Multi-criterion analysis
Wood and resin production schemes

Jornadas Internacionales
Proença-a-Nova (Portugal) 29-31 of may 2019
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Resin production in Europe
Variability

Different production systems:

- Gemmage à vie
  (Resinación a vida)
- Gemmage à mort
  (Resinación a muerte)
Economic analysis

Several points of view:

Resin tapper / Forester / Community
Economic analysis

Several points of view:

- **Resin tapper:** According to investments, variable expenses and rental costs, is it profitable?

- **Forester:** Is it profitable to include resin tapping in timber oriented silviculture?

- **Community:** Is resin tapping profitable for the whole community (forest sector, Spain, Europe)?

Profitability analysis
Economic analysis

Several points of view:

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

profitability analysis

Cost-benefit analysis
Economic analysis

Several points of view:

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

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Unit</th>
<th>Objective</th>
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<tbody>
<tr>
<td>Price</td>
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<tr>
<td>Consumption</td>
<td>l/100 km</td>
<td>Minimize</td>
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<td>Power</td>
<td>Kw</td>
<td>Maximize</td>
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<td>Space</td>
<td>5-points</td>
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<td>Comfort</td>
<td>5-points</td>
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PROMETHEE example – Hervé Jactel
An example: Choose a car

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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:
  - Walking weights

Price is the most important parameter.
An example: Choose a car

- Visualization:
  - Walking weights

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
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<td>Price</td>
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<tr>
<td>Fuel consumption</td>
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<td>Space</td>
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<tr>
<td>Comfort</td>
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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
Tapping method

Pica de corteza (8 months)  Pica de corteza (4 months)  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

Soil Expectation Value (SPV Inf - Resin price max)
### Tapping systems

<table>
<thead>
<tr>
<th>Escenario</th>
<th>País</th>
<th>Tipo de producción principal</th>
<th>Turno (años)</th>
<th>Número de claras</th>
<th>Número de árboles/ha antes de la corta final</th>
<th>Técnica de resinación</th>
<th>Número de meses de resinación por año</th>
<th>Número máximo de años de recolección por árbol</th>
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<td>Positive perception by the local population</td>
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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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