



# IMPACT OF PINE HONEY PRODUCTION ON TIMBER YIELDS AND FOREST MANAGEMENT

Timo Pukkala, Ahmet Yesil & Sergio de Miguel

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# Background

- *Marchalina hellenica* attacks *Pinus brutia*
- BAD:
  - ▣ Tree growth is reduced
- GOOD:
  - ▣ *Marchalina hellenica* exudates honeydew
  - ▣ Bees utilize honeydew to make pine honey
- Forest landowner loses income from timber sales
- Beekeepers benefit
- Conflicts when beekeeper  $\neq$  landowner



# Objectives



Find:

- Effect of honey production on timber yields
- Timber and honey benefits
- Optimal management with and without  
beekeeping

# Methods

- Arborex simulator
  - ▣ Calculates stand development under a given management schedule
  - ▣ Uses individual-tree growth models
- Honey-things added to Arborex
  - ▣ Effect of *Marchalina hellenica* on tree growth
- Linked with an optimization routine
  - ▣ Finds the management schedule which maximizes
    - Timber benefit (= NPV from timber production)
    - Total benefit (= NPV from timber and honey)



Let grow



Thin

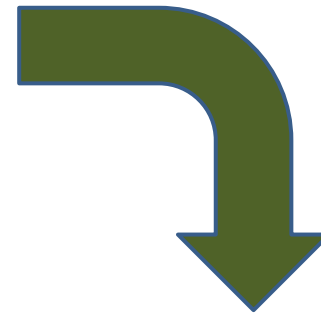
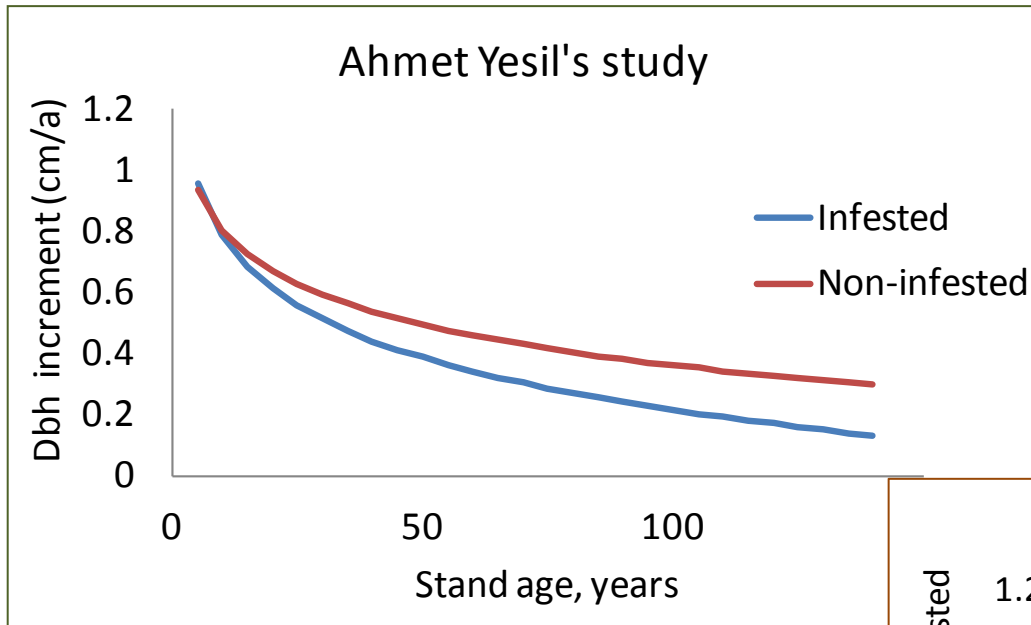


