# Multi-criterion analysis

## Wood and resin production schemes

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# Resin production in Europe
## Variability

Different production systems :

- Gemmage à vie

*(Resinación a vida)*

- Gemmage à mort

*(Resinación a muerte)*

*Pica de corteza*

*Eurogemme*

# Economic analysis

Several points of view:

Resin tapper / Forester / Community

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# Economic analysis

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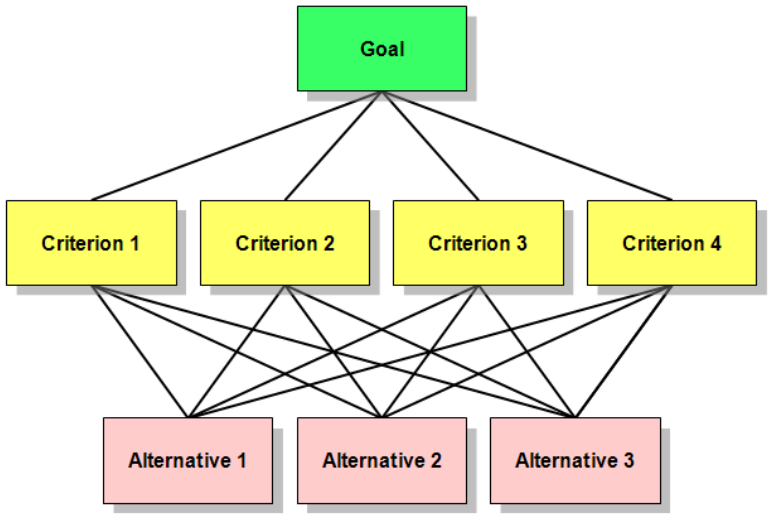
- Resin tapper: According to investments, variable expenses and rental costs, is it profitable ? → Profitability analysis
- Forester: It is profitable to include resin tapping in timber oriented silviculture ? → Cost-benefit analysis
- Community: Is resin tapping profitable for the whole community (forest sector, Spain, Europe) ? → Multi-criterion analysis

# Multi-criterion analysis

Evaluation and comparison method

# Why a multi-criterion analysis ?




- Take a decision
- Choose between several alternatives
- According to several factors
- According to their importance

In general, no ideal alternative exists considering all the factors. Multi-criterion analysis lead to compromises.

# An example : Choose a car

- 6 Scenarios :
  - Renault
  - Fiat
  - Dacia
  - Ford
  - BMW
  - Ferrari

| Criterion | Unit | Objective |
|---|---|---|
| Price | K€ | Minimize |
| Consumption | l/100 km | Minimize |
| Power | Kw | Maximize |
| Space | 5-points | Maximize |
| Comfort | 5-points | Maximize |

