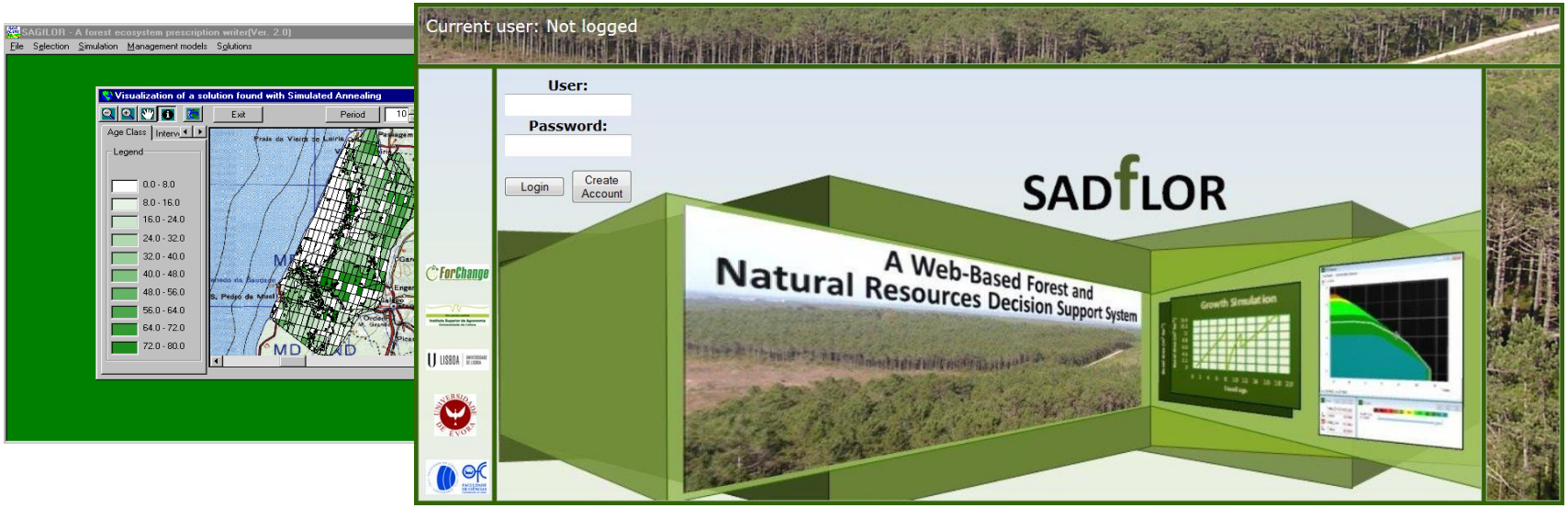
Portuguese DSS tools for forest management



Susete Marques

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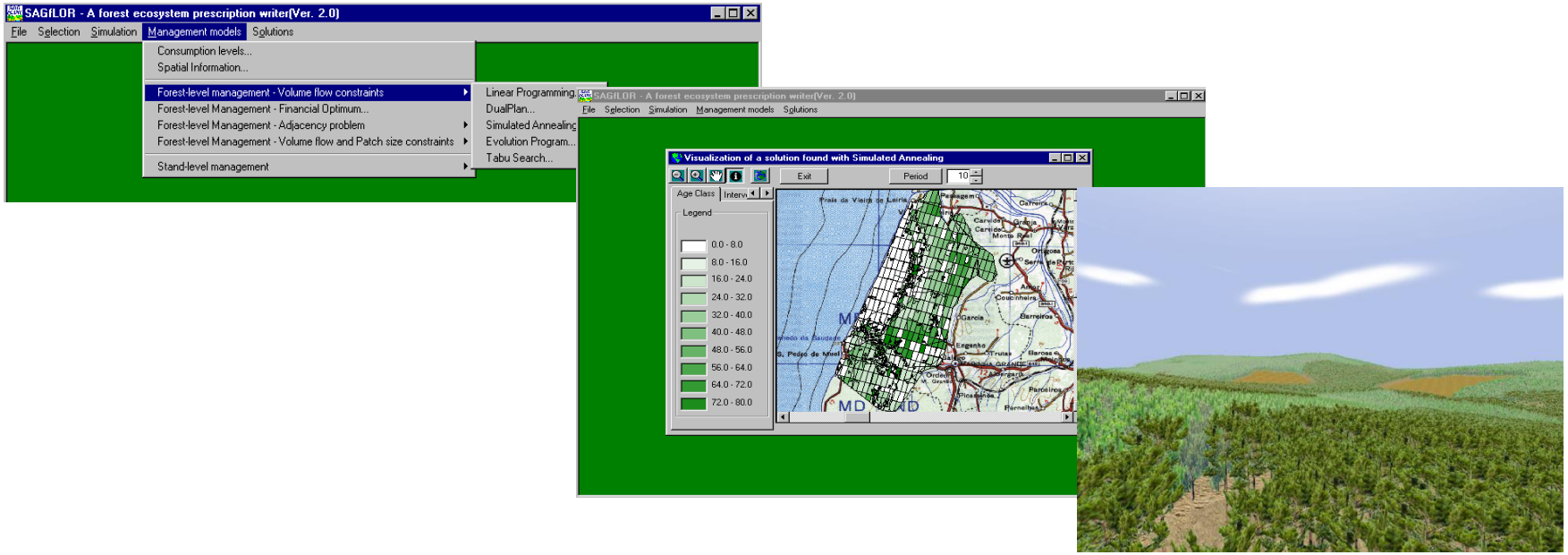
INSTITUTO SUPERIOR DE AGRONOMIA Universidade de Lisboa

U LISBOA | UNIVERSIDADE DE LISBOA

Outline

- I. Background/History
- II. The DSS architecture
- III. DSS Aplication in Vale do Sousa Case study
- IV. Discussion

The context (or a bit of history) SADfLOR



Reynolds, K.M., M. Twery, M. J. Lexer, H. Vacik, D. Ray, G. Shao and Jose G. Borges. 2008. Decision support systems in natural resource management. In: F. Burstein and C. Holsapple (Ed.) Handbook on Decision Support Systems. Springer, International Handbooks on Information Systems Series, Handbook on Decision Support System 2: 499-534

Borges, J. G., A. Falcão, C. Miragaia, P. Marques and M. Marques. 2003. A decision support system for forest resources management in Portugal. In: G. J. Arthaud and T. M. Barrett (Eds.) System Analysis in Forest Resources. Springer, Managing Forest Ecosystems Vol. 7: 155-164.

