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# Forest management and commercial mushroom yields in spruce stands in Eastern Finland

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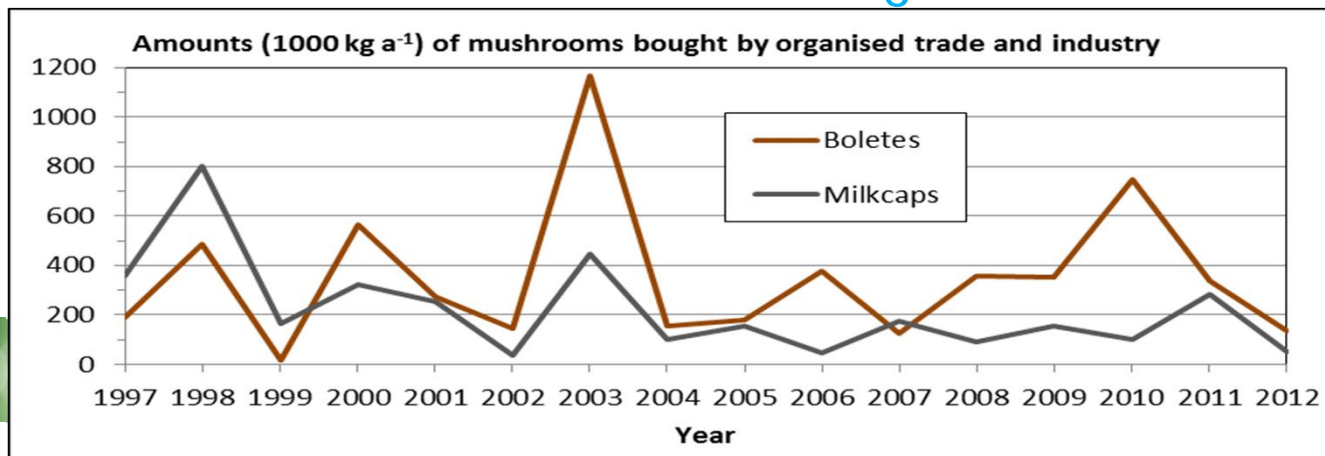
- Background
- Materials
- Commercial mushroom yields
- How forest management affects the yields?
- Conclusions

More information (in Finnish): Miina, J., Kurttila, M. & Salo, K. 2013.  
Kauppasienisadot itäsuomalaisissa kuusikoissa – koealaverkosto ja tuloksia vuosilta  
2010–2012 <http://www.metla.fi/julkaisut/workingpapers/2013/mwp266.htm>