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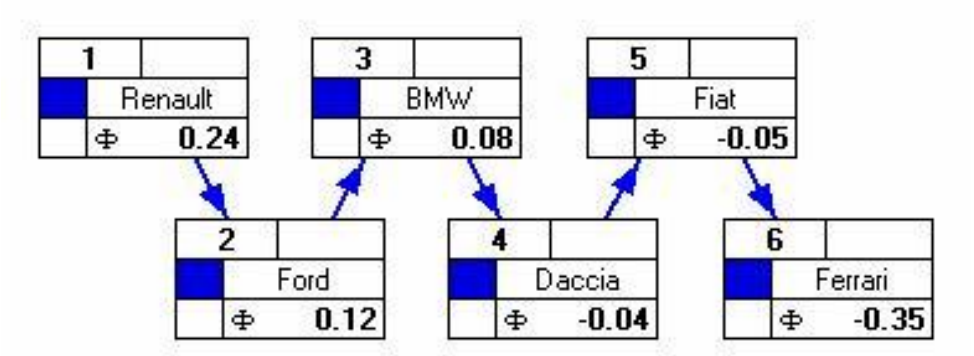
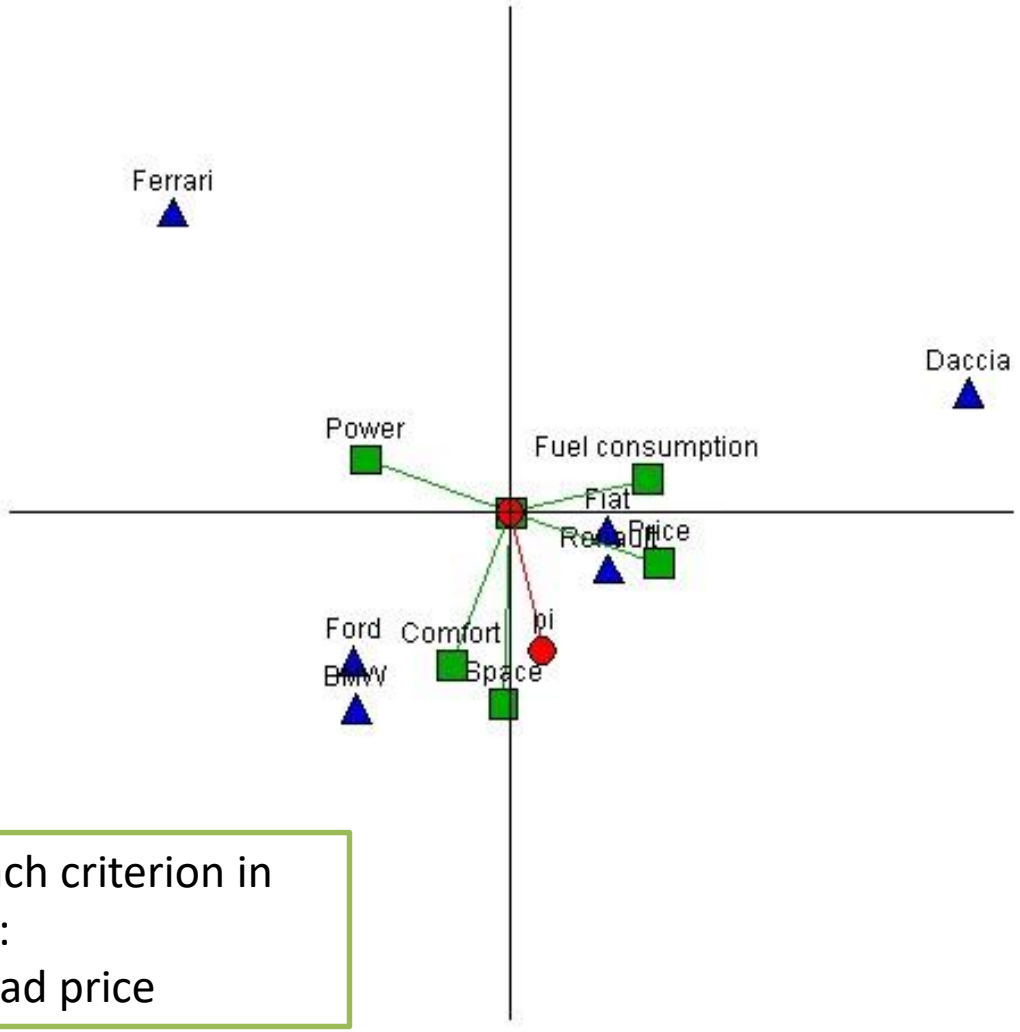



