

# A VISTA to whom?

## Assessing vulnerability in Traditional Agricultural Landscapes

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# Talk plan

- ✿ Context – marginal agricultural areas in Europe
- ✿ Vulnerability – concepts and definitions
- ✿ VISTA approach
- ✿ A practical example
- ✿ Conclusions

# Project context

- Land use change in marginal agricultural areas
  - ‘Traditional Agricultural Landscapes’
  - ‘natural’ conditions leading to low ecosystem productivity
  - marginal socio-economic conditions
  - Recent dynamics of land abandonment and/or extensification
  - Landscape transformation
  - Recent efforts (EU and individual countries) to work towards sustainable development

# 'Traditional Agricultural Landscapes'

- ✿ 'Landscapes developed by farmers between the Iron age and the 19th century, primarily representing low intensity mixed agricultural systems integrating pasture, extensive grazing lands and forests'.
  - typically species rich and are considered high conservation value.
  - represent < 50% Europe's highly valued biotypes

# Characteristics of low-intensity livestock and crop-based farming systems

Livestock systems	Crop systems
low nutrient input, predominately organic	low nutrient input, predominately organic
low stocking density	low yield per hectare
low agrochemical input	low agrochemical input (usually no growth regulators)
little investment in land drainage	little investment in land drainage
relativey high percentage of semi-natural vegetation	crops and varieties suited to specific regional conditions
relatively high species composition of sward	more traditional crop varieties
low degree of mechanisation	low degree of mechanisation
often hardier, regional breeds of livestock	use of fallow in the crop rotation
survival of long-established management practices	more traditional harvesting methods
e.g hay making, transhumance	
reliance on natural suckling	tree crops tall rather than dwarf
limited use of concentrate feeds	absence of irrigation

*Beaufoy et. al 1994*

# Project context

- ✿ Land use change in marginal agricultural areas
  - 'Traditional Agricultural Landscapes'
  - 'natural' conditions leading to low ecosystem productivity
  - marginal socio-economic conditions
  - Recent dynamics of agricultural extensification and/or land abandonment
  - Rapid landscape transformation
  - Recent efforts (EU and individual countries) to work towards sustainable development

# Land use change in TALs

## ❧ Ecological consequences

- Secondary succession
  - Changes in plant and animal diversity
  - Changes in ecosystem functioning

## ❧ Societal consequences

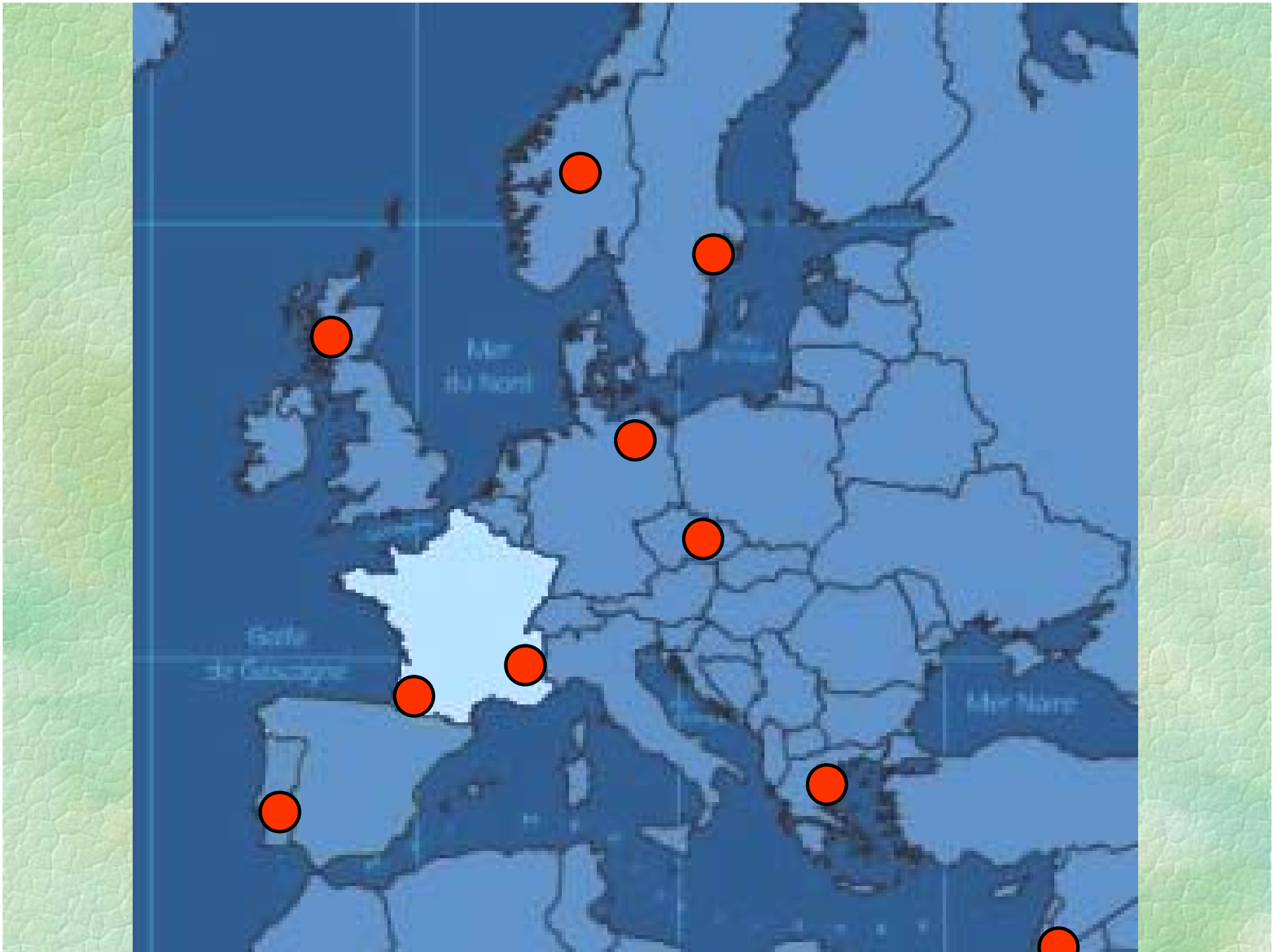
- Changes in ecosystem services
  - e.g. biodiversity conservation, agricultural production, tourism, recreation, aesthetics.