# NWFPs - undervalued and -utilized forest resource

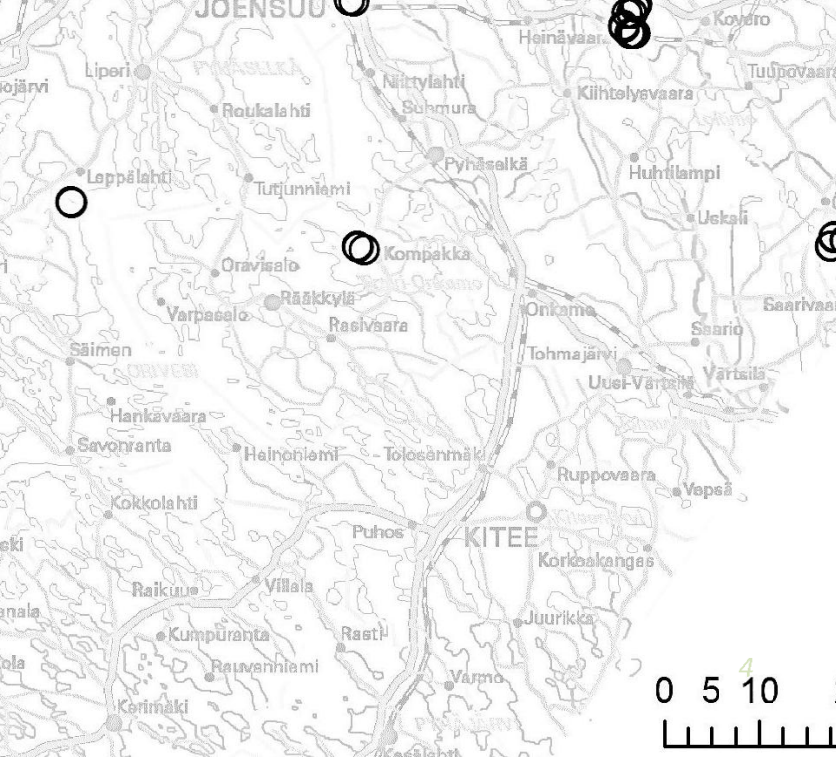
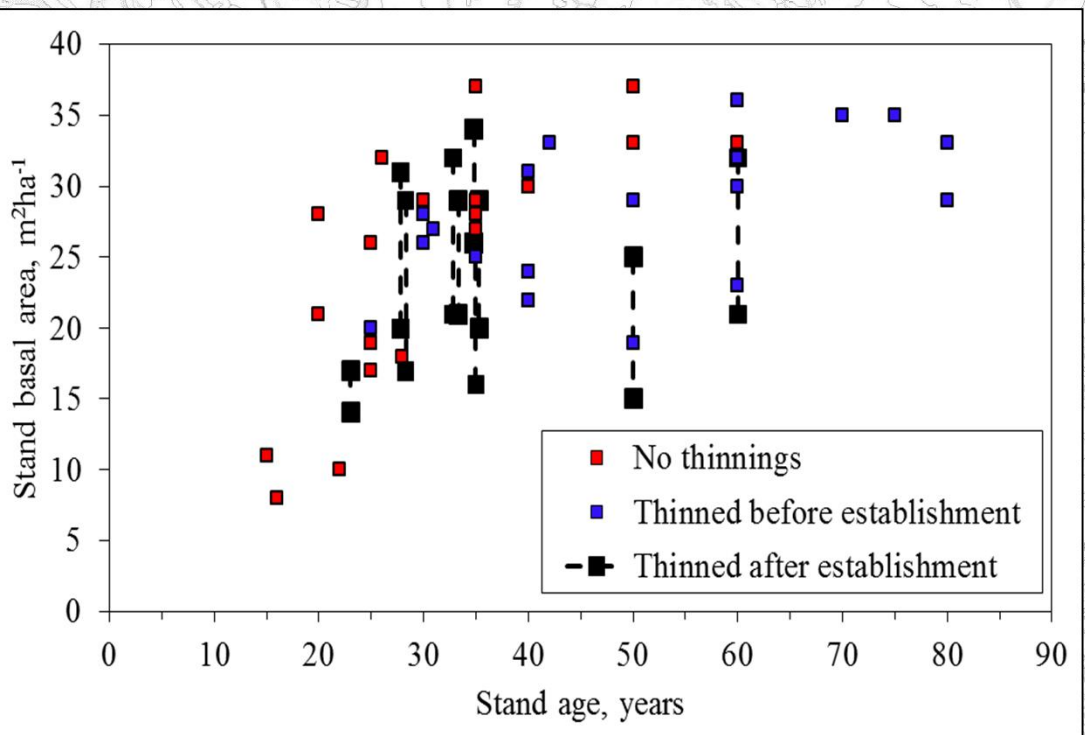
- Huge amounts of commercial mushrooms grows in our forests
  - Less than 1 % of biological yield collected
  - Mushroom species: about 200 edible – 31 listed as "commercial" - about 10 commonly marketed
  - Low value-added: mushrooms exported fresh or frozen
- In Finland, the value of commercial NWFPs) picking (berries and mushrooms) is about 1% of the value of wood from forests
  - However, commercial mushrooms were harvested in the peak year of 2003 about 13.5 mill. kg, value 32.5 mill. €

→ NWFPs not considered in forest management decisions



# Sample plot network in Eastern Finland

- 52 mushroom sample plots (20 x 20 m)
- Mainly in middle-aged, planted spruce stands
- Commercial mushroom yields inventoried during 4 seasons