*PROMETHEE example –Hervé Jactel*

# An example : Choose a car

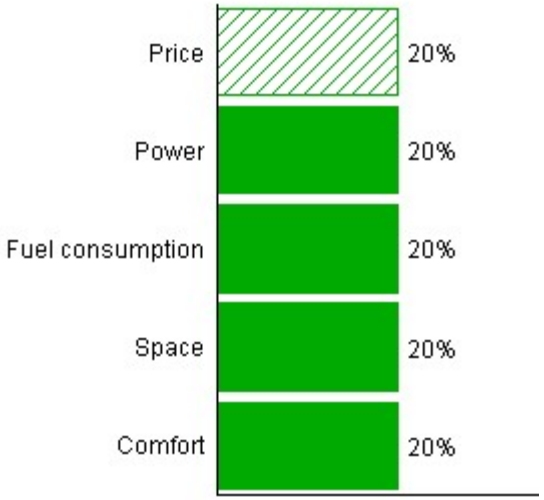
- Visualization :
  - GAIA Chart

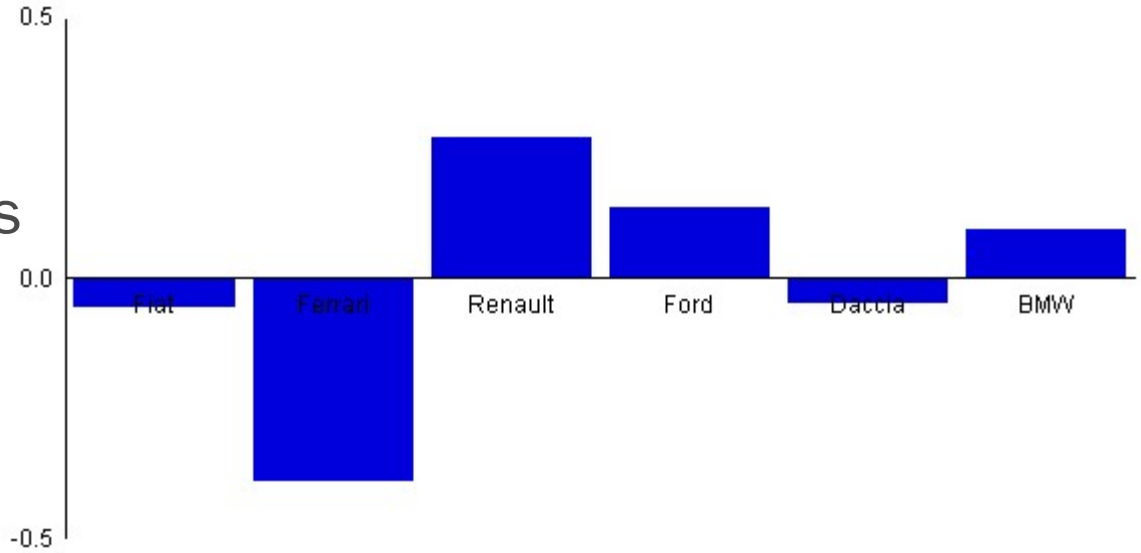



To know the importance of each criterion in the choice of one specific car :
- Ferrari : good power and bad price

# An example : Choose a car

- Visualization :
  - Walking weights




Price = Power = Fuel consumption = Space = Comfort

# An example : Choose a car

- Visualization :
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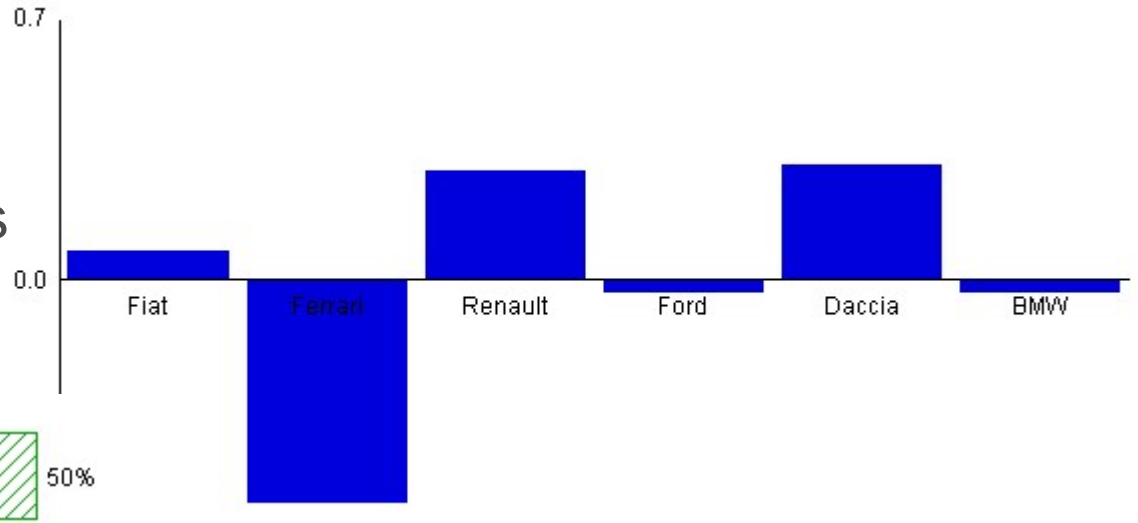


