

# Invasive forest pests in Iceland



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# Lecture outline

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- Introduction – trees and shrubs in Iceland
- Arthropod herbivores on trees and shrubs in Iceland
- Effect of climate change on introduction of arthropod herbivores
- Effect of introduced arthropod herbivores on trees and shrubs in Iceland
- Mitigation
- Conclusions

# Introduction – trees and shrubs in Iceland

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- Downy birch is the only native forest forming species in Iceland and covered about 25-30% of the land area when Iceland was settled. Presently it covers 1.5%.
- Tea-leaved willow, woolly willow and dwarf birch often form shrubland.
- Rowan is common as single tree in birch woodlands, whereas aspen is only found in a few places.
- Other woody species are: Arctic willow, juniper, burnet rose and glaucous dog rose.

# Introduction – cont.

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- Successful planting of exotic tree and shrub species in Iceland started by the end of the 19th Century.
- 150 new tree and shrub species have been tried by the Icelandic Forestry Service alone.
- 0.5 % of Iceland are covered by exotic tree species, 3-4 million seedlings are planted annually.
- The most important exotic species in forestry are: Siberian larch, sitka spruce, lodgepole pine and black cottonwood.

# Introduction – cont.

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Afforestation in Iceland serves many purposes:

- Build up of future forest resources
- Soil and water protection
- Amenity
- Restoration of degraded ecosystems
- Carbon sequestration for mitigation of climate change

Introduced pest species are a significant threat to all this

# Herbivores on trees and shrubs in Iceland

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In total 52 native insect species are known to feed on trees and shrubs in Iceland

Presently, 28 exotic insect and one mite species, feeding on trees and shrubs, have become permanently established

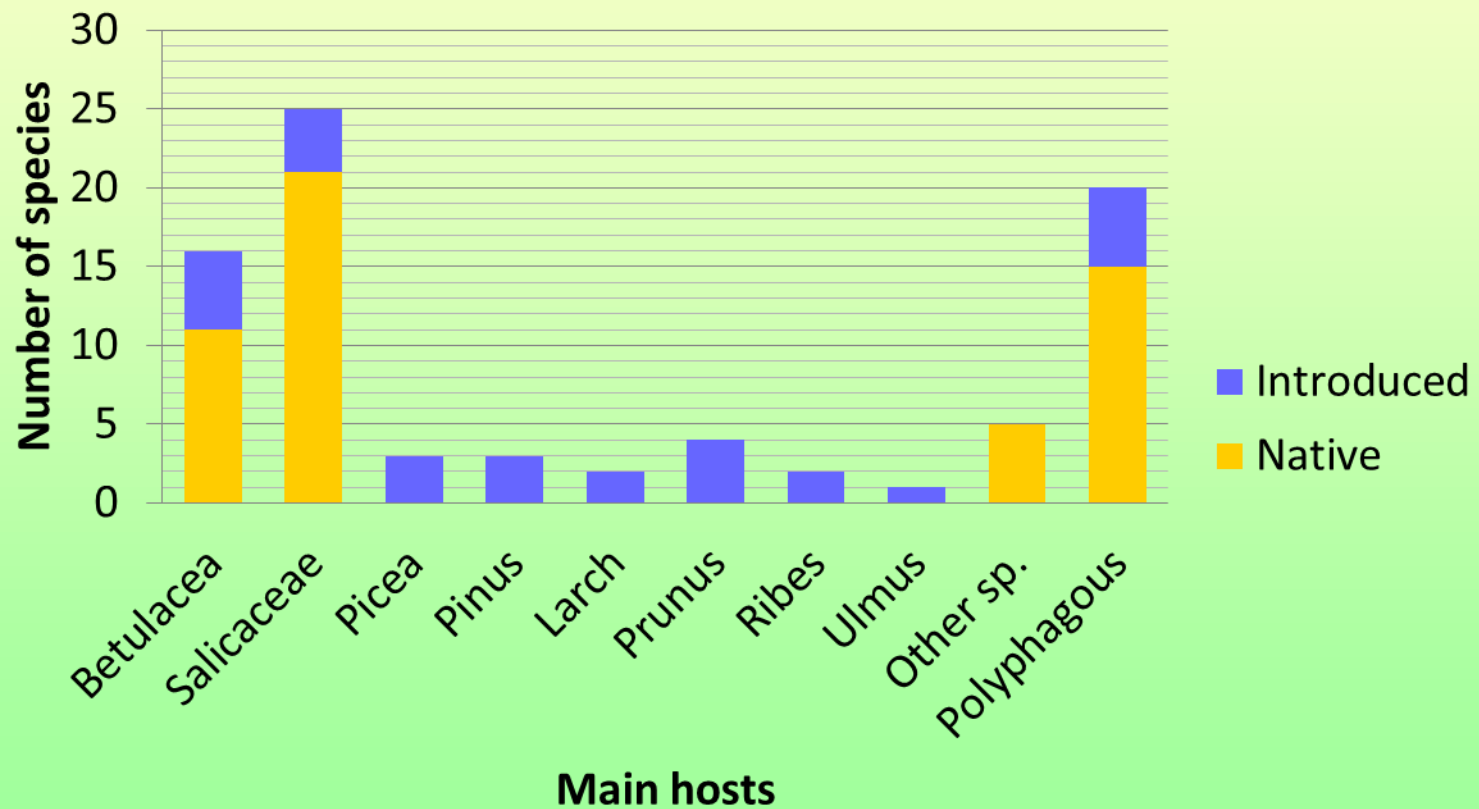
Willows are the main hosts of 25 insect species; 21 native and 4 introduced species