**VISTA aims to compile an  
integrated assessment of the  
vulnerability  
of European traditional agro-  
pastoral landscapes to land use  
change  
that will assist land managers and  
regional policy makers towards  
sustainable development**



# VISTA sites and partners

- 11 study sites across France, U.K, Germany, Sweden, Portugal, Greece, Norway, Czech Republic and Israel
- Range of partners
  - CEFE, CNRS, INRA, UJF France
  - MLURI, U.K.
  - UCL, Belgium
  - UOL, Germany
  - IMAR, LPN Portugal
  - NINA, Norway
  - AUTH, Greece
  - SU, Sweden
  - USB, Czech Republic
  - HUJ Israel



















# Vulnerability

## • Function of exposure, sensitivity and adaptive capacity

- **Exposure** - nature and degree to which ecosystems are exposed to environmental change' (ATEAM).
- **Sensitivity** - changes in the human – environment system as a response to exposure
- **Adaptive capacity** - ability of a system to adjust to global change (including variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences' (ATEAM).

*and...*

# Vulnerability..

- **Acceptability** - beneficiaries' judgements about changes in ecosystem services as a response to exposure
- **Vulnerability** - comparison of collective degree of acceptability of change in full set of ecosystem services, as a response to exposure, by all beneficiaries
  - within site, across scenario
  - across site, within scenario

# VISTA approach

- PFTs as indicators of prospective ecosystem change
- Scenario-based approach – four SRES climate change scenarios
- Combination field studies, landscape modelling, agent-based modelling
- Social surveys to identify beneficiaries and associated ecosystem services, and evaluate ‘acceptability’