Let grow



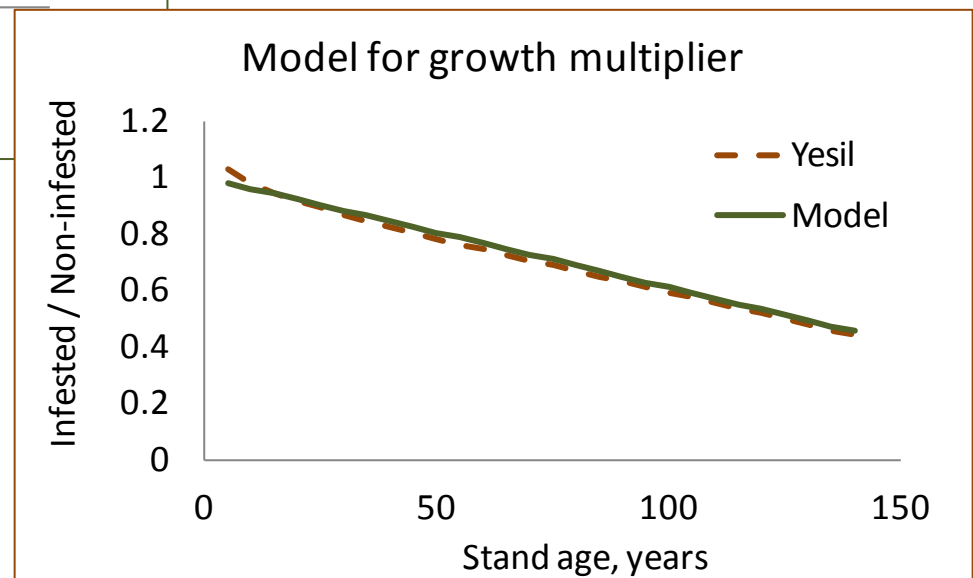
Clearcut

# Effect of *M. hellenica* on tree growth



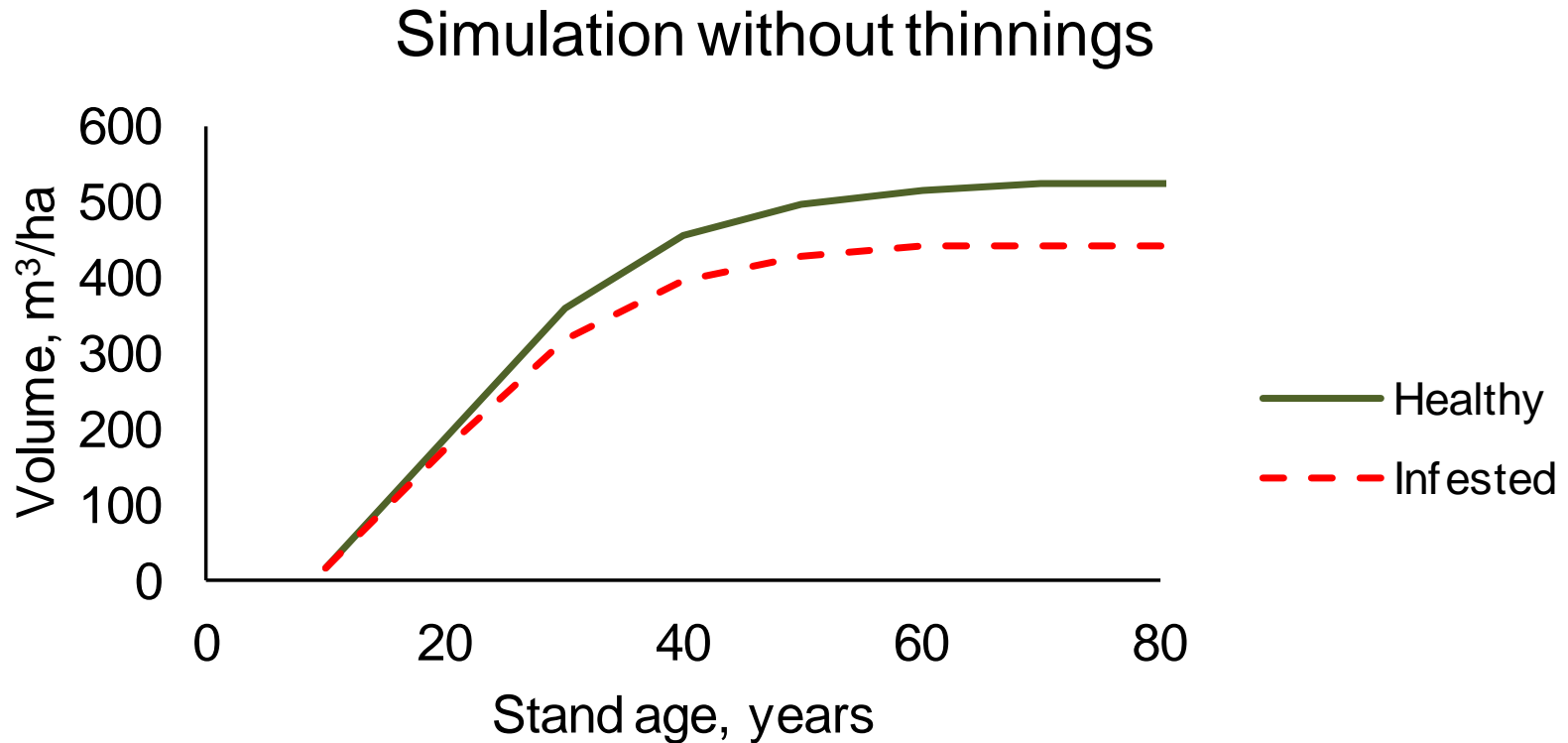
Multiplier applied to diameter and height increment