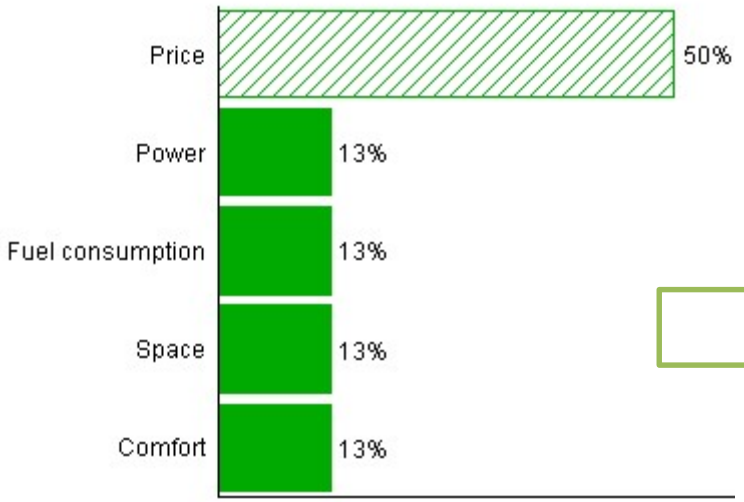


Price is the most important parameter

# An example : Choose a car

- Visualization :
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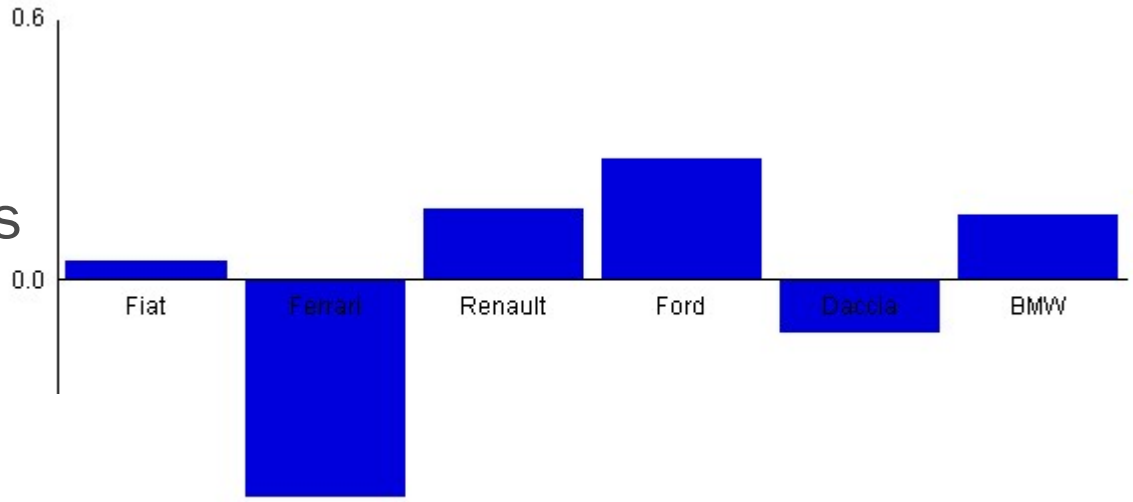
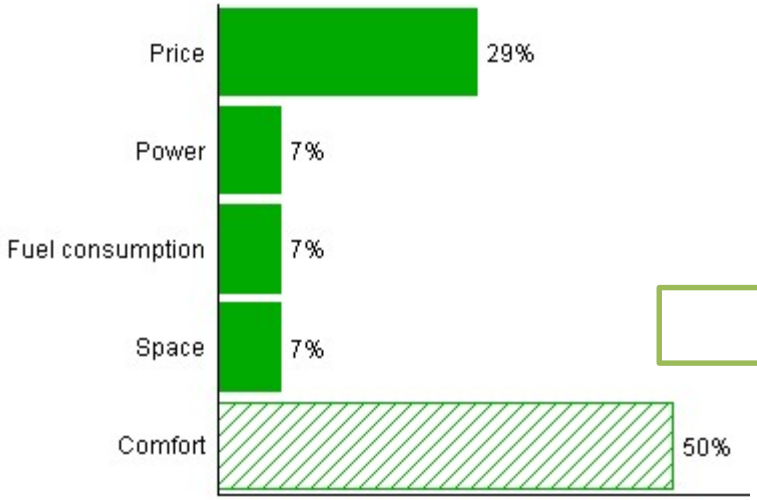