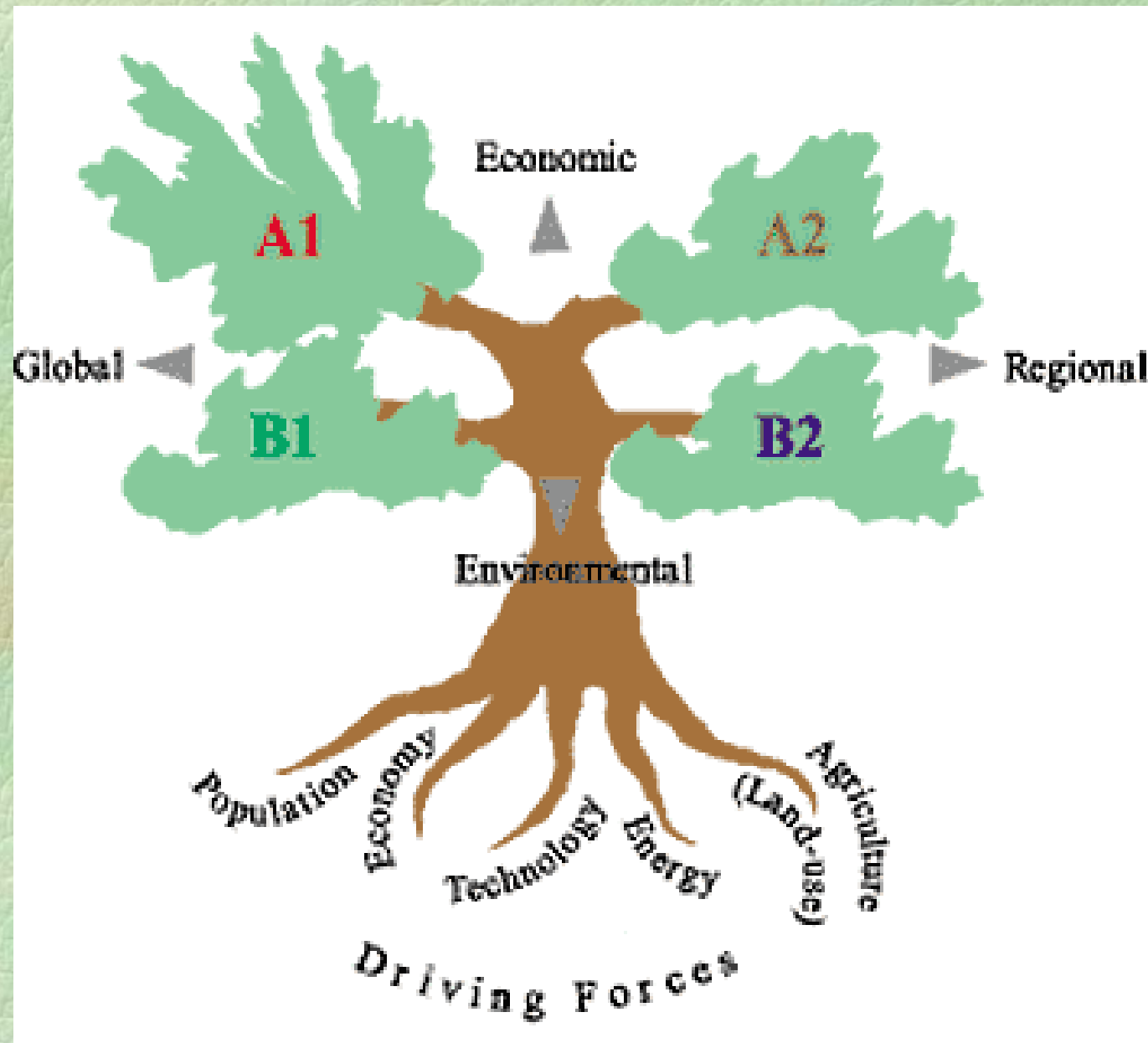
# Plant Functional Traits

## Plant Functional Group

- group of species with a similar **RESPONSE** to environmental conditions and/or similar **EFFECTS** on ecosystem functioning
- based on shared biological characteristics
  - ‘functional traits’
  - measured at the individual or population level
  - morphological, ecophysiological, reproductive, demographic
  - response / effect traits

# Scenarios of land use change

- ❧ Four SRES scenarios over next 100 years
- ❧ Modelled using land use history
- ❧ Develop scenarios of future change
  - downscaling of regional scenarios to study sites
  - maps of future land use under four scenarios



# Beneficiaries and Ecosystem Services

## Beneficiaries

- an individual, set of individuals, community or agency with identified preferences for a single or set of ecosystem services

## Ecosystem services

- Provisioning: goods produced or provided by ecosystems
  - herbage production, agricultural products
- Regulating: benefits obtained from regulation of ecosystem processes
  - fire regimes, water quality
- Supporting: services that maintain the conditions for life on earth
  - nutrient cycling, biodiversity
- Cultural: non-material benefits obtained from ecosystems
  - landscape aesthetic value, recreation



# Social survey methods

## 🌿 **Identifying beneficiaries and ecosystem services**

- Informal guided conversations
- Questionnaires

## 🌿 **Evaluating acceptability**

- Participative group meetings and workshops
- Presenting sensitivity: maps of land use change, ecosystem services, virtual aerial photos, artist paintings...others??

**How is this achieved?**

# Five Matrices

## Matrix BF-ES

- Identified beneficiaries and associated ecosystem services

## Matrix FT-EA

- Plant Functional Traits and ecosystem attributes

## Matrix EA-ES

- Ecosystem attributes and ecosystem services

## Matrix EF-ES(BF)

- Beneficiaries' perceptions of links between ecosystem attributes and ecosystem services

## Acceptability cube

- Evaluation of changes in ecosystem services by all beneficiaries for each scenario

# Matrix BF-ES

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Beneficiaries	Ecosystem services			
	Cheese production	Skiing	Biodiversity conservation	View
Farmer	+	-	+	+
Skier	0	+	0	+
Park manager	-	-	+	-
Tourist	-	-	+	+

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# Matrix FT-EA

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PFTs	Ecosystem attributes		
	primary productivity	species richness	pasture nutritional status
Clonality	0	-	0
Plant height	+	-	+
LNC	+	-	+
LPC	+?	-?	+
onset of flowering	0	0	+

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# Matrix EA-ES

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Ecosystem attribute	Ecosystem services			View
	Cheese production	Skiing	Biodiversity conservation.	
primary productivity	+	0	-	-
species richness	+	0	+	0
Plant height	0/+	-	-	-
pasture nutritional status	+	0	0	0

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# Matrix EA-ES(BF)

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Ecosystem attribute	Ecosystem services			View
	Cheese production	Skiing	Biodiversity conservation	
Primary productivity	-	0	-	-
Species richness	-	-	0	0
Plant height	0/+	-	-	-
Pasture nutritional status	+	0	+	0

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# Acceptability cube

Site 1

		Beneficiaries					Scenarios	
		BF1	BF2	BF3	BF4	BF5	A1	A2
Ecosystem services	ES <sub>1</sub>	no	yes	yes	yes	yes		
	ES <sub>2</sub>	yes	no	yes	no	yes		
	ES <sub>3</sub>	yes	no	yes	no	yes		
	ES <sub>4</sub>	yes	yes	yes	no	yes		
	ES <sub>5</sub>	yes	yes	yes	yes	yes		

