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REINFFORCE

Tree species selection

May 2012



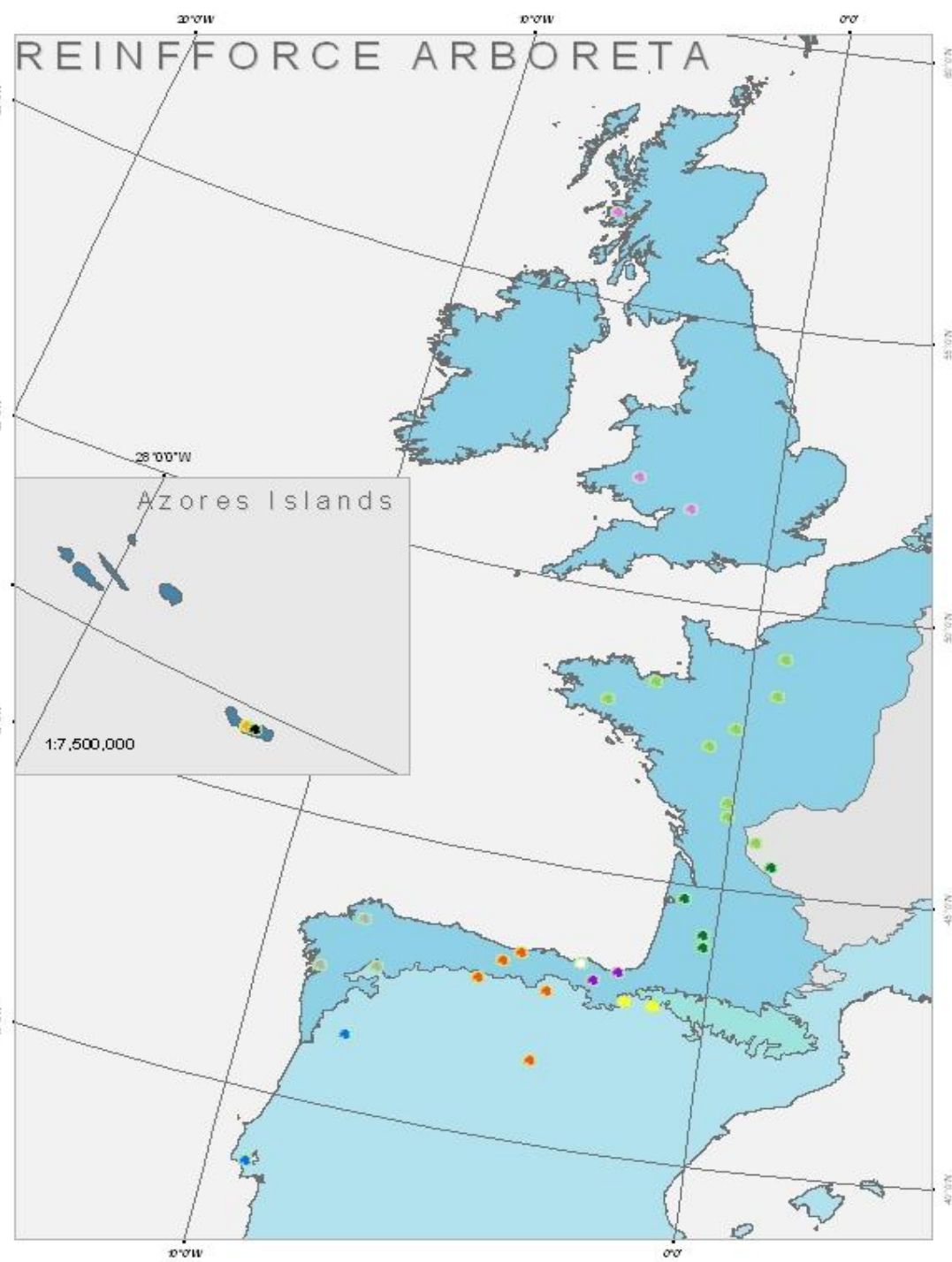
ESPAÑA ESPACIO ATLÁNTICO
FRANCE ESPACE ATLANTIQUE
IRELAND ATLANTIC AREA
PORTUGAL ESPAÇO ATLÂNTICO
U.K. ATLANTIC AREA





*(REsource INFrastructure for
atlantic FOrest)*

- ◆ Network of arboret
- ◆ Network of demons
- ◆ Data base for grow
- ◆ weather and phenol
monitoring





Introduction

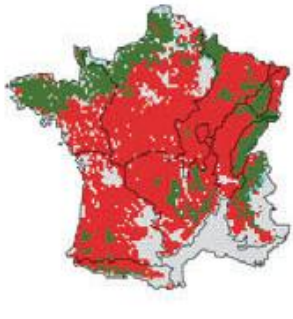


Why do we need field trials for climate change adaptation?