Comfort is the most important parameter

# Tapping scenarios

Country of production

Tapping method

Silviculture

# Country of production – Spatial scale

- Production in 2016
  - France (<0,1 kT/year)
  - Portugal (9 kT/year)
  - Spain (12 kT/year)

# Silviculture

- Silviculture first dedicated to
  - Wood production : the most common in the 3 countries
  - Resin production : interesting for resin production optimization

Stand managed with a silviculture dedicated to wood production, tapped before clearcut

# Tapping method

Pica de corteza
(8 months)

Pica de corteza
(4 months)

Biogemme

# France - Biogemme

Main characteristics:

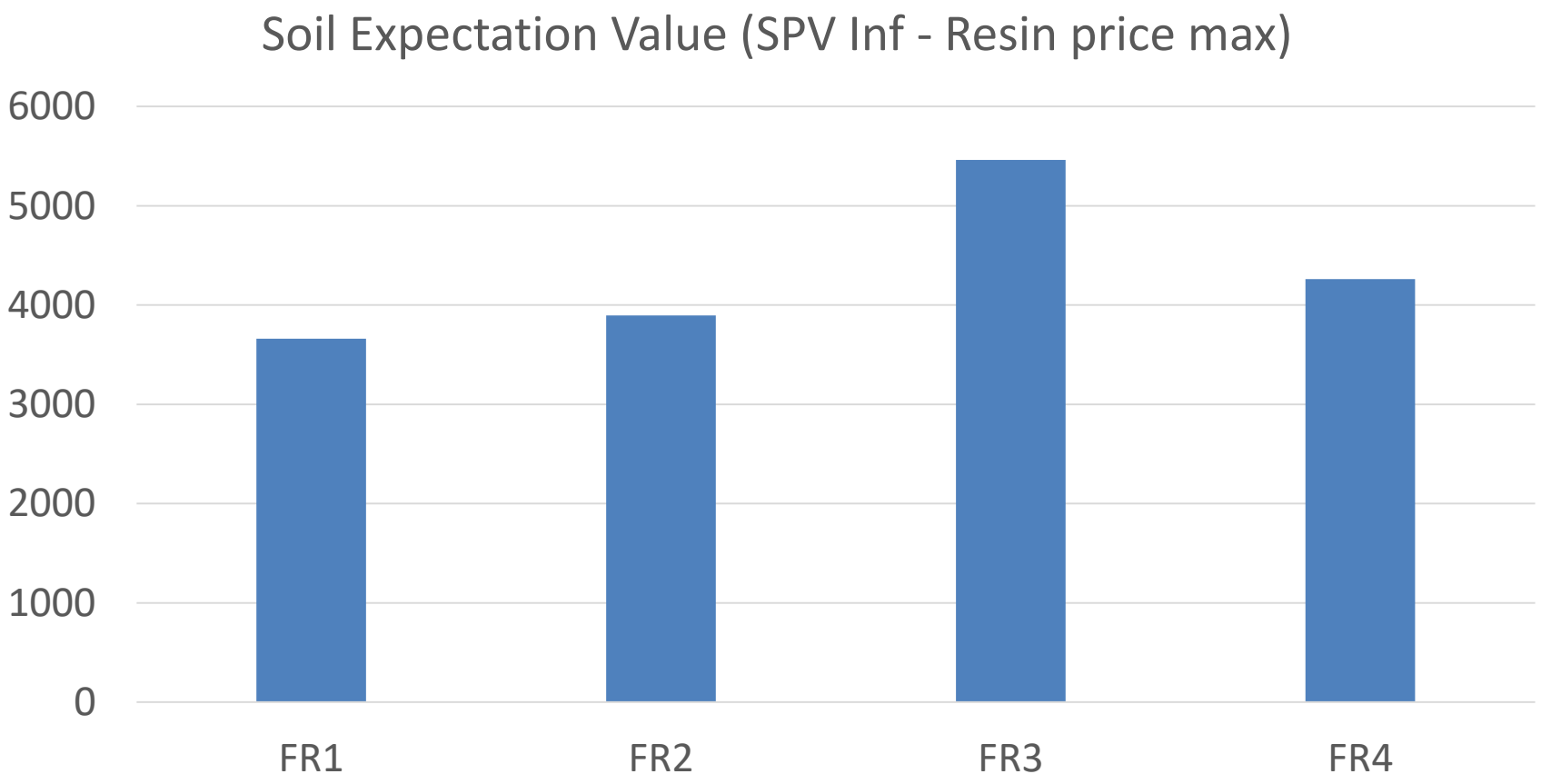
- Trees tapped
  - Tapping from the age of 20 years old (25 cm)
  - Tapping during 4 to 6 years
- Tapping method
  - No bark removal (*desroñar*)
  - 90 cm2 opened at each pass (*chaque pique, cada pica*)
  - Slightly damages the wood
- Activation
  - Alpha-hydroxy acid
- Resin collection
  - Collected in a close environment (*vaso cerrado, vase clos*)
- Tapping tool
  - Mechanized method
- Tapping season
  - Tapping 4 months/year
- Productivity
  - 3,2 kg/tree/year
  - 20,5 kg/h

# Spain & Portugal – Pica de corteza

Main characteristics:

- Trees tapped
  - Tapping to death from 30 years old and to life from 50 years old
  - Tapping during 25 years
- Tapping method
  - Necessity to remove the bark (desroñar)
  - 36 cm2 opened at each pass (*chaque pique, cada pica*)
  - Does not penetrate the wood
- Activation
  - Sulfuric acid
- Resin collection
  - Collected in an open environment (*pots, potes*)
- Tapping tool
  - Manual tapping
- Tapping season
  - Tapping during 8 months (possibility to reduce to 4 months)
- Productivity
  - 2,8 kg/tree/year in Castilla-y-León
  - 13 kg/h in Castilla-y-León