Site 2

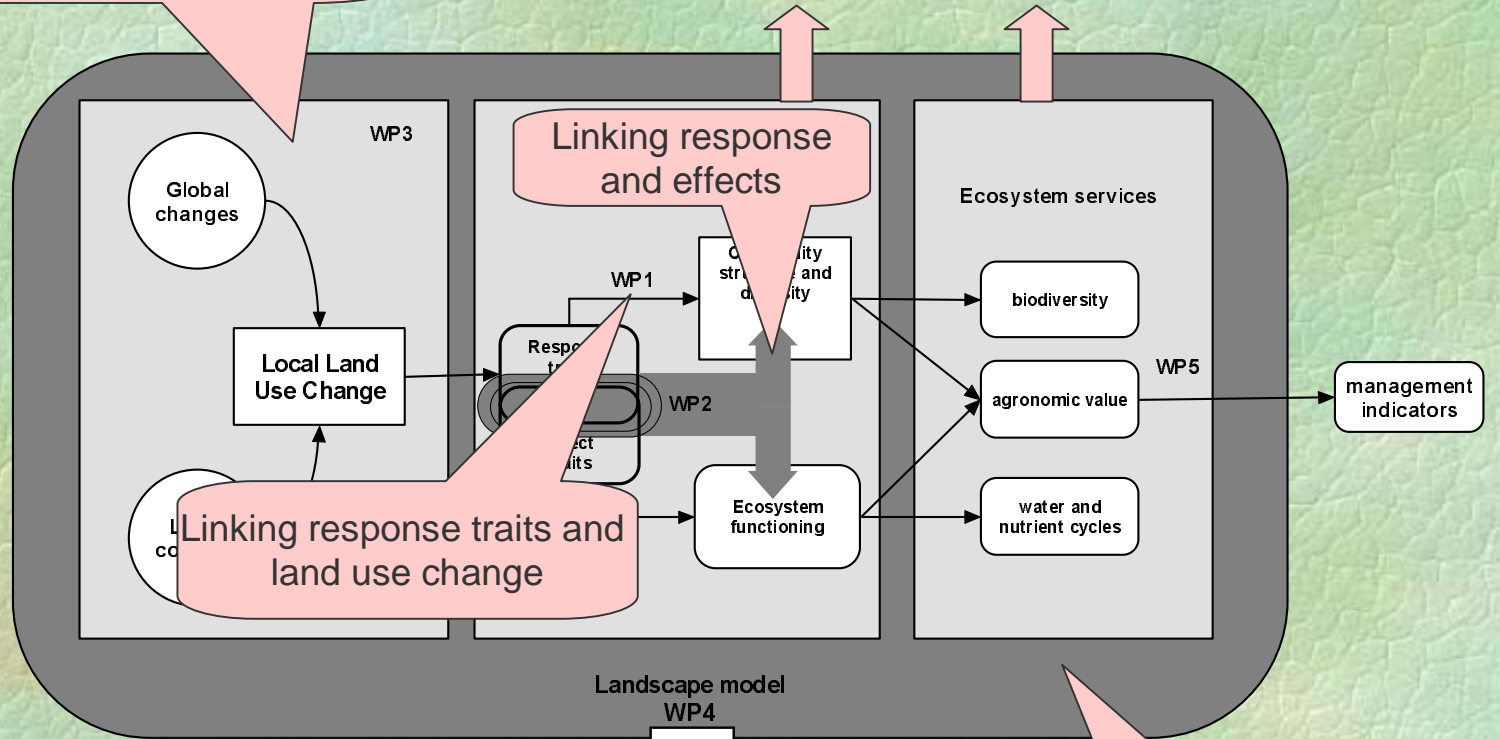
		Beneficiaries				Scenarios	
		BF1	BF2	BF3	BF4	A1	A2
Ecosystem services	ES <sub>1</sub>	no	yes	yes	yes		
	ES <sub>2</sub>	yes	no	yes	no		
	ES <sub>3</sub>	yes	no	yes	no		



Prospective local land use change under SRES scenarios = **EXPOSURE**

Matrix FT-EA

Matrix EA-ES



Linking response traits and land use change

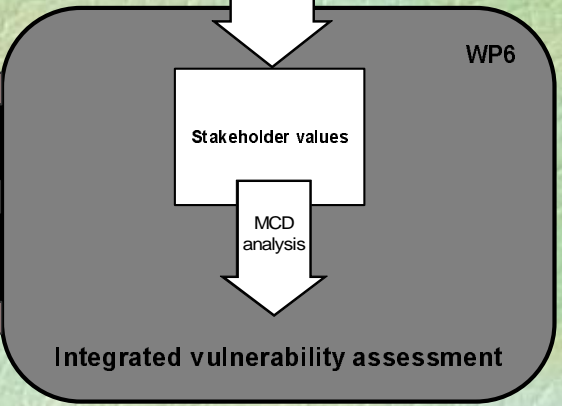
Linking response and effects

Landscape models of changes in PFTs → ES = **SENSITIVITY**

Matrix BF-ES

Matrix EA-ES(BF)

Acceptability cube



Integrated vulnerability assessment

# Vulnerability assessment

A. Within site,  
across scenario

A1

	BF1	BF2	BF3	BF4	BF5
ES1	no	yes	yes	yes	yes
ES2	yes	no	yes	no	yes
ES3	yes	no	yes	no	no
ES4	yes	yes	yes	no	yes
ES5	yes	yes	yes	yes	yes

A2

	BF1	BF2	BF3	BF4	BF5
ES1	no	yes	yes	yes	yes
ES2	yes	no	yes	no	yes
ES3	yes	no	yes	no	no
ES4	yes	yes	yes	no	yes
ES5	yes	yes	yes	yes	yes



Scenario	A1	A2
no. 'yes' as % of total	20	70



**A1 > A2**

B. Across site,  
within scenario

A1

	BF1	BF2	BF3	BF4	BF5
ES1	no	yes	yes	yes	yes
ES2	yes	no	yes	no	yes
ES3	yes	no	yes	no	no
ES4	yes	yes	yes	no	yes
ES5	yes	yes	yes	yes	yes

Site 1

A1

	BF1	BF2	BF3	BF4	BF5
ES1	no	yes	yes	yes	yes
ES2	yes	no	yes	no	yes
ES3	yes	no	yes	no	no
ES4	yes	yes	yes	no	yes
ES5	yes	yes	yes	yes	yes

Site 2



Scenario	A1	
Site	1	2
No. 'yes' as % of total	40	60



**For A1,  
Site 1 > Site 2**

**Matrix BF-ES**

	ES1	ES2	ES3	ES4
BF1	0	.	0	-
BF2	.	-	-	0
BF3	0	-	.	.
BF4	-	.	.	0

**Matrix FT-EA**

	EA1	EA2	EA3	EA4
PFT1	0	.	0	-
PFT2	.	-	-	0
PFT3	0	-	.	.
PFT4	-	.	.	0

**Matrix EA-ES(BF)**

	ES1	ES2	ES3	ES4
EA1	0	.	0	-
EA2	.	-	-	0
EA3	0	-	.	.
EA4	-	.	.	0

Comparison with matrix 2

WP4

Δ PFTs and EA under each scenario (exposure)