Stakeholders' engagement plan and a participatory planning approach

Stakeholders selection

- 1st meeting (stakeholders groups identification)
- Stakholders clustering into categories
- Contacts with stakeholders
- Kick-off meeting

Individual decison processes

- Modelling tool
- 1st PA session (context diagram)
- 2nd PA session (decision processes)
- Questionaire
- Data Repository & report
- Report validation by stakeholders

Integrated stakeholders analysis

- 1st meeting (integrated context diagram)
- 2nd meeting (overall RFMP framework)
- Matrix with questionaire consolidation

Regional Toolbox components

- Decison-support tools
- Data elements
- Data ownership matrix
- Components validation by stakeholders
- Final meeting

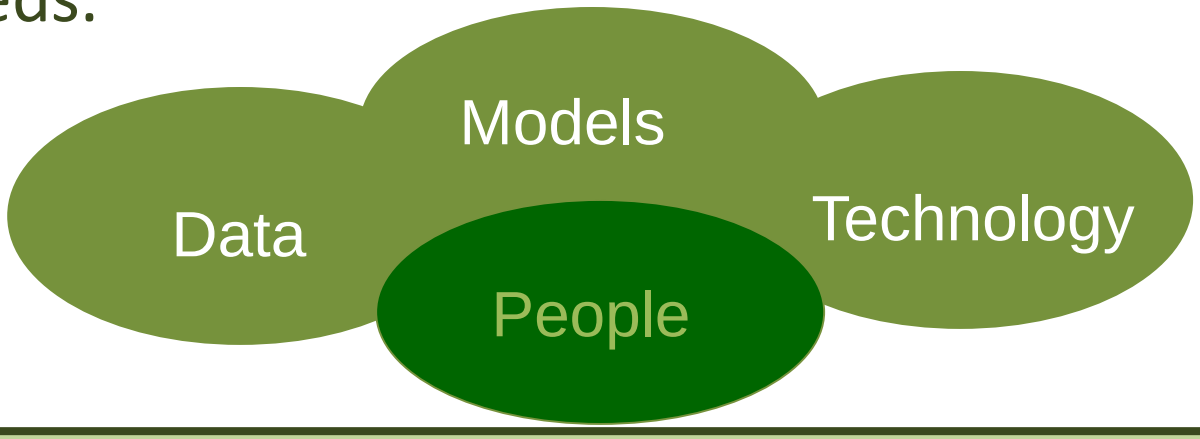
Decision support tools
(excerpt with some models and methods)

Decision Support tools	Stakeholders groups													Total
	NIPF	IPF	FIF	FAr	FSP	FA	I	M	FAn	FRC	FF	LC	NGO	
Models/methods:														
Q1. Forest productivity zoning	x	x	x			x	x		x	x				**6**
Q2. Regional growth and yield models	x	x	x	x		x				x				**6**
Q3. Fruit production estimation model	x	x	x	x		x			x	x				**7**
Q4. Cork quality & quantity prediction models	x	x	x	x		x				x				**6**
Q5. Harvesting/stripping opt. Models	x	x	x	x		x				x				**6**
Q6. Impacts of fertilization into production	x	x	x	x		x				x				**6**
Q7. Forest market models	x	x	x	x		x	x		x	x	x		x	**9**
Q8. Product distrib. Routing, storing,…		x	x	x		x	x			x				**5**
Q9. Optimal equipment allocation models		x	x	x		x	x			x				**5**
Q10. Risk prediction models		x	x	x						x				**4**

The proposed approach

How does participation contribute to the development of successful DSS?

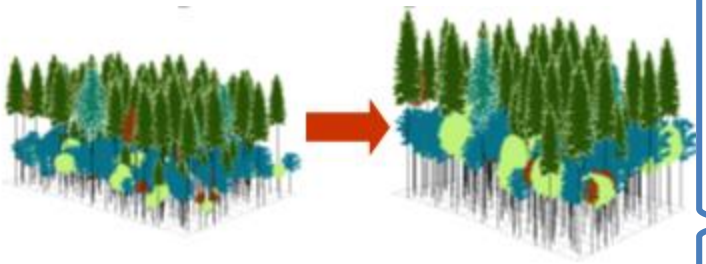
- The DSS's functional requirements emerge from business and information architectures in workshops with the stakeholders. No *a priori* assumptions are made about decision processes so that the DSS may effectively address their needs.