Projected changes in distribution of temperate broadleaf trees

Predicted future distribution (2055)

BIOMOD



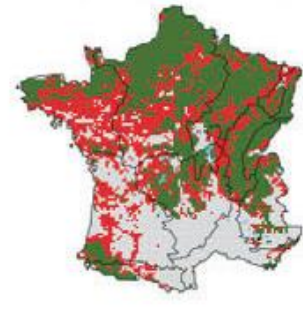
N-NBM



IBIS



ORCHIDEE



Source : Climate change impacts on tree ranges: model intercomparison facilitates understanding and quantification of uncertainty

ASSUMPTIONS

- Each tree species is found in a location suitable for it
- Future climate will induce the same tree response as now
- Level of risks for forests will have the same intensity as now
- Climate scenarios are taken for granted





Why do we need field trials for climate change adaptation ?

Each tree species is found in a location suitable for it

- ❖ *Anthropogenic interferences*
- ❖ *Genetic disturbances*
- ❖ *Health status of the present species (it is changing very fast and not providing an accurate vision of their real capacity to cope with climate on the whole life cycle)*

Future climate will induce the same tree response as now

- ❖ *CO2 concentration affects phenology, C-allocation, etc.*
- ❖ *Extreme weather events regime will change*

Level of risks for forests will have the same intensity as now

- ❖ *Insect outbreaks, pathogens, fire, storms..*

Climate scenarios are taken for granted





Material and methods





Species selection method for adaptation field trials

Selection criteria of the REINFFORCE species

- ♦ *Commercial interests (timber, seeds, cork, etc.)*
- ♦ *Plasticity in the climate conditions*
- ♦ *Suitability for the present and future climate of the Atlantic rim*

Potential methods for selection

- ♦ *Analysis of exsisting field trials*
- ♦ *Experts knowledge*
- ♦ *Literature review*



Register of forest long term monitoring trials



Number of matching rows : 19

plot_id	country	Experimental serie	Experiment id	Priority	Altitude	Province-Region	Municipality	Municipality code	Local name	Stand establishment	Stand removal	Start of monitoring	End of monitoring	Responsible institution	Responsible department	Responsible name	Responsible phone number	Objecti
FR100	United-Kingdom		Culbin 2	4	10	Moray	Elgin		Culbin	1922-01-01	0000-00-00	0000-00-00	0000-00-00	FR	FMD			C25
FR229	United-Kingdom		Lewis 4	3	8	Western Isles	Stornoway		Lewis	1990-01-01	0000-00-00	0000-00-00	0000-00-00	FR	FMD			C24
FR324	United-Kingdom		Pembrey 6	3	5	Carmarthenshire	Carmarthen		Pembrey	1985-01-01	0000-00-00	0000-00-00	0000-00-00	FR	FMD			C24
FR491	United-Kingdom		Neroche 43	3	305	Somerset	Taunton		Neroche	1993-01-01	0000-00-00	0000-00-00	1996-01-01	FR	FMD			A01
FR511	United-Kingdom		Thetford 2	3	30	Norfolk	Norfolk		Thetford	1993-01-01	0000-00-00	0000-00-00	1996-01-01	FR	FMD			A01
FR516	United-Kingdom		Wareham 97	3	30	Dorset	Dorchester		Wareham	1950-01-01	0000-00-00	0000-00-00	0000-00-00	FR	FMD			A01
IDF-0809003	France	changement		1	183		OLIZY			1997-01-01	0000-00-00	0000-00-00	0000-00-00			Régis		C24





Expert knowledge

Step 1

- ◆ The experts of the project created a list of species, meeting the above criteria
- ◆ 174 tree species have been proposed

Step 2

- ◆ Online voting query : each partner assigned a total of 60 points ranging from 1 to 3 points per species
- ◆ Total votes number : 265

Step 3

- ◆ The species were ranked according to the total score and the number of voting organizations. Based on the results of the votes, the species were divided into 3 different groups.
 - ◆ *Red group: 74 species classified as not interesting*
 - ◆ *Green group: 12 species classified as very interesting*
 - ◆ *White group: 89 species classified as uncertain*





Decision support tools / Literature review

From the previous ranking and further experts' changes 66 tree species were selected for literature review, listing:

- ❖ *Scientific name (the most common and accepted scientific name)*
- ❖ *Local name (in Portuguese, Spanish, French and English)*
- ❖ *Different botanical aspects (a list of links)*
- ❖ *Geographical distribution of the species*
- ❖ *Intra-specific variation (defined as the differences seen within species)*
- ❖ *Ecological characteristics*
- ❖ *Pest, diseases and other perturbations*
- ❖ *A list of species provenances proposed by the partners*
- ❖ *Bibliography*