Site index adjusted after every 5-year time step





# Effect of *M. hellenica* on tree growth



# Economic parameters

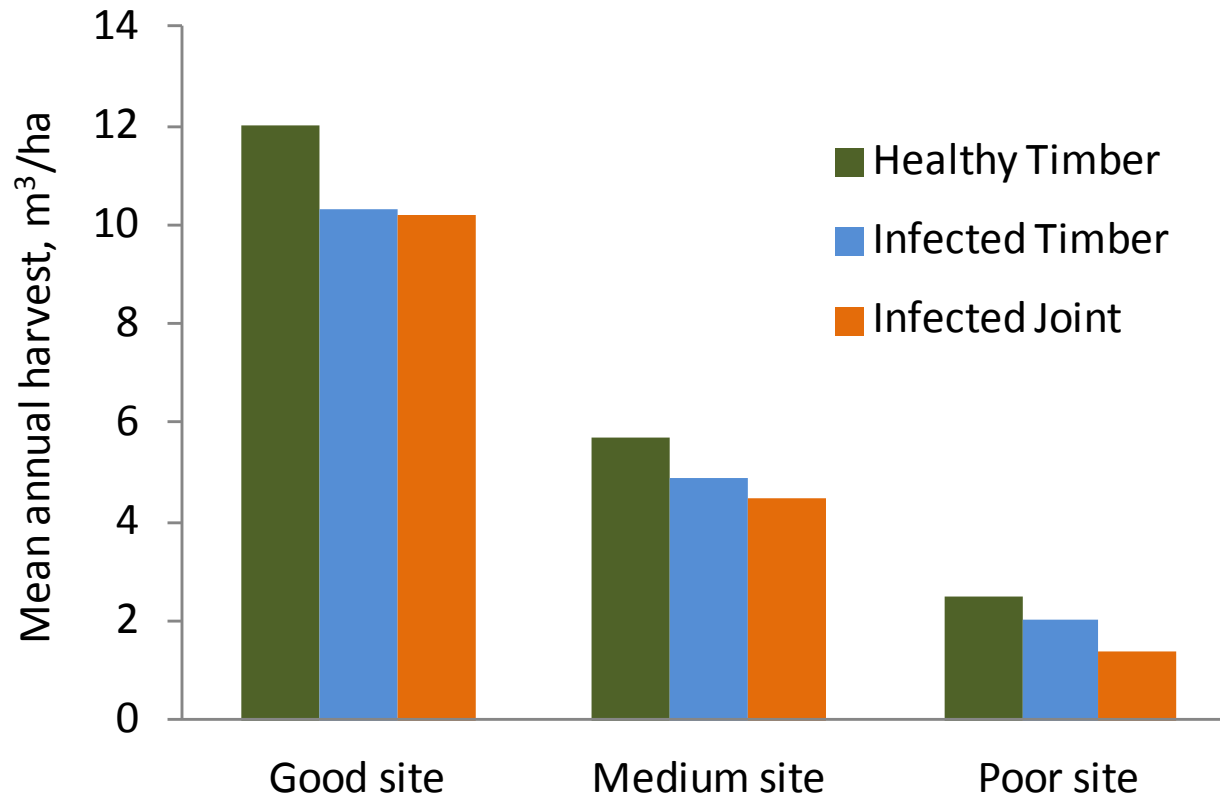
## Stumpage prices of timber

- Grade 1 top diameter 19 cm: 90 \$/m<sup>3</sup>
- Grade 2 top diameter 8 cm: 45 \$/m<sup>3</sup>
- Grade 3 top diameter 4 cm: 10 \$/m<sup>3</sup>