# Yields (kg/ha/a) of commercial mushrooms

| Mushroom species                  | Mean        | Std dev.    | Min.       | Max.         |
|-----------------------------------|-------------|-------------|------------|--------------|
| <i>Boletus edulis</i>             | 6.1         | 7.4         | 0.0        | 30.0         |
| <i>Suillus variegatus</i>         | 0.1         | 0.3         | 0.0        | 1.8          |
| <i>Leccinum versipelle</i>        | 2.5         | 5.6         | 0.0        | 24.2         |
| <i>Boletus pinophilus</i>         | 0.0         | 0.0         | 0.0        | 0.0          |
| <i>Leccinum vulpinum</i>          | 0.1         | 0.4         | 0.0        | 2.8          |
| <i>Lactarius trivialis</i>        | 8.2         | 10.2        | 0.0        | 55.3         |
| <i>Lactarius rufus</i>            | 8.7         | 23.9        | 0.0        | 170.3        |
| <i>Lactarius torminosus</i>       | 0.4         | 1.1         | 0.0        | 4.2          |
| <i>Russula paludosa</i>           | 2.3         | 6.6         | 0.0        | 35.3         |
| <i>Russula decolorans</i>         | 0.1         | 0.1         | 0.0        | 0.7          |
| <i>Russula claroflava</i>         | 0.2         | 0.6         | 0.0        | 3.8          |
| <i>Russula vinosa</i>             | 1.1         | 2.2         | 0.0        | 14.3         |
| <i>Rozites caperatus</i>          | 0.2         | 0.4         | 0.0        | 2.3          |
| <i>Cantharellus cibarius</i>      | 0.4         | 1.6         | 0.0        | 10.4         |
| <i>Albatrellus ovinus</i>         | 0.0         | 0.2         | 0.0        | 1.7          |
| <i>Craterellus cornucopioides</i> | 0.0         | 0.0         | 0.0        | 0.0          |
| <i>Hygrophorus camarophyllus</i>  | 0.0         | 0.0         | 0.0        | 0.0          |
| <i>Cantharellus tubaeformis</i>   | 0.1         | 0.8         | 0.0        | 5.6          |
| <i>Hydnum repandum</i>            | 0.0         | 0.3         | 0.0        | 2.1          |
| <b>All edible mushrooms</b>       | <b>30.6</b> | <b>27.6</b> | <b>4.0</b> | <b>178.7</b> |

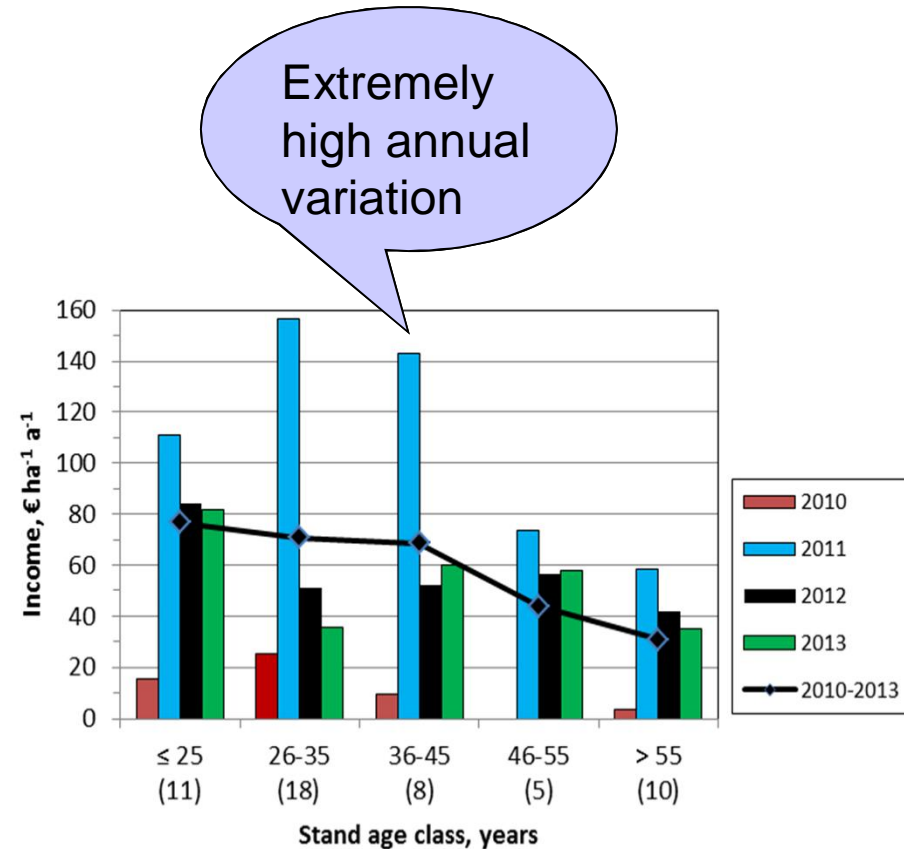
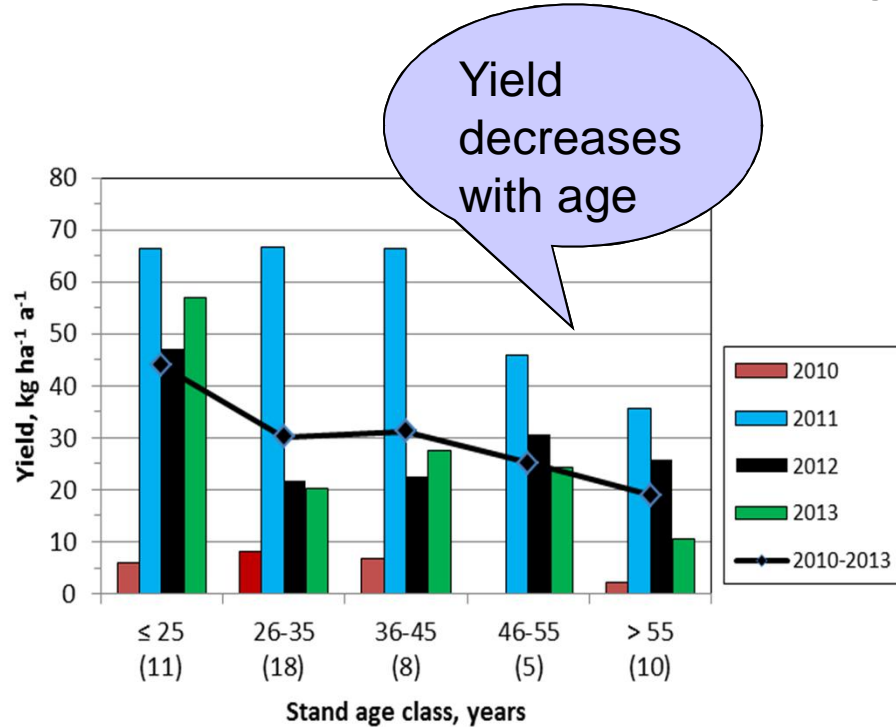
Some stands are extremely good and specialized, some are generalists