Birch is the main hosts of 16 insect species; 11 native and 5 introduced species

Exotic tree species host 1-4 species each, all introduced

Polyphagous species are 20; 15 native and 5 introduced

# Main hosts of forest pests in Iceland



# Introduced herbivores on trees and shrubs

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The first new forest insect pests in Iceland was *Epinotia solandriana*, first recorded in 1907

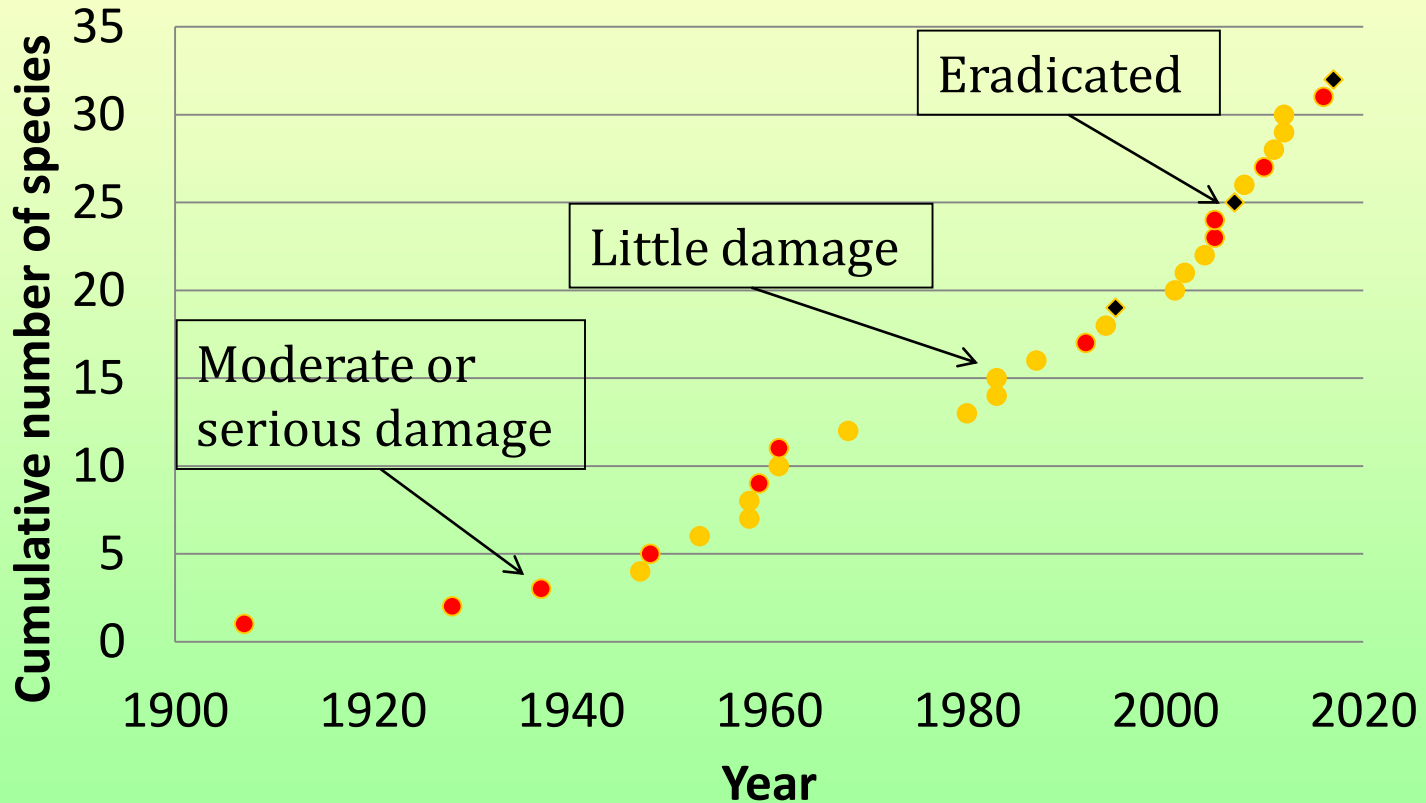
The rate of introduction of new forest pests was low until the middle of the 20th Century