## Honey

- Yield 60 kg/ha, cost 2 \$/kg, price 7\$/kg
- Beekeeping begins at 35 years

# Effect on timber yields



Healthy Timber = Healthy stand, timber benefit maximized  
Infected Timber = Infected stand, timber benefit maximized  
Infected Joint = Infected stand, total benefit maximized

# Timber and honey benefits

	Healthy Max Timber NPV	Infested Max Timber NPV	Infested Max Total NPV
Good site			
- Timber NPV	14272	11363	11217
- honey NPV	0	0	1388
- total NPV	<b>14272</b>	<b>11363</b>	<b>12605</b>
Medium site			
- timber NPV	4688	3374	3040
- honey NPV	0	0	2616
- total NPV	<b>4688</b>	<b>3374</b>	<b>5656</b>
Poor site			
- timber NPV	802	441	3
- honey NPV	0	0	3562
- total NPV	<b>802</b>	<b>441</b>	<b>3565</b>

# Effect on management



Optimal rotation length is longer in  
joint production than in timber production

Assumed that annual honey yield is constant: 60 kg/ha

This assumption is called **Baseline**

How about if honey yield depends on site ?

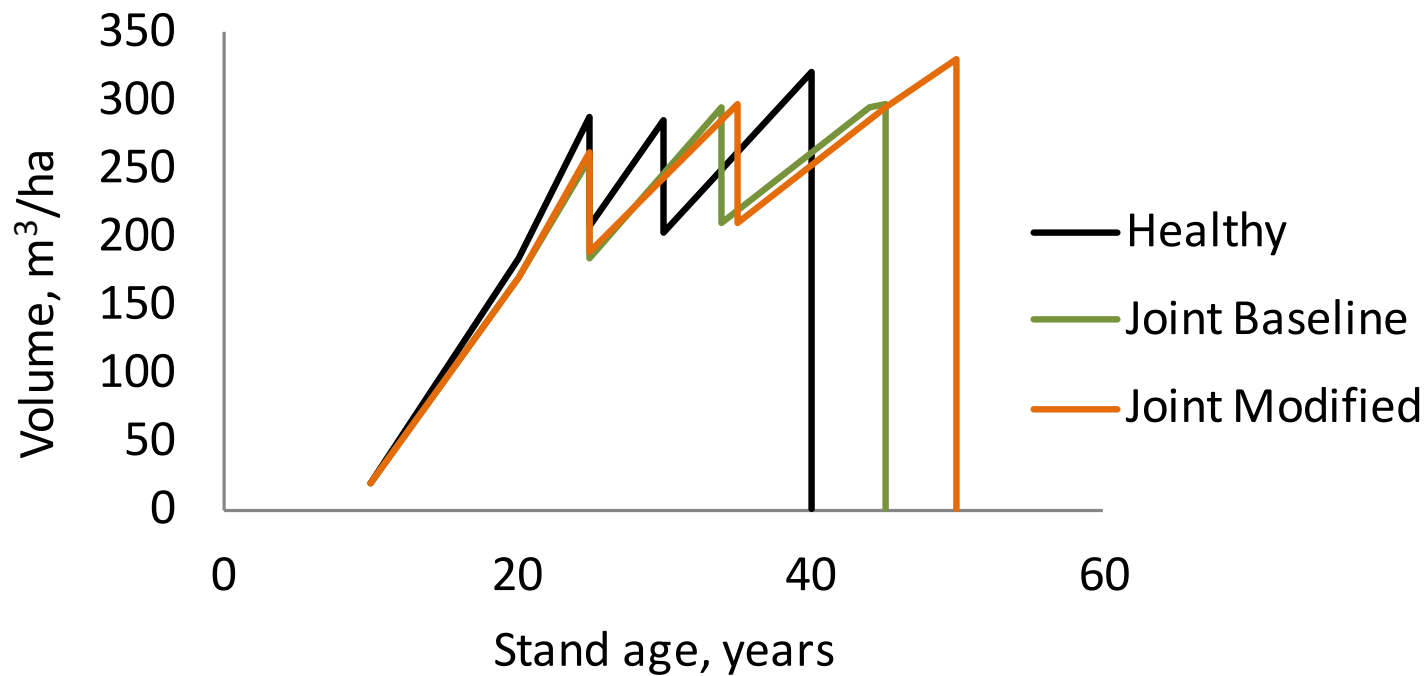
Good site: 90 kg/ha

Medium site 60 kg/ha

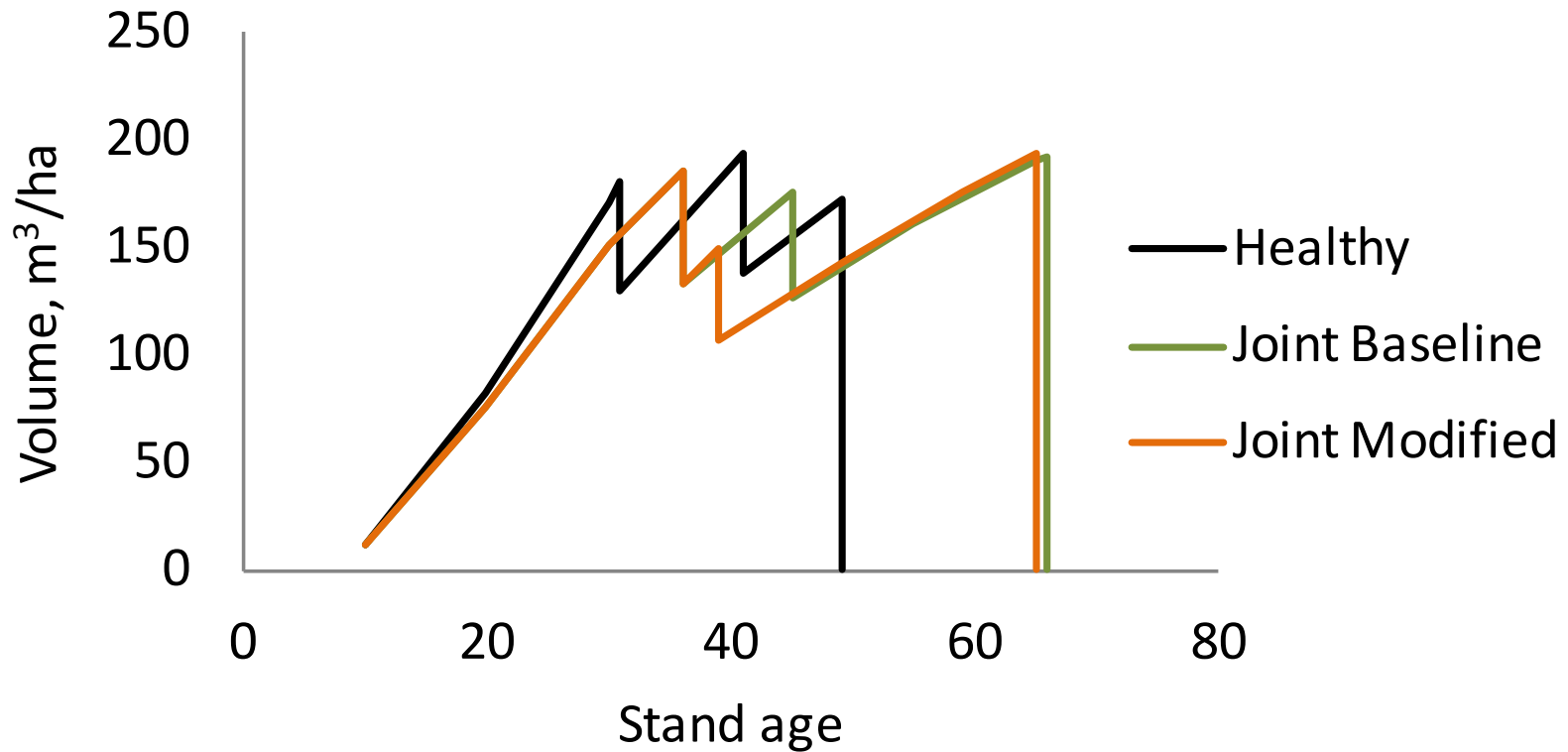
Poor site 30 kg/ha