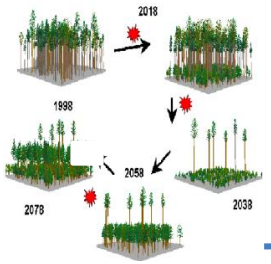
Decision Support System

User friendly tools

Growth modelling

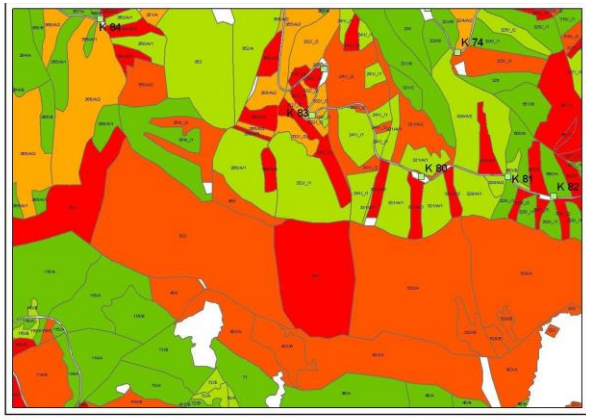


Predict Growth under CC

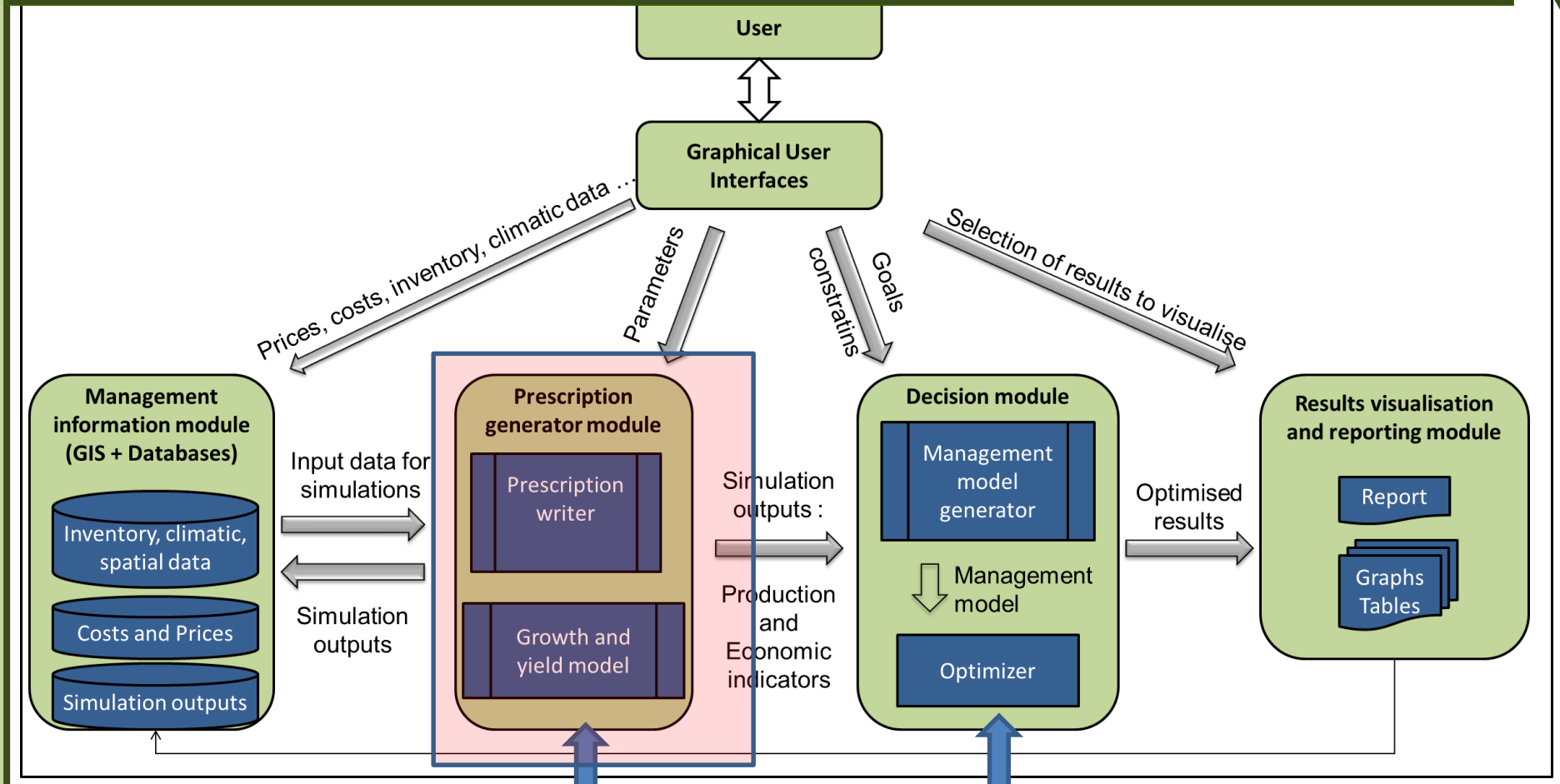


Decision support

Forest management plans



The DSS architecture

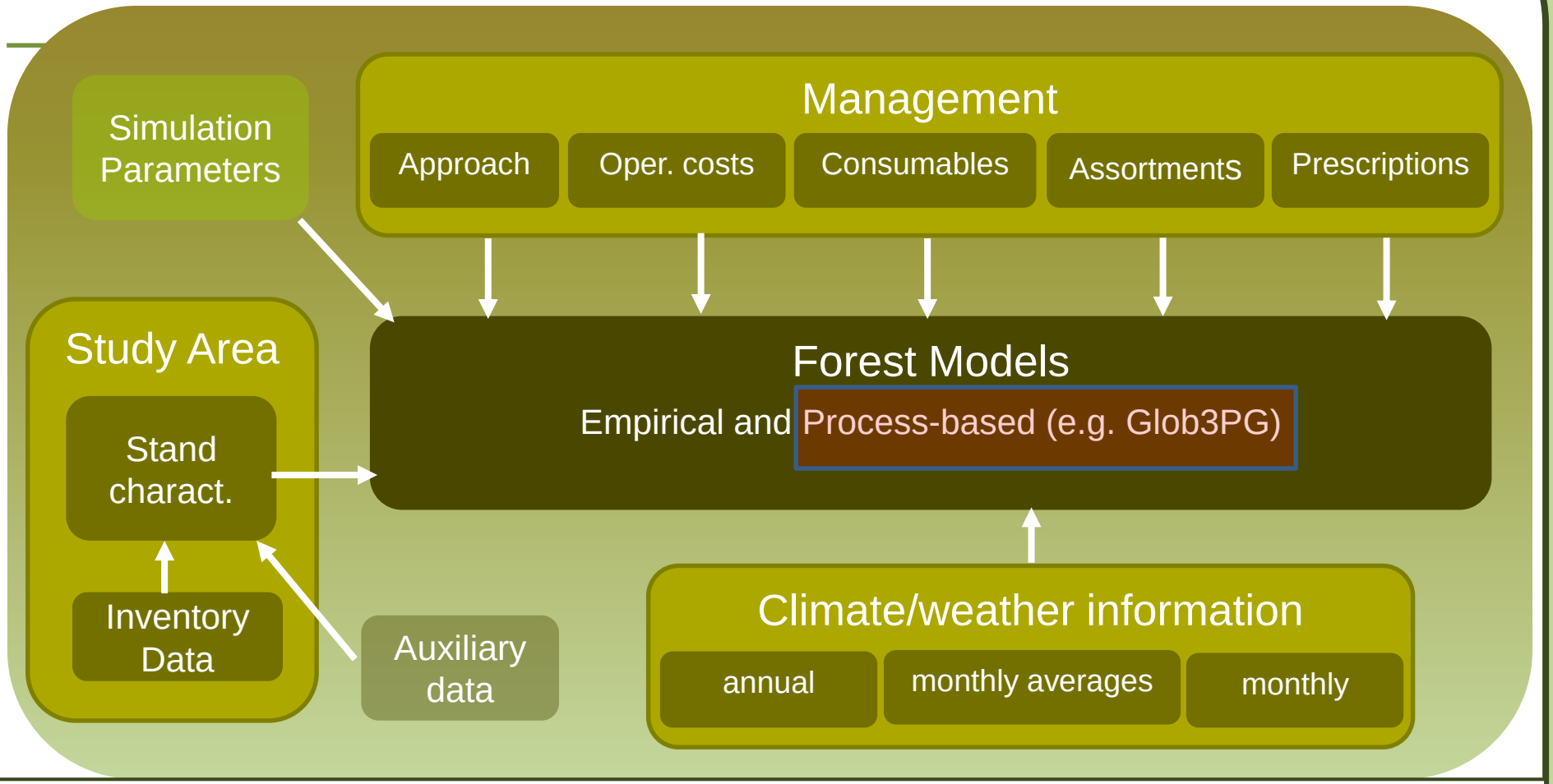


- Process-based models
- Wood Quality models
- Risk and damage models…

- Different mathematical techniques are implemented

Garcia-Gonzalo J., Borges J. G., Palma, J.H.N., Zuzibarreta-Gerendiain. 2014. A decision support system for management planning of Eucalyptus plantations facing climate change. Annals of Forest Science. Volume 71, Issue 2 , pp 187-199.

