of RedN - internal calculation for
robinia
>>>FORESEE message: Cannot find data of RedN - internal calculation for
eglobulus
>>>FORESEE message: Cannot find data of RedN - internal calculation for
egrandis

>>>FORESEE message: Cannot find data of litter initialisation - internal calc
ulation

Stand initialization with new file
Creating new file (y/n): y

*** Choice of forest stand data set:
1 - Datenspeicher Waldfond
2 - single tree data; classification must be performed (e.g. SILVA data)
3 - Level2-data
4 - already existing class file
5 - FORGRA data
6 - Bavarian inventory data
***Make your choice: 2

Zvirgzde11
If you want to use SILVA data, type: 1
If you want to use levelII data from Sachsen, type: 2
If you want to use single tree data with tree class information, type: 3

if you want to use data like level II single tree data and generate one tree
cohorts, type: 4
2
Forest stand data set: levelII Sachsen (classification must be performed)

Do you want to read the input file from
1 - the Standard 4C stand directory on data/safe/4C/4C_input/stand
2 - or do you want to specify another directory?
***Make your choice: 2
Input directory and file: input/zvirgzde11.prn
```



## 6.4. Result

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

In the case of the example the file zvrgzde11.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 (m <sup>2</sup> )
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

```
D:\4c_v1.1\4c1.4\4C1.4\4C\debug\4c.exe
>>>foresee message: now reading species parameter file...
>>>foresee message: Filetest - file d:\4c_v1.1\input/species_neu.par
exists!

>>>foresee message: reading file d:\4c_v1.1\input/species_neu.par completed

>>>foresee message: Filetest - file d:\4c_v1.1\input/Kranzb.sop exists!
***** Reading soil parameter from file
d:\4c_v1.1\input/Kranzb.sop
...

>>>FORESEE message: Now reading DEPOSITION data from file, please wait...

>>>FORESEE message: Now reading RedN data from file, please wait...

>>>FORESEE message: Cannot find data of litter initialisation - internal calc
ulation

Stand initialization file not exists!
Stand initialization with new file
Creating new file (y/n): y

*** Choice of forest stand data set:
1 - Datenspeicher Waldfond
2 - single tree data; classification must be performed (e.g. SILVA data)
3 - Level2-data
4 - already existing class file
5 - FORGRA data
6 - Bavarian inventory data
***Make your choice: 4

brastest4

Do you want to use the standard procedure - type: S
or Manfred Lexers input format - type: L
S
Input file: brassch.prn_
```

### 7.4. Result

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