This assumption is called **Modified**

# Optimal management, good site

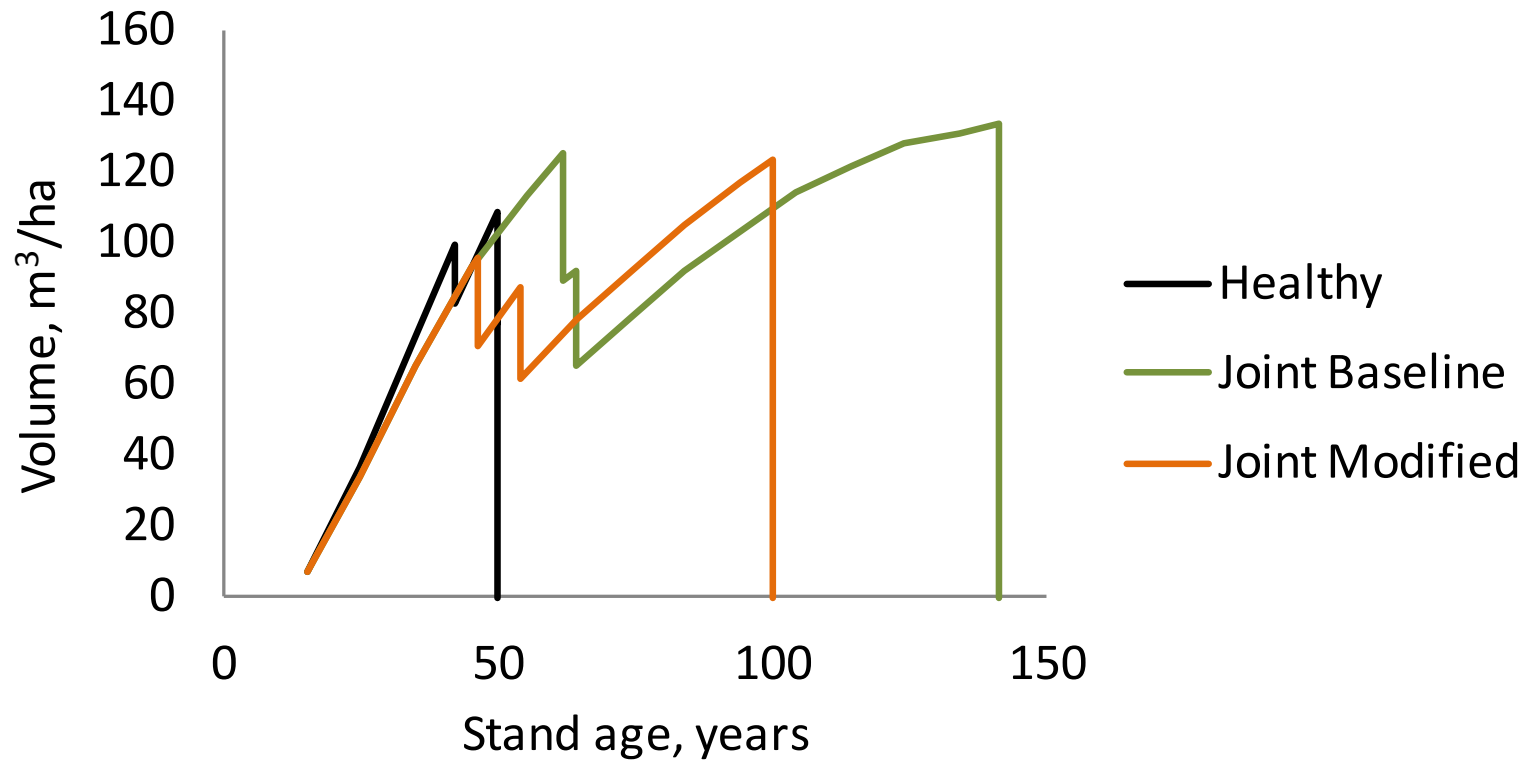


# Optimal management, medium site





# Optimal management, poor site



# Conclusions

## *Marchalina hellenica* infestation

- Decreases timber yields by 14 – 20 %

## Infestation and beekeeping

- Decrease total benefits on the best sites
- Increase total benefits on medium and poor sites
- Increase optimal rotation length
- Effects are biggest on poor sites



# Teşekkürler !

(Pronunciation: te-shek-kewr-lehr)

If you have any questions,  
please ask Ahmet Yeşil