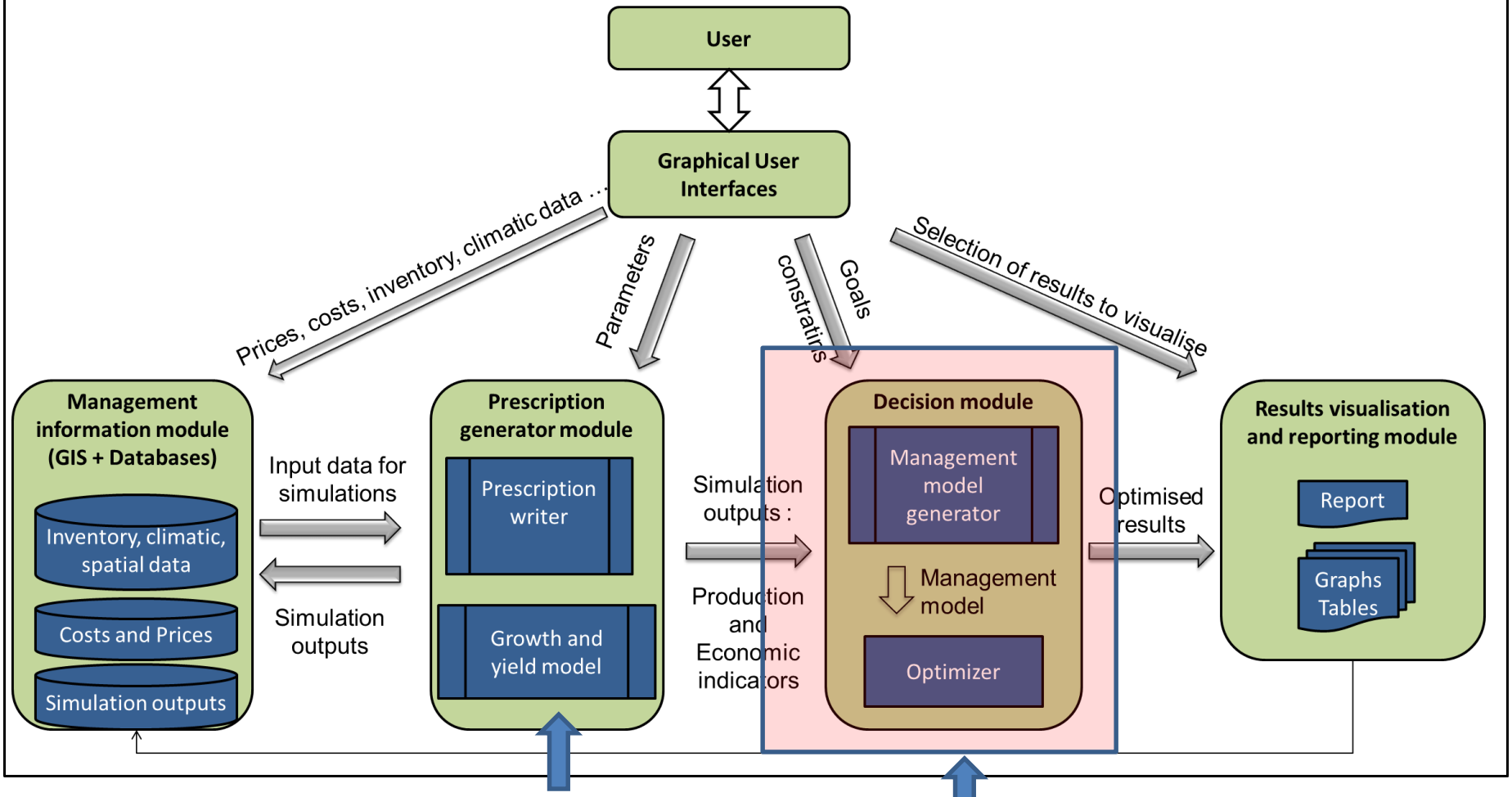
Simulation Module | StandSim



Fontes L, Landsberg J, Tomé J, Tomé M, Pacheco CA, Soares P, Aruajo C (2006) Calibration and testing of a generalized process-based model for use in Portuguese Eucalypt plantations. Can J For Res 36:3209–3221.

Tomé M, Faias S P, Tomé J, Cortiçada A, Soares P, Araújo C (2004) Hybridizing a stand level process-based model with growth and yield models for Eucalyptus globulus plantations in Portugal In: Borralho NMG, Pereira JS, Marques C, Coutinho J, Madeira M, Tomé M (eds) Eucalyptus in a changing world Proc Iufro Conf, Aveiro, 11–15 Oct (RAIZ, Instituto de Investigação da Floresta e do Papel, Portugal), pp 290–297

The DSS architecture



- Process-based models
- Wood Quality models
- Risk and damage models…

- Different mathematical techniques are implemented

III. A. DSS – SIMULATION/OPTIMIZATION

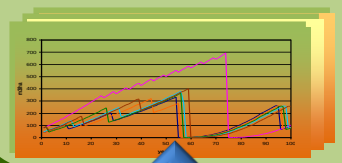
EfLOR- a Forest level Simulation Optimization system for Eucalipt

Precriptions | Simulation | Optimization | About | Help

Prices
Costs

Production indicators:

Volume cut
Run-off
Carbon stocks

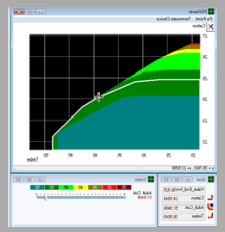


Management models (LP, MIP, GP, Stochastic formulations, Heurist.):

- Maximization of SEV
- Maximization of C seq.
- Minimization run-off
- Multiple objecitves

- Regulation of harvest flows
- Budget constraints

Optimization



Final report with production indicators and preliminary operations scheduling Effects of climate change

Growth and Yield simulations (Process-based model – Glob3PG)