# Cost-benefit analysis



# Tapping systems

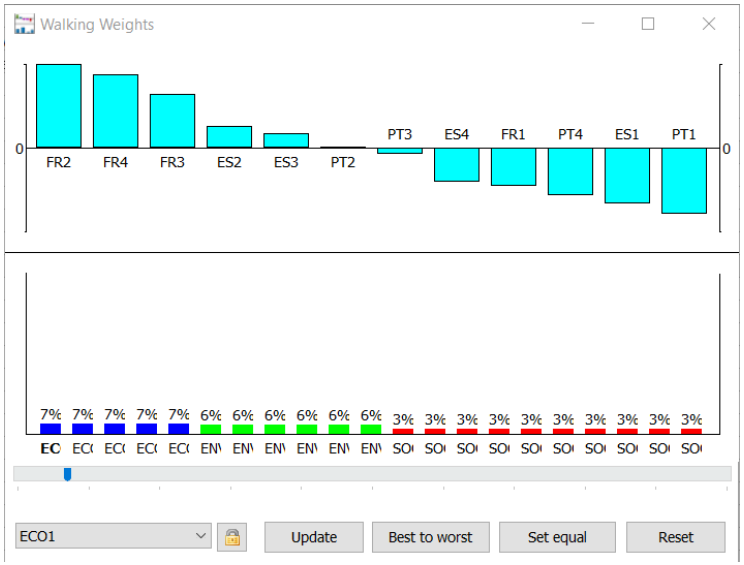
| Escenario | País | Silvicultura | | | | Resinación | | |
|---|---|---|---|---|---|---|---|---|
| | | Tipo de producción principal | Turno (años) | Número de claras | Número de árboles/ha antes de la corta final | Técnica de resinación | Número de meses de resinación por año | Número máximo de años de recolección por árbol |
| FR1 | Francia | Madera | 45 | 4 | 300 | Sin resinar | | |
| FR2 | Francia | Resina | 70 | 7 | 200 | Biogemme | 4 | 5 |
| FR3 | Francia | Resina | 45 | 3 | 180 | Biogemme | 4 | 5 |
| FR4 | Francia | Madera | 45 | 4 | 300 | Biogemme | 4 | 5 |
| ES1 | España | Madera | 70 | 4 | 300 | Sin resinar | | |
| ES2 | España | Resina | 100 | 4 | 180 | Pica de corteza | 4 | 25 |
| ES3 | España | Resina | 100 | 4 | 180 | Pica de corteza | 8 | 25 |
| ES4 | España | Madera | 70 | 4 | 300 | Pica de corteza | 8 | 25 |
| PT1 | Portugal | Madera | 65 | 3 | 300 | Sin resinar | | |
| PT2 | Portugal | Resina | 90 | 3 | 200 | Pica de corteza | 4 | 25 |
| PT3 | Portugal | Resina | 90 | 3 | 200 | Pica de corteza | 8 | 25 |
| PT4 | Portugal | Madera | 65 | 3 | 300 | Pica de corteza | 8 | 25 |

# Indicators

| Criterion | Sustainability objective | Indicator |
|---|---|---|
| **Economy** | Being economically viable | Income for the forest owner |
| | | Impact of tapping on the quality of the wood |
| | | Efficiency of the resinous workforce |
| | Being flexible and adaptable | Product diversification (pulpwood, wood, resin) |
| | | Regularity of annual income during the revolution |
| **Environment** | Sustainable management of forest ecosystems | Vulnerability to storms |
| | | Vulnerability to pathogens |
| | | Vulnerability to fire |
| | | Damage to ecosystems due to the use of chemicals for activation |
| | | Benefits for biodiversity |
| | | Generation of non-renewable waste |
| **Social** | Preserving the quality of life and working conditions of the resin tappers | Remuneration of the tapper |
| | | Arduousness of the work |
| | | Good distribution of work throughout the year |
| | | Jobs creation |
| | | Risk of accidents for the tapper |
| | Responding to the demands of citizens and consumers | Positive perception by the local population |
| | | Positive perception by the tourists |
| | | Contribution to local identity and tradition |
| | | Compatibility with hunting |
| | | Quality of the resin |

# Multi-criterion evaluation

- Main differences between countries
  - France: Economic aspect are fundamental
    - Profitability for private forest owners
    - Efficiency of the resinous workforce
    - Vulnerability to storms
  - Spain: Social criterion are key points
    - Jobs creation
    - Remuneration of the tapper
    - Positive perception by the local population
  - Portugal: Environment
    - Benefits for biodiversity
    - Vulnerability to fire
    - Soil protection
    - Heritage conservation



# Thank you for your attention

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