

MODELAÇÃO DOS RECURSOS FLORESTAIS 2019/20

FOREST MODELS 2019/20

Continuous evaluation – Topic 6

StandsSIM, simulator practice

SIMfLOR is a platform that integrates several simulators developed for the main Portuguese forest species under a common environment. Using StandsSIM.md solve the following exercises, organized by tree species.

Blue gum *Eucalyptus globulus*

- 1 Build a yield table for a eucalyptus for a planning horizon of 30 years considering the following information:
 - **Location:** Coruche municipality
 - **Altitude:** 14 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)
 - **Site index:** 15 m (base age 10 years)
 - **FMA:** [FMA41_Ec_REGular.csv](#)
 - **Prescription:** 3 cycles with 10 years each (one plantation followed by two coppices).
- 2 Build a yield table for a eucalyptus using the instructions from exercise 1 but considering the following prescription:
 - **Cycle 1:** plantation harvest age is 12 years
 - **Cycles 2 and 3:** coppice harvest age is 9 years
- 3 Use the instructions from exercise 1 and considering a planning horizon of 60 years and compare the following prescriptions:
 - a) 6 cycles with the plantation harvested at age 10, followed by 5 coppices all harvested at age 10
 - b) 6 cycles all harvested at age 10, but considering a replantation in the 4th cycle. Please note that soil preparation when replanting is different, which implies the definition of 2 different FMAs.
- 4 Simulate the existing stand:
 - **Location:** Coruche municipality
 - **Age:** 7 years (even-aged)
 - **Dominant height:** 12 m
 - **Stand density:** 980 trees ha⁻¹
 - **Rotation:** first rotation (plantation)
 - **Altitude:** 14 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)

Use both the FMA and the prescription from exercise 1. You will likely get the message: “terminated before the planning horizon – check prescriptions” because the 3 cycles only cover 23 years (3 years for the plantation and 10+10 for coppice). Therefore, in order to run the simulation, you will have to define another cycle or change the planning horizon. Having more than the required number of cycles represents no problem for StandsSIM.md.

- 5 Build a set of yield tables for site indices ranging from 15 to 25 m (base age 10 years) using the “Multiple Stands” option of StandsSIM.md for the same conditions described for exercise 1. Consider the same location and management for all site indices. You can import the file [inv_Ec_S15_25.csv](#).

Maritime pine Pinus pinaster

- 1 Consider a planning horizon of 50 years and build a yield table for maritime pine using the following information:
 - **Location:** São Pedro de Moel municipality
 - **Altitude:** 31 m (if you don’t know the altitude you can use the webGLOBULUS stand simulator to obtain it)
 - **Site index:** 18 m (50 years)
 - **Plantation spacing:** 2 x 2 (the interface requires the number of trees per hectare)

Define a suitable forest management approach (FMA) considering thinning from bellow to take place every 10 years based on a Wilson factor of 0.25 and final harvest at 50 years. Alternatively, import the FMA file [FMA41_Pb_025_REGular.csv](#).

Repeat the previous exercise considering a residual basal area basal of 25 m² ha⁻¹ (or import the FMA file [FMA41_Pb_G25_REGular.csv](#)).

- 2 Repeat the simulations delaying the final harvest age to 80 years without thinning or final harvest (the stand will reach self-thinning; import the FMA file [FMA41_Pb_SelfThin_REGular.csv](#)).

- 3 Consider a planning horizon of 80 years and simulate the following existing stand:

- **Location:** São Pedro de Moel municipality
- **Stand structure:** even-aged
- **Age:** 15 years
- **Number of trees in the plot:** 49 trees
- **Plot area:** 500 m²
- **Altitude:** 31 m (if you don’t know the altitude you can use the webGLOBULUS stand simulator to obtain it)
- **Tree data file:** [inv_Pb_Existing_arv_n49_t15.csv](#)

Define a suitable FMA (e.g. [FMA41_Pb_025_REGular.csv](#) or [FMA41_Pb_G25_REGular.csv](#)) considering a prescription composed of 4 cycles of 50 years each.

- 4 Simulate the growth of the following maritime pine stand for a planning horizon of 70 years:
 - **Location:** Alcácer do Sal municipality

- **Stand structure:** uneven-aged
- **Number of trees in the plot:** 10 trees
- **Plot area:** 500 m²
- **Altitude:** 100 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)
- **Tree data file:** [inv_Pb_irreg_arv.csv](#)
- **Build a prescription with 2 cycles as described below:**
 - **cycle 1:** uneven-aged management for 35 years with final harvest in the end of the cycle, FMA considering thinning from bellow every 5 years and residual basal area of 10 m² ha⁻¹ ;
 - **cycle 2:** planting (even-aged management) and final harvest at 35 years, FMA considering thinning from bellow every 5 years and a Wilson factor of 0.25.

Please note that 2 different FMAs need to be considered (suggestion:

[FMA31_Pb_Gres_IRReg.csv](#) and [FMA41_Pb_025_REGular.csv](#)).

5 Simulate the growth of the following maritime pine stand for a planning horizon of 70 years:

- **Location:** São Pedro de Moel municipality
- **Stand structure:** even-aged
- **Age:** 15 years
- **Number of trees in the plot:** 49 trees
- **Plot area:** 500 m²
- **Altitude:** 31 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)
- **Tree data file:** [inv_Pb_Existing_arv_n49_t15.csv](#)
- **Build a prescription with 2 cycles as described below:**
 - **cycle 1:** even-aged management for 35 years without final harvest in the end of the cycle, FMA considering thinning from bellow every 5 years and a Wilson factor of 0.25;
 - **cycle 2:** uneven-aged management for 35 years, FMA considering thinning from bellow every 5 years and residual basal area of 10 m² ha⁻¹.