Climate data
Inventory data
List of Prescriptions

Climate picker

PRESCRIPTION WRITER

Status

integral

Future-oriented integrated management of European forest landscapes

Vale do Sousa Case study

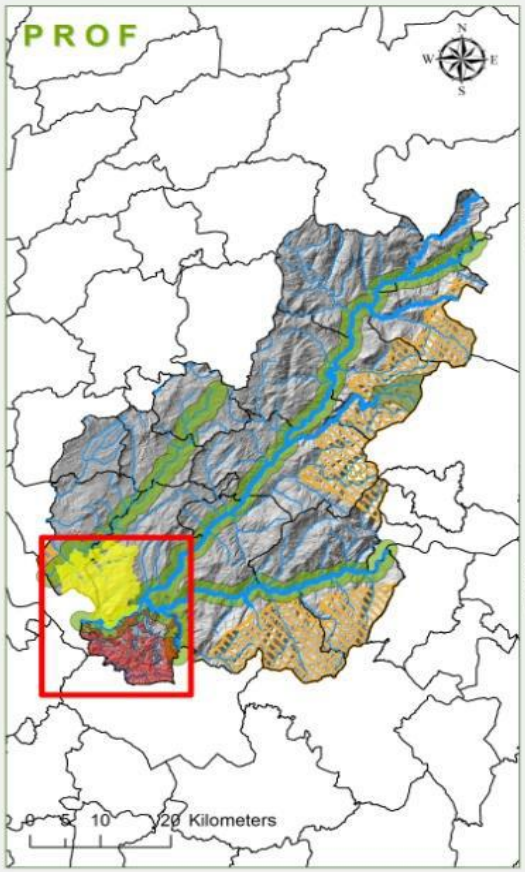
EUROPEAN COMMISSION

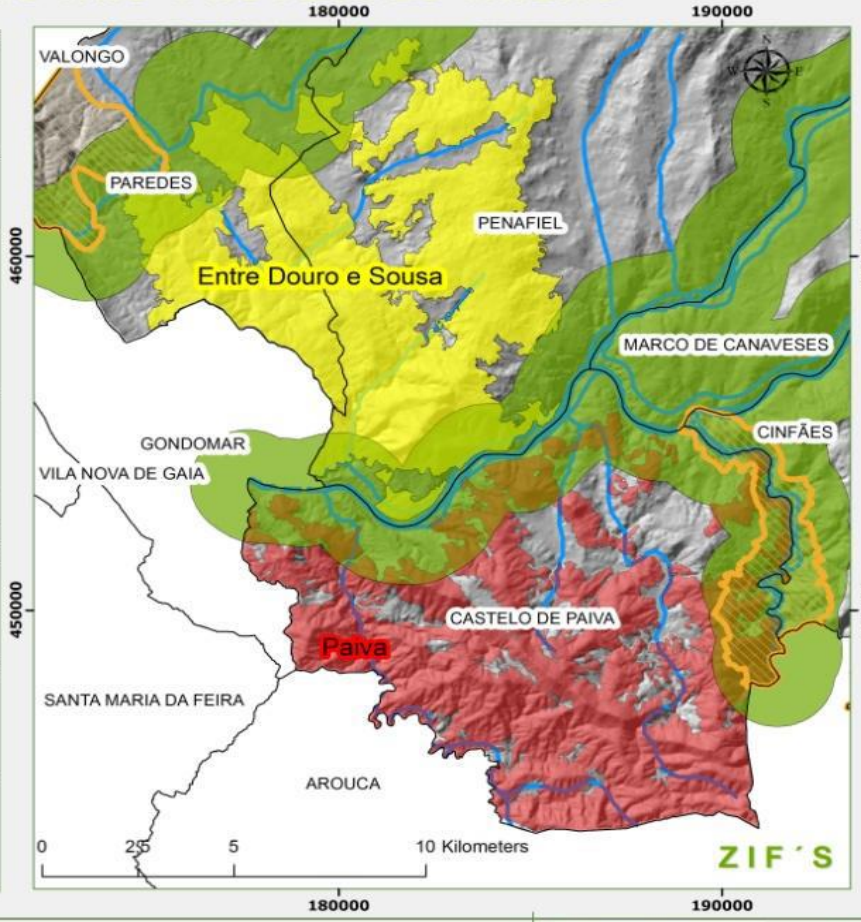
COOPERATION

Forest Ecosystem Management under Global Change

University of Lisbon
School of Agriculture (ISA)