**Matrix EA-ES**

	ES1	ES2	ES3	ES4
EA1	0	.	0	-
EA2	.	-	-	0
EA3	0	-	.	.
EA4	-	.	.	0

Δ ES under each scenario = sensitivity

A. Within site, across scenario

acceptability

vulnerability

A1

	BF1	BF2	BF3	BF4	BF
EA1	no	yes	yes	yes	yes
EA2	yes	no	yes	no	yes
EA3	yes	no	yes	no	no
EA4	yes	yes	yes	no	yes
EA5	yes	yes	yes	yes	yes

Scenario	A1	A2
no. 'yes' as % of total	20	70

A1 > A2

A2

	BF1	BF2	BF3	BF4	BF
EA1	no	yes	yes	yes	yes
EA2	yes	no	yes	no	yes
EA3	yes	no	yes	no	no
EA4	yes	yes	yes	no	yes
EA5	yes	yes	yes	yes	yes

B. Across site, within scenario

A1 Site 1

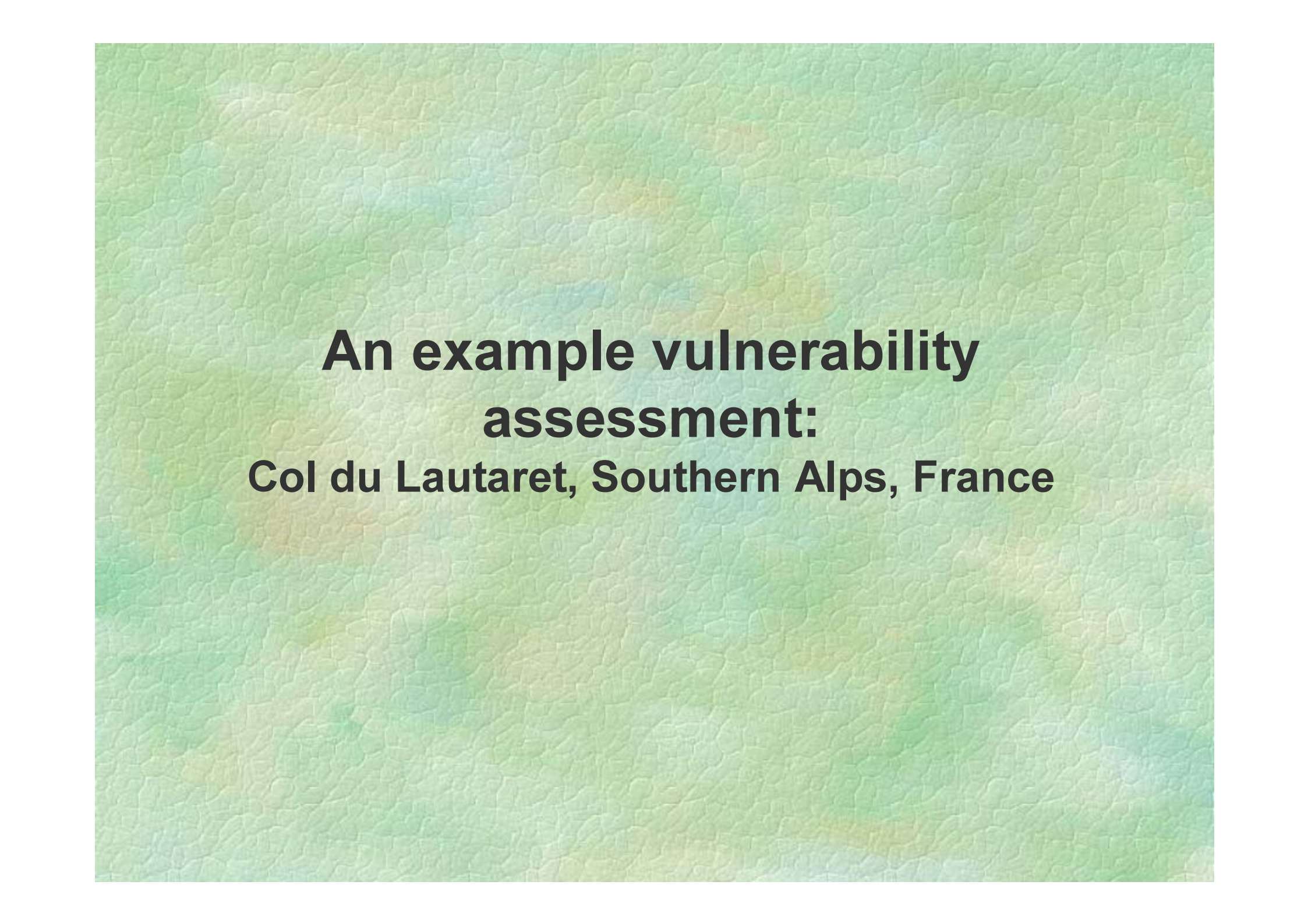
	BF1	BF2	BF3	BF4	BF5
EA1	no	yes	yes	yes	yes
EA2	yes	no	yes	no	yes
EA3	yes	no	yes	no	no
EA4	yes	yes	yes	no	yes
EA5	yes	yes	yes	yes	yes

Scenario	A1	
Site	1	2
No. 'yes' as % of total	40	60

For A1, Site 1 > Site 2

A1 Site 2

	BF1	BF2	BF3	BF4	BF5
EA1	no	yes	yes	yes	yes
EA2	yes	no	yes	no	yes
EA3	yes	no	yes	no	no
EA4	yes	yes	yes	no	yes
EA5	yes	yes	yes	yes	yes