Please note that 2 different FMAs need to be considered (suggestion:

[FMA41_Pb_025_REGular.csv](#) and [FMA31_Pb_Gres_Irreg.csv](#)).

6 Build a set of yield tables for site indices ranging from 15 to 25 m (base age 50 years), considering final harvest at 80 years using the "Multiple Stands" option of StandsSIM.md for the same conditions described in exercise 1. Consider the same location and management for all site indices (suggestion: [inv_Pb_S15_25.csv](#) and [inv_Pb_S15_25_arv.csv](#)).

Stone pine *Pinus pinea*

7 Consider a planning horizon of 50 years and build a yield table for stone pine using the following information:

- **Location:** Alcacer do Sal municipality
- **Altitude:** 100 m
- **Site index:** 18 m (80 years)
- **Plantation spacing:** 5 x 5 (the interface requires the number of trees per hectare)

Define a suitable forest management approach (FMA) considering thinning from bellow to take place every 10 years based on a residual basal area of 15 m² ha⁻¹ (suggestion: [FMA41_Pm_15_REGular.csv](#)). Consider a single prescription of 50 years.

8 Simulate for a planning horizon of 100 years the following existing stand:

- **Location:** Alcácer do Sal municipality
- **Stand structure:** even-aged
- **Age:** 10 years
- **Number of trees in the plot:** 136 trees
- **Plot area:** 5000 m²
- **Altitude:** 100 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)
- **Tree data file:** [inv_Pm_arv_n136.csv](#)

Define 2 FMAs/prescriptions considering even-aged management considering 2 different regimes corresponding to two different stockings (thinning intensities) and compare the results (suggestion: [FMA41_Pm_15_REGular.csv](#) and [FMA41_Pm_25_REGular.csv](#)).

9 Simulate for a planning horizon of 100 years the following existing stand:

- **Location:** Évora municipality
- **Stand structure:** even-aged
- **Age:** 18 years
- **Number of trees in the plot:** 34 trees
- **Plot area:** 2000 m²
- **Altitude:** 275 m (if you don't know the altitude you can use the webGLOBULUS stand simulator to obtain it)
- **Tree data file:** [inv_Pm_arv_n34.csv](#)

Define 2 FMAs/prescriptions considering even-aged management considering 2 different regimes corresponding to two different stockings (thinning intensities) and compare the results (suggestion: [FMA41_Pm_15_REGular.csv](#) and [FMA41_Pm_25_REGular.csv](#)).

Cork oak *Quercus suber*

10 Consider a planning horizon of **xxxx** years and build a yield table with the SUBER simulator using the following information:

- **Location:** Mora municipality
- **Site index:** average
- **FMA:** use the Generator to build the forest management approach described in the table below (suggestion [FMA_Sb_YieldTable_CC35_R9.csv](#))

Year of 1 st occurrence	Periodic (Y=yes; N=no)	Periodicity	Operation
0			Plantation (spacing 8x4)
1	Y	4	Weed control Manual?

1	N		Beating-up (20% of the trees)
4	N		Formation pruning (80% of the trees)
5	Y	4	Application of fertilizer Manual?
8	N		Formation pruning (30% of the trees)
10			Thinning (% crown cover = 35)
12	N		Formation pruning (10% of the trees)
15	N		Thinning (% crown cover = 35)
$t_d \in [19;30]$	Y	9	First debarking
t_d	N		Formation pruning (10% of the trees)
t_d	Y	9	Thinning (% crown cover=35)

Start by running SUBER without selecting the debarking operation to find the age at which the **dug** is close to a perimeter of 70 cm, this will indicate the optimum age to start cork debarking.

Run the SUBER for several alternative FMAs that differ among them by the age of the first debarking (t_d) and compare the results.

- 11 Repeat the simulation for a yield table in Estremoz municipality.
- 12 Consider a planning horizon of **xxxx** years and use the SUBER to simulate the growth of the following existing stand:
 - **Location:** Herdade da Bolota, **xxxx** municipality
 - **Age:** 10 years
 - **Plot area:** 2000 m²
 - **Tree data file:** [inv_Sb_HBolota_t10_arv.csv](#)
 - **FMA:** use the Generator to build the forest management approach described in the table below (suggestion [FMA_Sb_Existing_CC35_R9.csv](#))

Year of 1 st occurrence	Periodic (Y=yes; N=no)	Periodicity	Operation
5	Y	4	Weed control and Application of fertilizer Manual?
8	N		Formation pruning (30% of the trees)
10			Thinning (% crown cover = 35)
12	N		Formation pruning (10% of the trees)
15	N		Thinning (% crown cover = 35)
$t_d \in [19;30]$	Y	9	First debarking
t_d	N		Formation pruning (10% of the trees)
t_d	Y	9	Thinning (% crown cover=35)

Start by running SUBER without selecting the debarking operation to find the age at which the **dug** is close to a perimeter of 70 cm, this will indicate the optimum age to start cork debarking.

Run the SUBER for several alternative FMAs that differ among them by the age of the first debarking (t_d) and compare the results.