ADMINISTRATIVE LIMITS AND PROTECTED AREAS





CASES OF STUDY

Sistema de coordenadas
Hayford Gauss
Datum de Lisboa

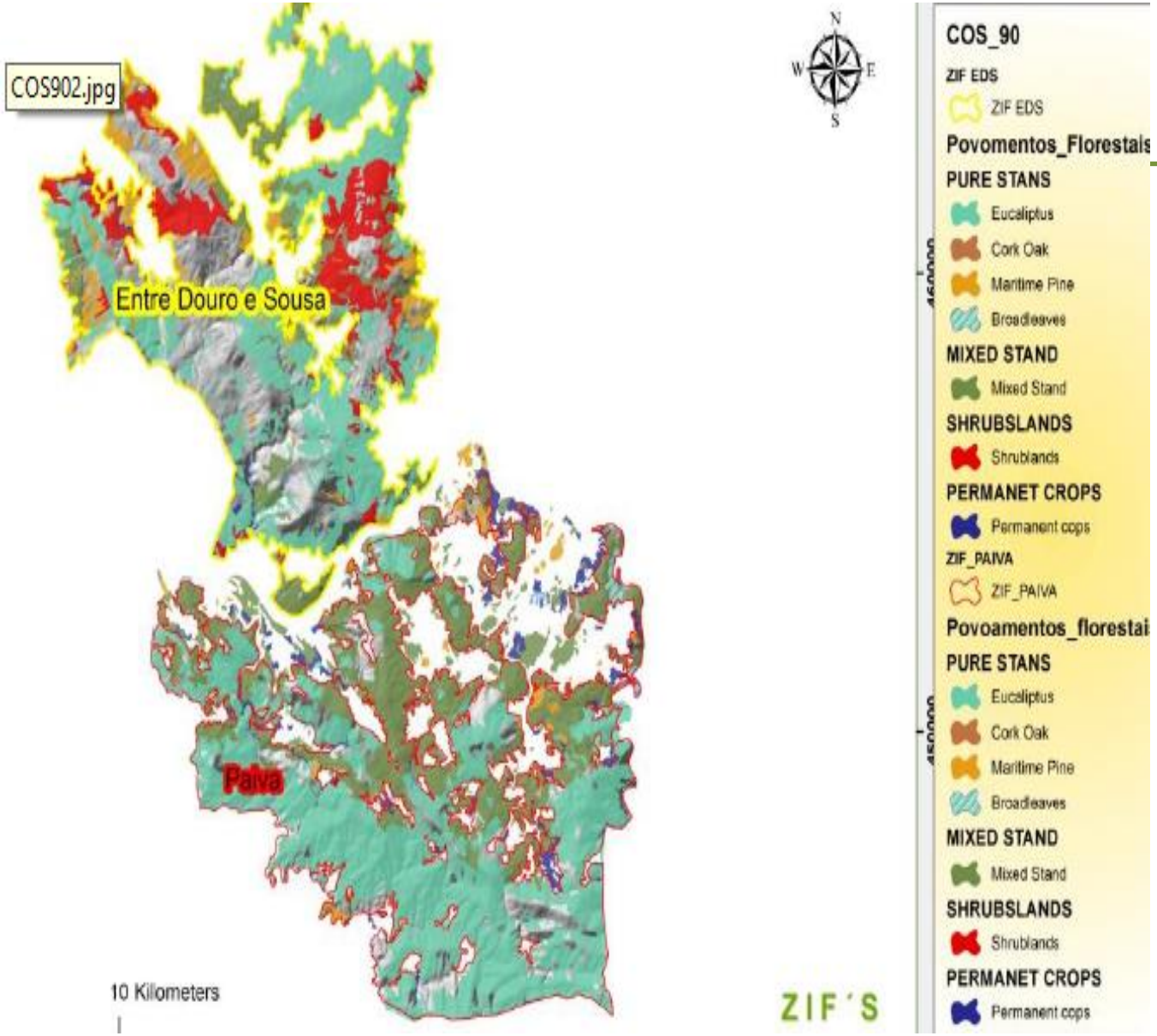
ZIF EDS
ZIF PAIVA

FONTE: AFVS(2012),

Fevereiro de 2012

Instituto Superior de Agronomia
Universidade Técnica de Lisboa

ForChange
Forest Ecosystem Management Under Global Change


COS902.jpg
Entre Douro e Sousa
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COS_90
ZIF EDS
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Povomentos_Florestais
PURE STANS
Eucaliptus
Cork Oak
Maritime Pine
Broadleaves
MIXED STAND
Mixed Stand
SHRUBSLANDS
Shrublands
PERMANET CROPS
Permanent cops
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PURE STANS
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Maritime Pine
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SHRUBSLANDS
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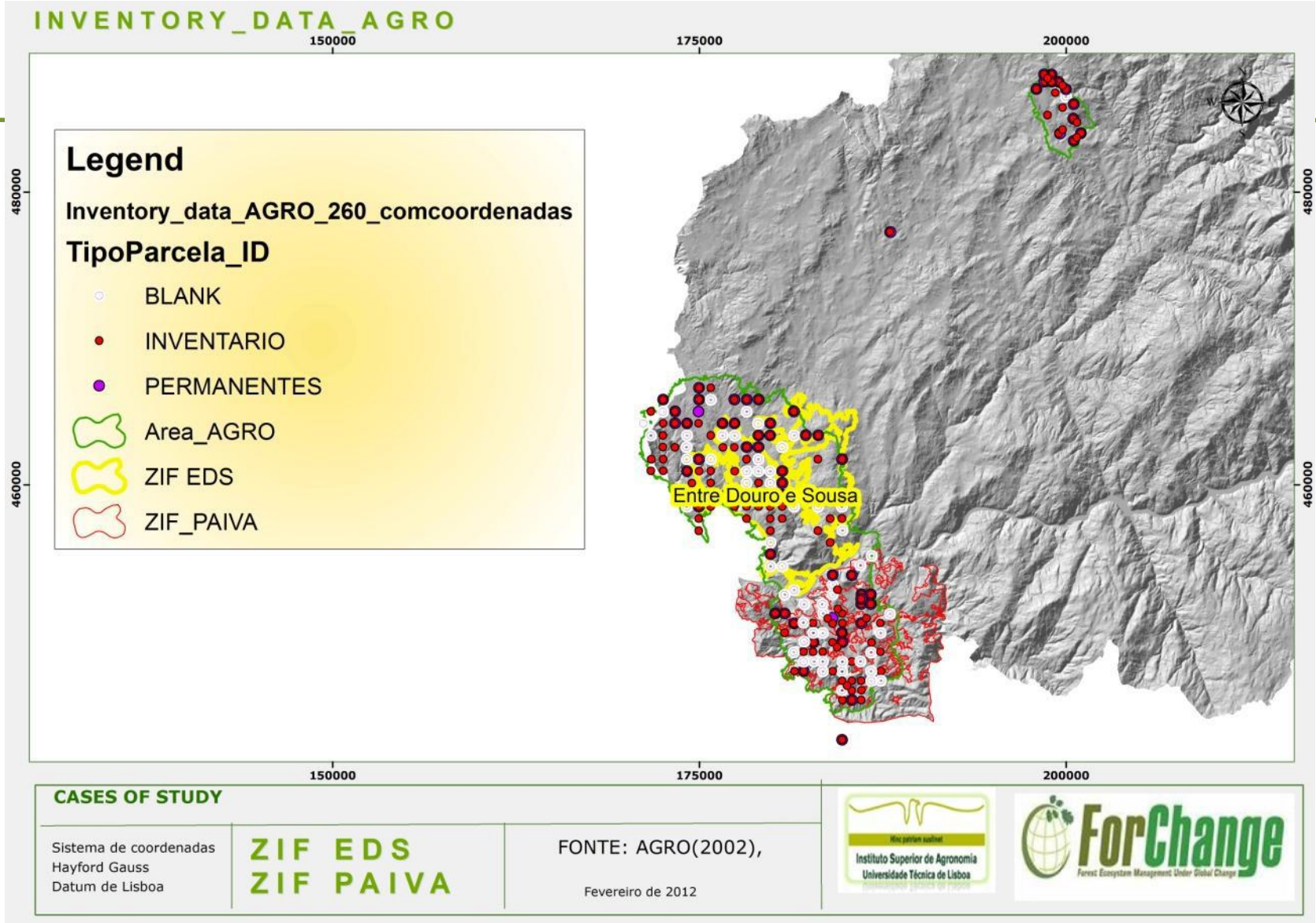
Permanent cops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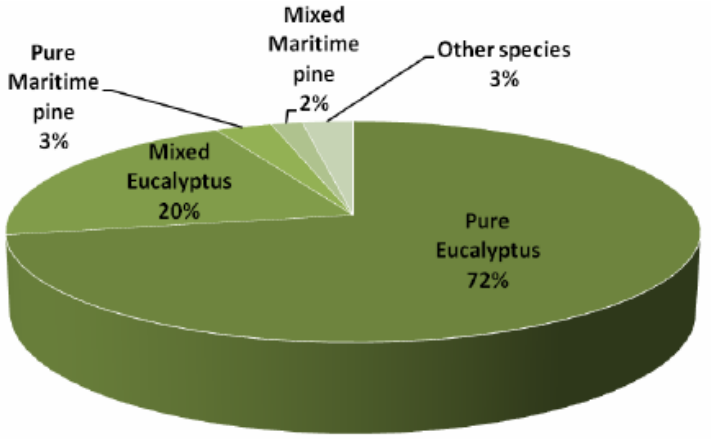
Entre Douro e Sousa
CASES OF STUDY
Sistema de coordenadas
Hayford Gauss
Datum de Lisboa
ZIF EDS
ZIF PAIVA
FONTE: AGRO(2002),
Fevereiro de 2012
Instituto Superior de Agronomia
Universidade Técnica de Lisboa
ForChange
Forest Ecosystem Management Under Global Change

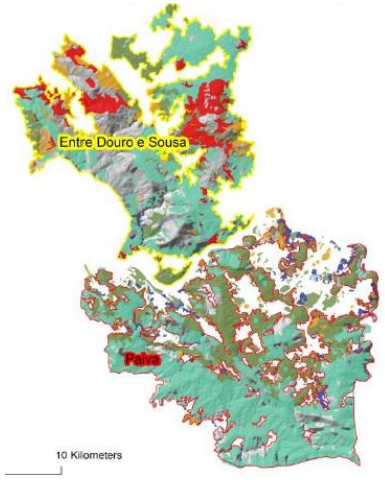
Vale do Sousa - Case study

Land Use	Forest Stands	Area (ha)	Area (%)
Agriculture		222	1,49%
Water		7	0,05%
Social		124	0,83%
Unproductive		43	0,29%
Shrubs		3141	21,15%
Forest	Pure Eucalyptus	8161	54,95%
	Mixed Eucalyptus	2309	15,54%
	Pure Maritime pine	347	2,33%
	Mixed Maritime pine	191	1,29%
	Other species	308	2,07%
Total		14853	



Ecosystem Services identification and stakeholders priorities definition

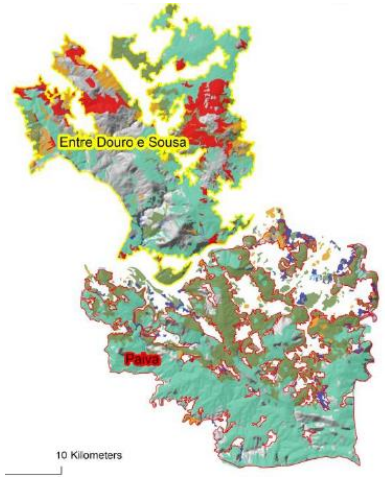
Vale do Sousa



ES	Goals (2014-2104)	Programs	Politics
Maritime pine fuelwood and sawlogs	?	M	
	= ?	A	
	= ?	N	
Eucalypt pulpwood	= ?	A	
Chestnut wood	= ?	G	<= ?
VEI	= ?	E	
Carbon storage		M	
		E	
		N	
		T	

Ecosystem Services identification and stakeholders priorities definition

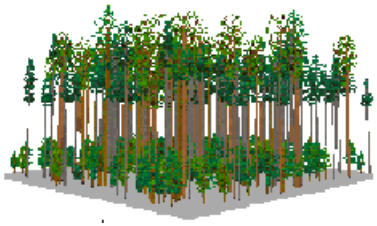
Vale do Sousa



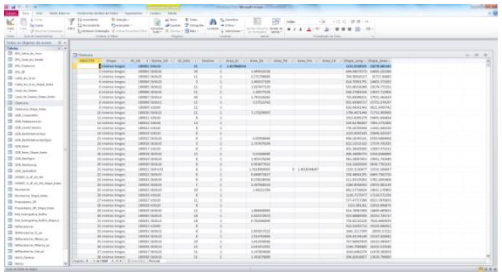
ES	Goals (2014-2104)	Programs	Politics
Maritime pine fuelwood and sawlogs	=1.5 milion m3	MANAGEMENT	<= ?
Eucalypt pulpwood	= .7 milion m3		
Chestnut wood	= 0.04 milion m3		
VEI	= ?		
Carbon storage	= ?		