**An example vulnerability  
assessment:  
Col du Lautaret, Southern Alps, France**

# Local context: Environmental

- ❧ High altitude (1650 – 2960m) & steep slopes
- ❧ Snow cover October–April
- ❧ Strong altitude gradients
- ❧ Deep soils on slate (acid) substrate
- ❧ Intermediate climate in mountain rain shadow

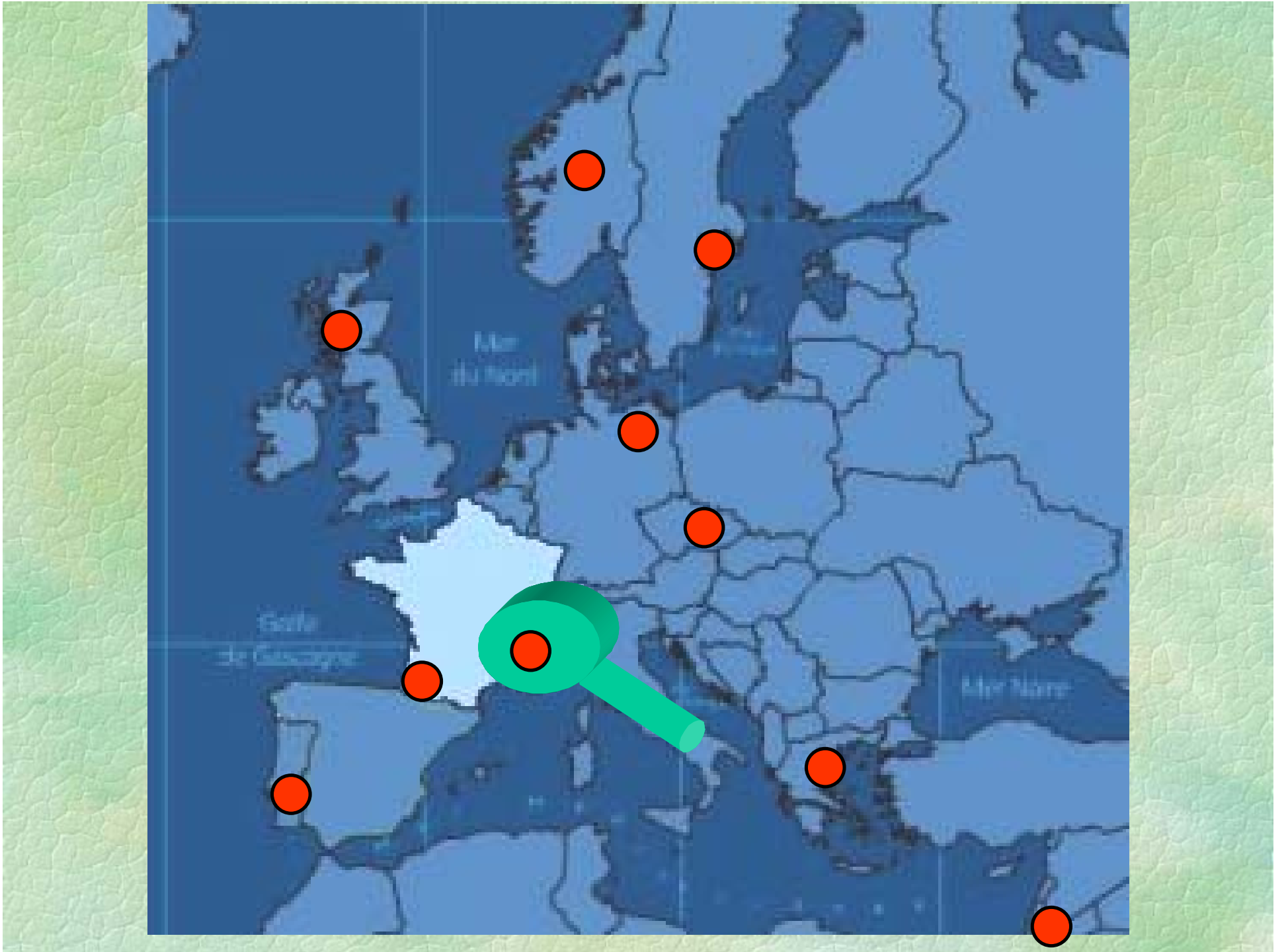
# Local context: Land use

## ☞ *Pre-war phase*

- self-sufficient diverse agricultural system
- Terraced
- Cultivated lower slopes
- Hay making middle slopes
- Grazing upper slopes
- Overuse - deforestation

## ☞ *Post-war phase*

- Rural exodus
- Land abandonment
- 'subsidy farming' - cattle, sheep grazing, hay making
- Transhumance
- Tourism – economic mainstay - consumers of the landscape
- Agricultural extensification – shift in stratification of land use
- Area of conservation interest



