Decision support tools

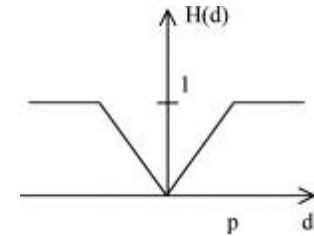
66 species characteristics used for selecting the following indicators reflecting plasticity and economical interests

- ◆ *Distribution area*
- ◆ *Climate tolerance*
- ◆ *Soil tolerance*
- ◆ *Use in forestry*
- ◆ *Social interest*
- ◆ *Annual growth rate*
- ◆ *Wood and products quality*
- ◆ *Sensitivity to disturbances*
- ◆ *Management references*





Decision support tools



Five rankings were built-up using PROMETHEE algorithm with the following parameters

	Code for unknown	Number of Unknown	pref	Function	Q	P	objective	R1	R2	R3	R4	R5
GeoDistr	-	0	1<2<3<4	V-Shape	-	2.5	maximize	1	1	0	0	1
ClimaDistri	4 replaced by 0.9	2	1<2<3	V-Shape	-	1.5	maximize	1	1	0	2	3
FrostTol	6 replaced by 1.9	2	1<2<3<4<5	level	0.5	1.5	maximize	1	1	0	0	1
HTempTol	4 replaced by 1.9	2	1<2<3	V-Shape	-	1.5	maximize	1	1	0	2	3
DroughtTol	4 replaced by 0.9	1	1<2<3	V-Shape	-	1.5	maximize	1	1	0	2	3
WaterDemand	-	0	1>2>3	V-Shape	-	1.5	minimize	1	1	0	2	3
Nutrient	-	0	4>1>2>3	V-Shape	-	2.5	minimize	1	1	0	0	1
SoilDepth	-	0	0>1>2>3	V-Shape	-	2.5	minimize	1	1	0	1	2
SoilMoisture	4 replaced by 1.9	5	1<2<3	V-Shape	-	1.5	maximize	1	1	0	1	2
Econ	-	0	1<2<3<4	V-Shape	-	2.5	maximize	1	0	1	1	2
Social	4 replaced by 1.9	7	1<2<3	V-Shape	-	1.5	maximize	1	0	1	0	1
height	-	1	-	V-Shape	-	30	maximize	1	0	1	2	3
WQuality	5 replaced by 1.9	6	1<2<3<4	V-Shape	-	2.5	maximize	1	0	1	1	2
Wproducts	-	0	1<2<3<4<5	V-Shape	-	3.5	maximize	1	0	1	1	2
Biodamages	4 replaced by 0.9	5	1>2>3	V-Shape	-	1.5	minimize	1	0	1	1	2
AbioDamages	4 replaced by 0.9	6	1>2>3	V-Shape	-	1.5	minimize	1	0	1	0	1
management	-	0	1<2<3	V-Shape	-	1.5	maximize	1	0	1	0	1





Tree species in the arboreta



◆ *Acer pseudoplatanus*

◆ ***Betula pendula***

◆ *Castanea Sativa*

◆ ***Cedrus atlantica***

◆ *Calocedrus decurrens*

◆ *Cedrus libani*

◆ *Cunninghamia lanceolata*

◆ *Cupressus sempervirens*

◆ *Ceratonia siliqua*

◆ *Eucalyptus nitens*,

◆ *E. gundal* and *E. globulus*

◆ *Fagus orientalis*

◆ *Larix decidua*

◆ *Pinus brutia*

◆ *Pinus elliotii*

◆ *Pinus nigra* subsp *laricio*
and *salzmanii*

◆ *Pinus peuce*

◆ *Pinus pinaster*

◆ *Pinus pinea*

◆ *Pinus ponderosa*

◆ *Pinus sylvestris*

◆ *Pinus taeda*

◆ *Pseudotsuga menziesii*

◆ *Quercus ilex* and *Q.*
rotundifolia

◆ *Quercus petraea*

◆ ***Quercus robur***

◆ *Quercus rubra* and *Q.*
shumardii

◆ *Quercus suber*

◆ *Robinia pseudoacacia*

◆ *Sequoia sempervirens*

◆ *Thuja plicata*





Discussion





Limits of the various approaches

Existing trials

lack of information database

lack of appropriate knowledge for climate impact assessment

Expert knowledge

future climate impact limited or biased knowledge

limited tree ecology knowledge

Decision support / Literature review

subjective evaluation of indicators from literature review





Conclusion

This combination of methods resulted in:

A consensual list of tree species

Set-up of permanent online tool listing the forest trials accessible to any organisation (even beyond REINFFORCE network)

The use of tree species literature review to select the provenances (at least three per species)





Status

147 genetic units (32 selected species and an average of 4 provenances per species) will be planted in the 38 selected arboreta



90,000 seedlings planted

Autumn 2011



45,000 seedlings in the nursery

Autumn 2012





Thank you!