HOMEWORK

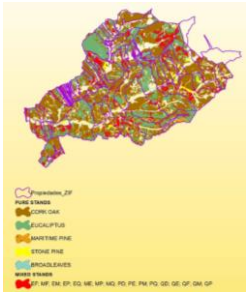
Inventory:
Initial state of the forest



Data analysis

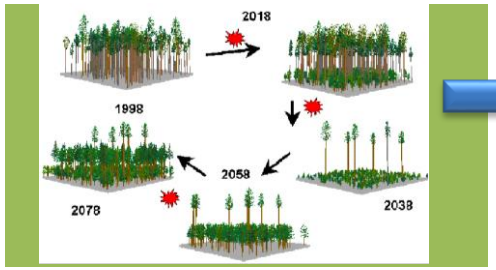


Stand characterization

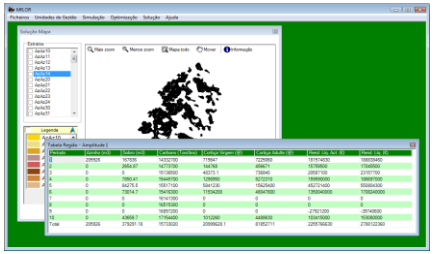


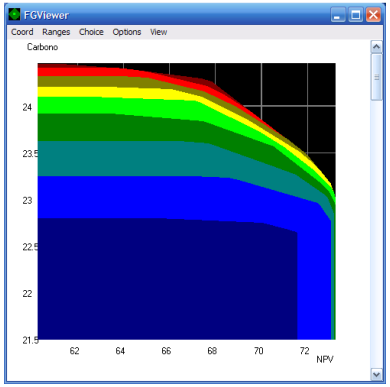
Tradeoff analysis
between ES

Scenario evolution and
ES Demand

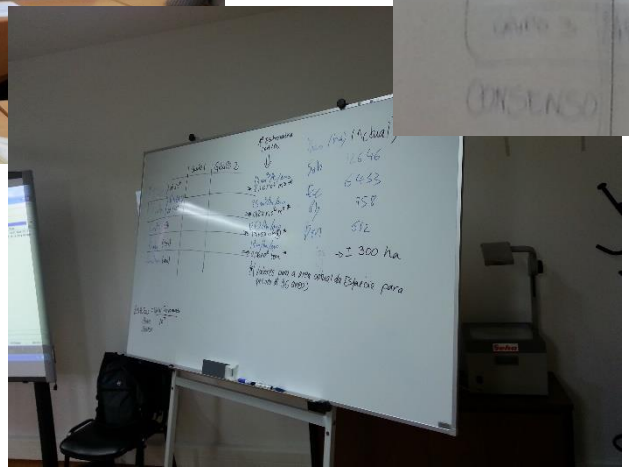


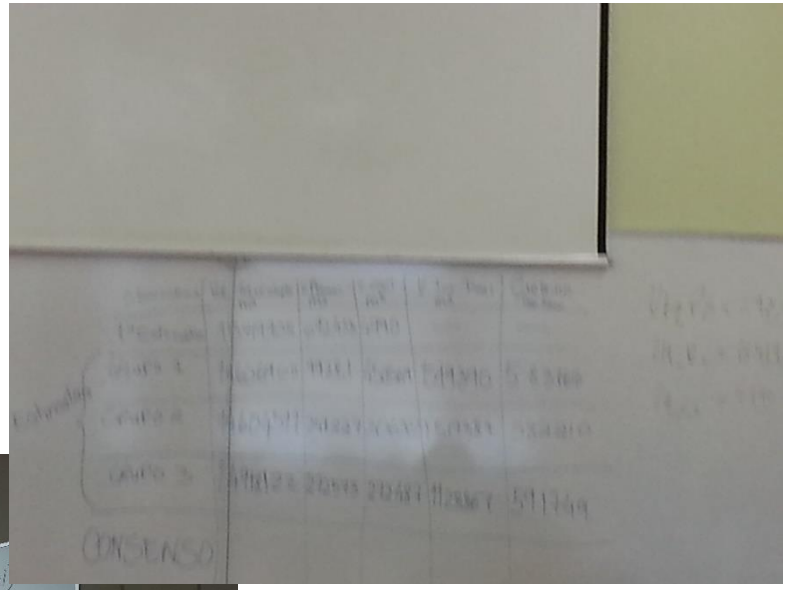
Simulation of MA for all MU



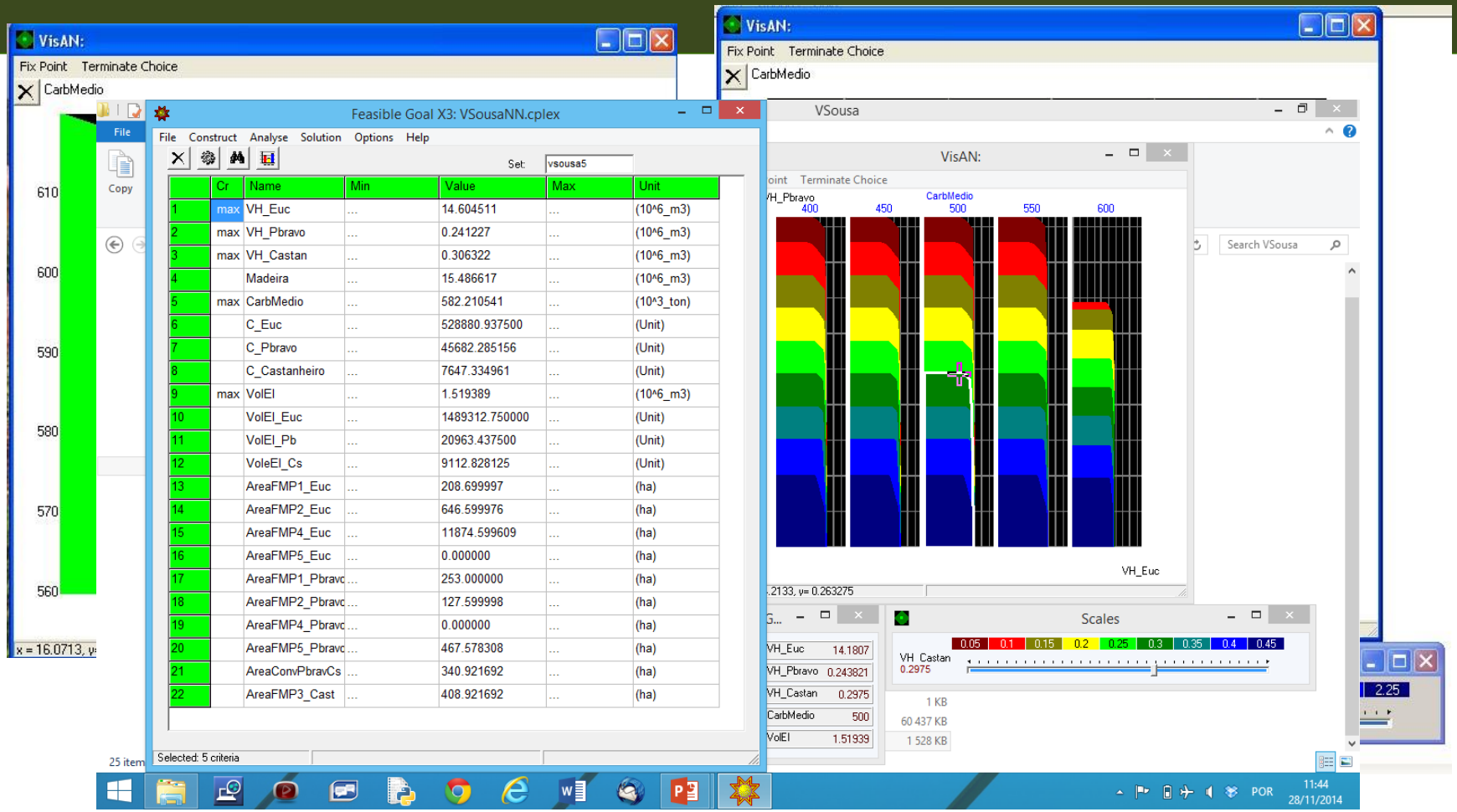


3rd round of workshops with stakeholders

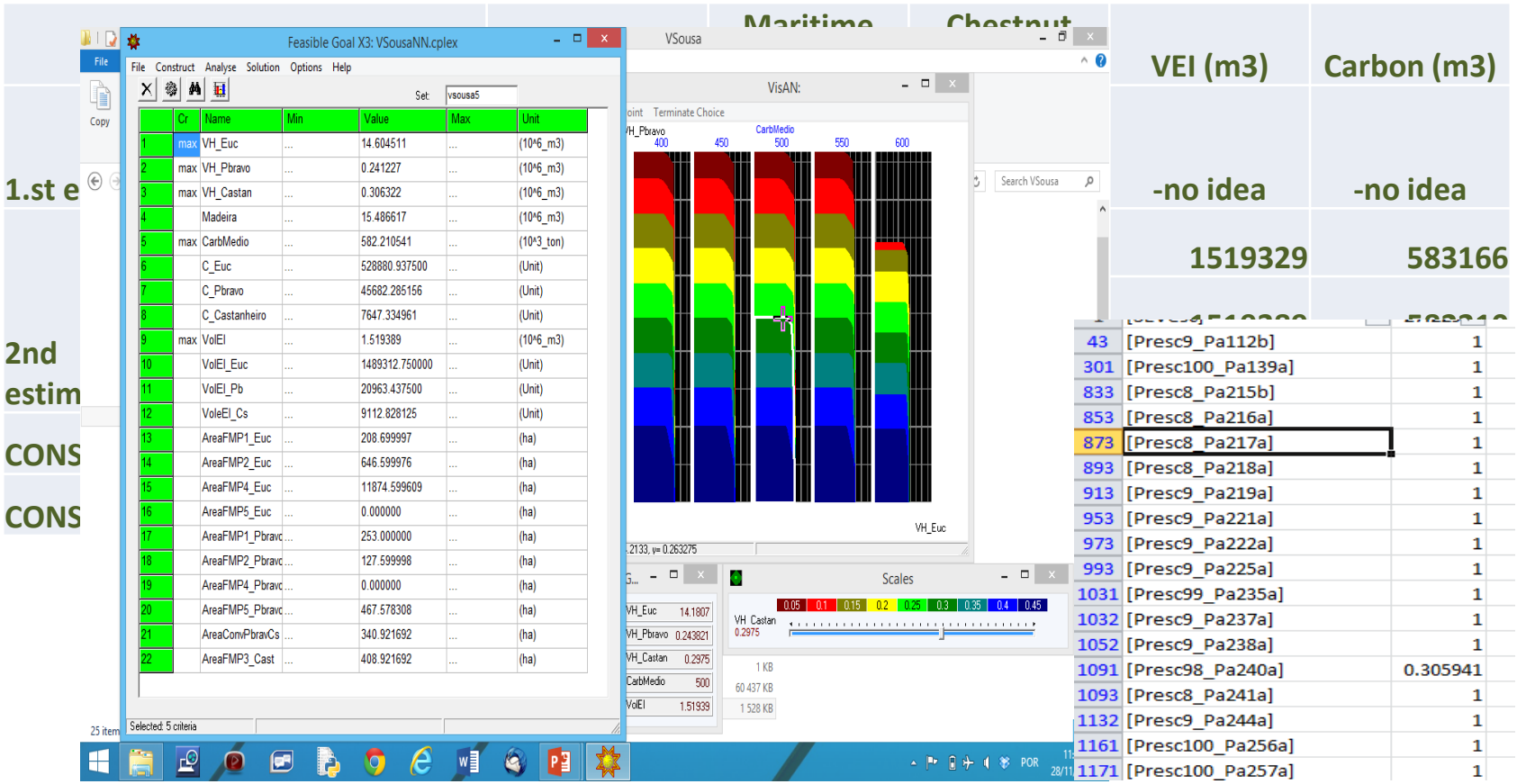




IDM Tool


VisAN:
Fix Point
Terminate Choice
CarbMedio
Feasible Goal X3: VSousaNN.cplex
File
Construct
Analyse
Solution
Options
Help
Set:
vsousa5
Cr
Name
Min
Value
Max
Unit
1 max VH_Euc ... 14.604511 ... (10^6_m3)
2 max VH_Pbravo ... 0.241227 ... (10^6_m3)
3 max VH_Castan ... 0.306322 ... (10^6_m3)
4 Madeira ... 15.486617 ... (10^6_m3)
5 max CarbMedio ... 582.210541 ... (10^3_ton)