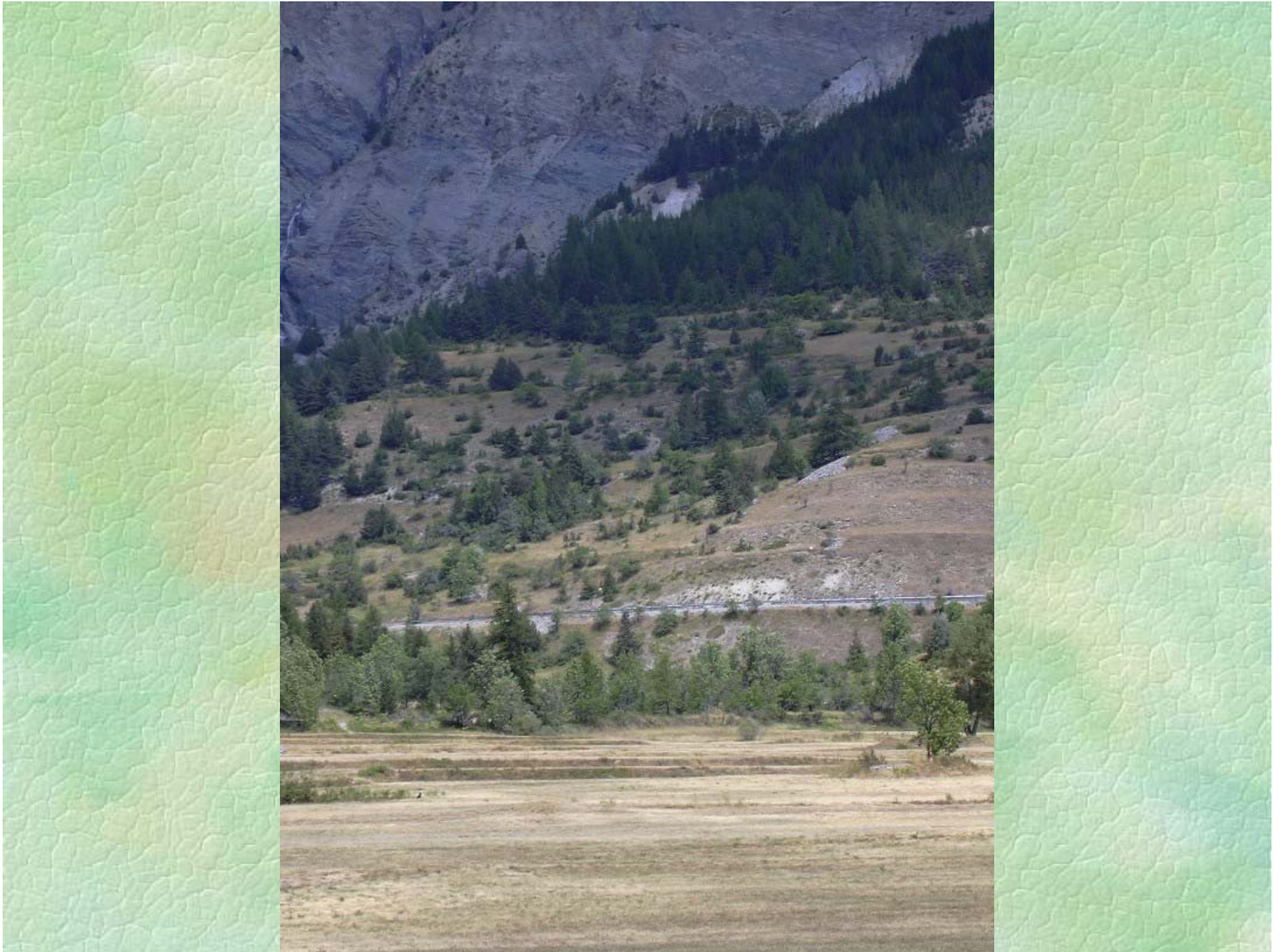
# The downshift of agriculture since 19th century

Former spring  
& summer  
grazing areas

Former hay  
making area  
(winter feed)

Former  
cultivated  
land for  
human  
consumption

A.P.









# Local beneficiaries and ecosystem services

Beneficiaries	Ecosystem services					'Authentic' rural experience
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	
Farmer	+	-	0	-	0	+
Skier	0	+	0	+	+	0
Ecrins NP manager	-	-	-	+	-	0
Tourist	-	-	+	+	+	+

# Possible land use changes

- Returning wild - increased land abandonment
- Staying tame - maintaining/increasing open landscapes

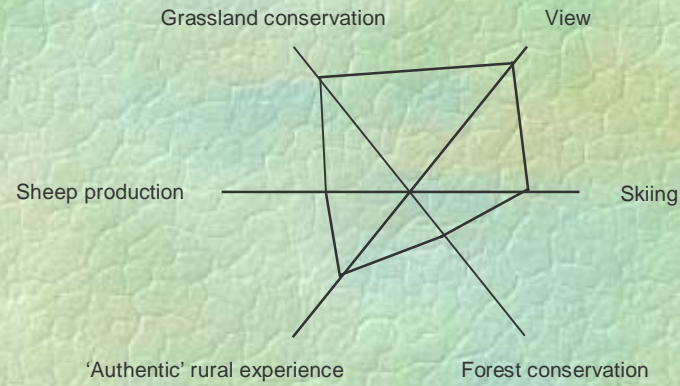
## A VISTA to whom?