# Value (€/ha/a) of commercial mushrooms

Boletus 1/3  
of total value

| Mushroom species            | Mean        | Std dev.    | Min.        | Max.         |
|-----------------------------|-------------|-------------|-------------|--------------|
| <b>Boletus edulis</b>       | <b>22.2</b> | <b>26.7</b> | <b>0.0</b>  | <b>108.8</b> |
| Other boletes               | 3.5         | 7.5         | 0.0         | 32.5         |
| Lactarius trivialis         | 16.3        | 20.2        | 0.0         | 109.6        |
| Other milkcaps              | 11.9        | 31.1        | 0.0         | 221.3        |
| Russulas                    | 4.8         | 9.1         | 0.0         | 47.0         |
| Other edible mushrooms      | 2.7         | 8.7         | 0.0         | 54.5         |
| <b>All edible mushrooms</b> | <b>61.4</b> | <b>48.3</b> | <b>10.4</b> | <b>235.7</b> |

# Mean annual yield and income from the sale of mushrooms by stand age classes



# How about the effects of forest management

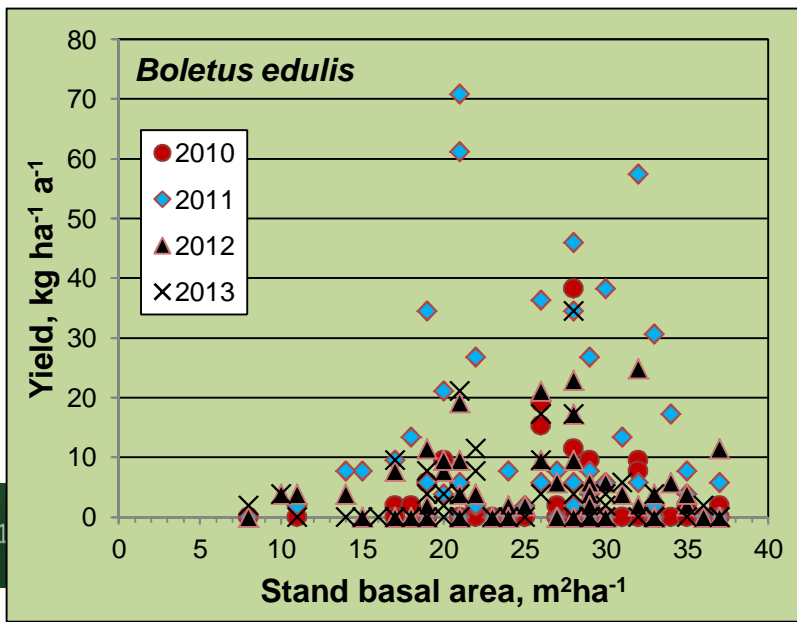
- Different mushroom species have different responses to management operations
- Recommendation: Concentrate efforts on stands that have been identified to be good mushroom forests !

