

FOREST MODELS

9 Whole stand models for even-aged stands – Exercises

1. Install the PBRAVO stand simulator in your computer and read the description of the model in the respective word file
2. Use the model trying to learn its characteristics and limitations
3. Using the equations that make up the model that are listed in the word file PBRAVO, program the model in EXCEL, with the exception of the estimation of the parameter c from the Weibull distribution. Using the observed data from stand nº 32 in the National Forest of Leiria (Figure 1) try to reproduce the results obtained with the PBRAVO stand simulator. Use, in each year, the estimates of the c parameter given by the PBRAVO.

National Forest of Leiria - stand nº 2

observed data - forest inventory

year	t (years)	N (ha ⁻¹)	hdom (m)	dmin (cm)	G (m ² ha ⁻¹)	dg (cm)	V (m ³ ha ⁻¹)
1970	17	878	7.0	2.5	7.2	10.2	23.81
1971	18	878					
1971	at 18	726			7.2		
1975	22	726	9.6	2.5	12.0	14.5	49.75
1980	27	726	11.3	2.5	18.1	17.8	85.27
1985	32	726	13.5	2.5	22.7	20.0	122.66

at - after thinning

DIAMETER DISTRIBUTION IN 1970			
d central	lim sup	N	ΣN
5	7.5	205.2	205.2
10	12.5	538.6	743.8
15	17.5	121.5	865.3
20	22.5	11.7	877.0
25	27.5	1.0	878.0
30	32.5		

NOTE: Before 1970 the stand was object of a non-commercial thinning

Figure 1. Data from the continuous forest inventory of the National Forest of Leiria – stand nº 2

4. In your opinion what are the major differences between this model and the yield tables?
5. Consider the stand nº 2 of the Mata Nacional de Leiria in the year 1970 and simulate its growth and yield till the age of 82 years with the following management alternatives:
 - a) Apply the first thinning at the age of 22 years and every 10 years after that until the age of 82 years. The residual basal area (after thinning) must be around $22 \text{ m}^2 \text{ ha}^{-1}$
 - b) Apply the first thinning at the age of 22 years and every time the basal area gets a value higher than 18 and try to maintain it close to $18 \text{ m}^2 \text{ ha}^{-1}$. The last thinning should occur at the age of 62 years and final harvesting at 82 years
 - c) Compare the two management alternatives above using the net present value. The prices are 40 € for round wood, 15 € for pulp and 5 € for firewood. You don't need to use costs for the comparison as they will be the same in both alternatives. Use a discount rate of 0.04.
 - d) Suppose that you want to define a management alternative with the first thinning at the age of 20 years. Is it possible with this simulator?
6. Suppose that a landowner is planning to plant a pine stand using 2500 plants per ha. In order to get support from the National Agriculture Services he needs to present a project including the proposed management and an estimate of the revenues. He estimates that the productivity of his site is representative of the average in the country. Use the PBRADO model to support this landowner by comparing two alternatives:
 - a) Apply the first thinning at the age of 20 years and every 10 years after that until the age of 80 years. The residual basal area (after thinning) must be around $22 \text{ m}^2 \text{ ha}^{-1}$
 - b) Apply the first thinning at the age of 20 years and every time the basal area gets a value higher than 18 and try to maintain it close to $18 \text{ m}^2 \text{ ha}^{-1}$. The last thinning should occur at the age of 50 years and final harvesting at 60 years

Assume that the silvicultural operations are the ones presented in table 1.

7. Are you able to propose some improvements to this simulator? And to the model?