- Farmer
- Tourist
- Skier
- Ecrins National Park

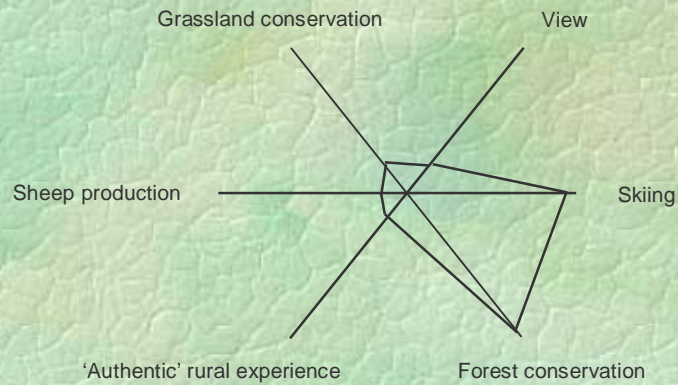


# Possible sensitivity

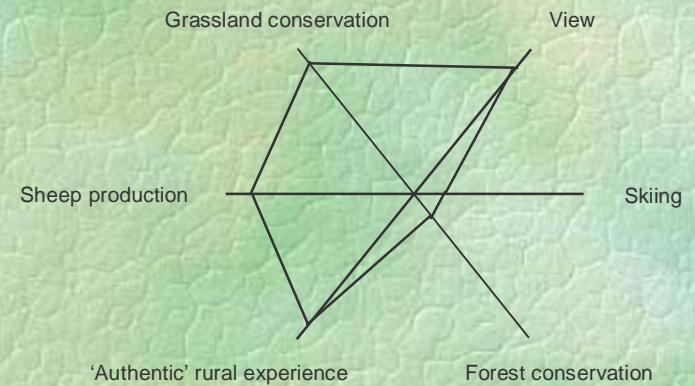
Present day



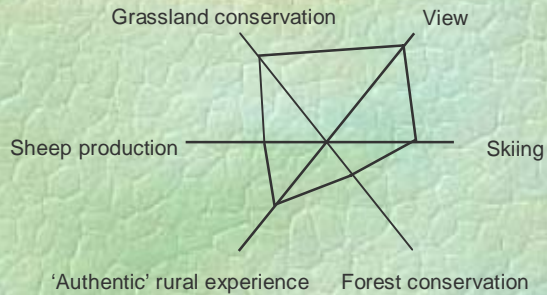
**A1**



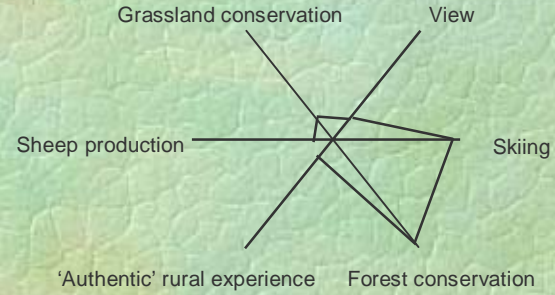
**B2**



# Acceptability A1



Present day



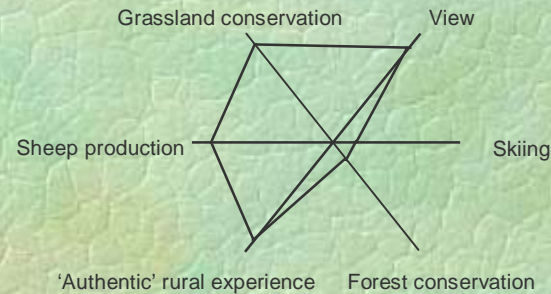
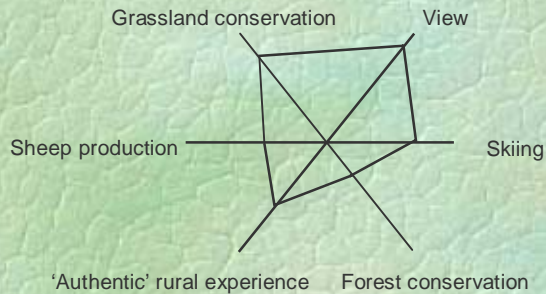
2100

Beneficiaries	Ecosystem services					
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	'Authentic' rural experience
Farmer	+	-	0	-	0	+
Skier	0	+	0	+	+	0
Ecrins NP manager	-	-	-	+	-	0
Tourist	-	-	+	+	+	+

## A1

Beneficiaries	Ecosystem services					
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	'Authentic' rural experience
Farmer	no	no	yes	no	yes	no
Skier	yes	yes	yes	yes	no	yes
Ecrins NP manager	yes	no	yes	yes	yes	yes
Tourist	yes	no	no	yes	no	no

# Acceptability B2



Beneficiaries	Ecosystem services					
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	'Authentic' rural experience
Farmer	+	-	0	-	0	+
Skier	0	+	0	+	+	0
Ecrins NP manager	-	-	-	+	-	0
Tourist	-	-	+	+	+	+

## B2

Beneficiaries	Ecosystem services					
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	'Authentic' rural experience
Farmer	yes	yes	yes	yes	yes	yes
Skier	yes	no	yes	no	yes	yes
Ecrins NP manager	no	yes	no	no	no	yes
Tourist	no	yes	yes	no	yes	yes

# Possible vulnerability

**A1** returning wild: vulnerability = 13/24

Beneficiaries	Ecosystem services					'Authentic' rural experience
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	
Farmer	no	no	yes	no	yes	no
Skier	yes	yes	yes	yes	no	yes
Ecrins NP manager	yes	no	yes	yes	yes	yes
Tourist	yes	no	no	yes	no	no

**B2** staying tame: vulnerability = 16/24

Beneficiaries	Ecosystem services					'Authentic' rural experience
	Sheep grazing	Skiing	Grassland conservation	Forest conservation	View	
Farmer	yes	yes	yes	yes	yes	yes
Skier	yes	no	yes	no	yes	yes
Ecrins NP manager	no	yes	no	no	no	yes
Tourist	no	yes	yes	no	yes	yes

# Conclusions



















- ✿ Abandonment more vulnerable than maintaining TALs
- ✿ Future management and policy implications
  - Continued agri-pastoral use the corner-stone
  - Reliance of tourism/recreation on open landscapes
  - How?
    - Keep the resident farmers
    - Contract graziers - more transhumance
    - Authentic rural escape for city dreamers



# Discussion points

- ❧ Acceptability - acceptable addition?
- ❧ good and bad of using PFTs as indicators of ecosystem change
- ❧ ways of representing sensitivity to beneficiaries

# Global driving forces

<i>Scenario</i>	Population	Economy	Environment	Equity	Technology	Globalization
A1B						
B1						
A2						
B2	