Principle: The total benefit of modified forest management must be  $>$  benefit from timber production oriented management (monetary or utility to forest owner)



# Some advice for management:

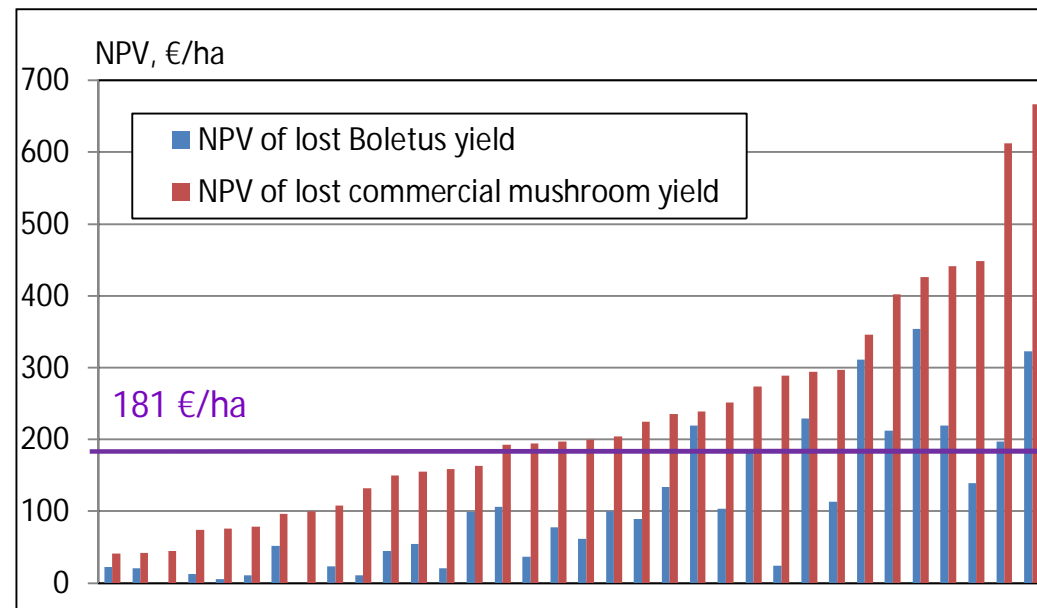
- In very dense spruce stands, lack of water reduces the yields of all mushrooms => thinning beneficial
- However, the most productive stands are at the stage of the first commercial thinning => postpone thinning?
- *Boletus edulis* is not clearly affected by stand basal area; long-term effect of thinning is unknown



# Postponing 1<sup>st</sup> commercial thinning

- Opportunity cost of postponing 1<sup>st</sup> commercial thinning by 10 years vs. discounted value of current average mushroom yield for the next 10 years.
  - Opportunity cost 181 €/ha at 3 % interest rate
- Spruce stand management is flexible

→ Maintaining the average yield for 10 years without thinning is beneficial in almost 2/3 of our sample plots.



# Conclusions

- Spruce stands produce high amounts of commercial mushrooms
  - Forest regeneration for spruce is common – more young spruce stands are achieving the stage of high mushroom production
  - Between-year variation in the yields is a problem for commercial utilization
- Effects of stand characteristics and stand management on the mushroom yields are not (yet) clear
  - Long-term monitoring of experimental plots is needed
  - Not only stand characteristics, but also soil properties, ground vegetation, weather conditions, etc. affect the mushroom yields
- Forest owners have multiple goals – other than timber becoming more important
  - Increasing need to give advice how to manage forests for NWFPs



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Know-how

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*Thank you*