6 C_Euc ... 528880.937500 ... (Unit)
7 C_Pbravo ... 45682.285156 ... (Unit)
8 C_Castanheiro ... 7647.334961 ... (Unit)
9 max VolEI ... 1.519389 ... (10^6_m3)
10 VolEI_Euc ... 1489312.750000 ... (Unit)
11 VolEI_Pb ... 20963.437500 ... (Unit)
12 VoleEI_Cs ... 9112.828125 ... (Unit)
13 AreaFMP1_Euc ... 208.699997 ... (ha)
14 AreaFMP2_Euc ... 646.599976 ... (ha)
15 AreaFMP4_Euc ... 11874.599609 ... (ha)
16 AreaFMP5_Euc ... 0.000000 ... (ha)
17 AreaFMP1_Pbravo ... 253.000000 ... (ha)
18 AreaFMP2_Pbravo ... 127.599998 ... (ha)
19 AreaFMP4_Pbravo ... 0.000000 ... (ha)
20 AreaFMP5_Pbravo ... 467.578308 ... (ha)
21 AreaConvPbravCs ... 340.921692 ... (ha)
22 AreaFMP3_Cast ... 408.921692 ... (ha)
Selected: 5 criteria
VSousa
Search VSousa
Scales
VH_Euc 14.1807
VH_Pbravo 0.243821
VH_Castan 0.2975
CarbMedio 500
VolEI 1.51939
POR
11:44
28/11/2014

Reajustment of goals



THANK YOU!

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Universidade de Lisboa (Portugal)