The rate of introduction has been fastest since around 1990, which coincides with increasing mean annual temperature in Iceland

Presently, 29 forest arthropod pests have become established in Iceland, many of them cause significant damage



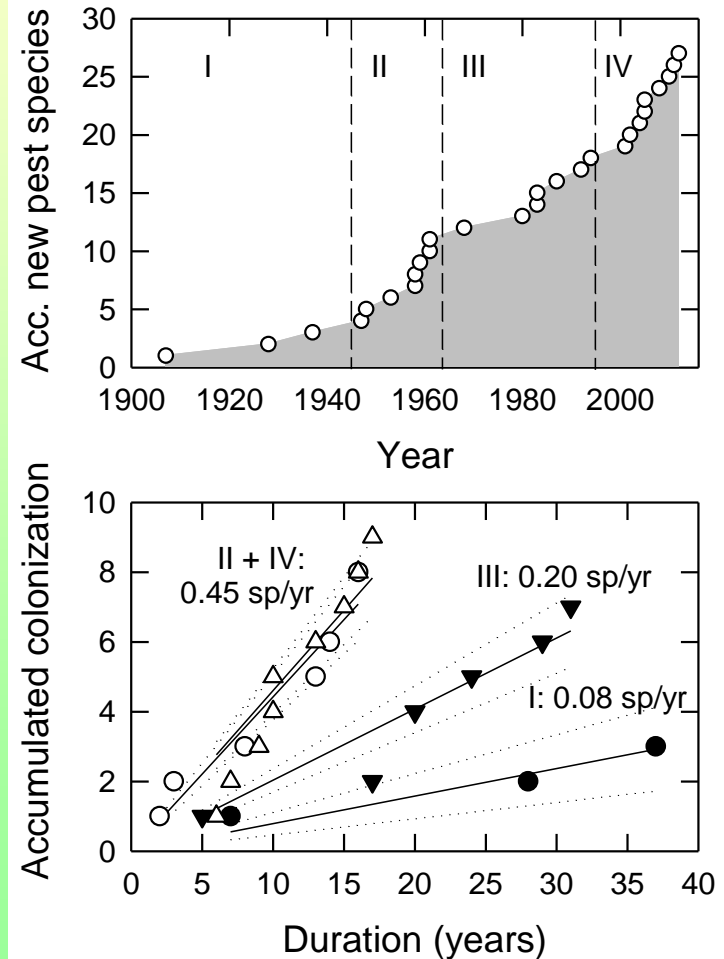
# Introduced herbivores on trees and shrubs



# Introduction of new pest species

Introduction of new forest pest species in Iceland seems to be linked to climate warming

The rate of colonisation of new species until 2013 was found to be greatest during warm periods (II and IV)



# Introd. herbiv. on trees and shrubs, cont.

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Four of the introduced herbivores on trees and shrubs have caused serious damage

- *Epinotia solandriana* is presently the most damaging pest in birch woodlands
- The winter moth contributes to defoliation of birch and willows and tree death
- The pine woolly aphid caused extensive dieback of Scots pine during the 1950s and 1960s
- The green spruce aphid causes extensive defoliation of sitka spruce and can cause tree death

# Introd. herbiv. on trees and shrubs, cont.

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Seven species have caused moderate damage

- *Oligonychus ununguis* on Norway spruce
- *Schizoneura ulmi* on elm
- *Zeiraphera grisana* on lodgepole pine
- *Heringocrania unimaculella* on birch
- *Phratora vitellinae* on poplars and willows
- *Nematus ribesii* on ribes
- *Scolioneura betuleti* on birch

# Effects of new forest pests

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The effect of new forest pests can be very serious.

The pine woolly aphid caused extensive dieback of Scots pine during the 1950s and 1960s.

All the most serious insect pests on birch in Iceland are introduced.

- *E. solandriana* has for a long time been the most serious insect pest on birch
- *H. unimaculella* and *Scolioneura betuleti*, are presently spreading fast and have caused considerable damage on birch

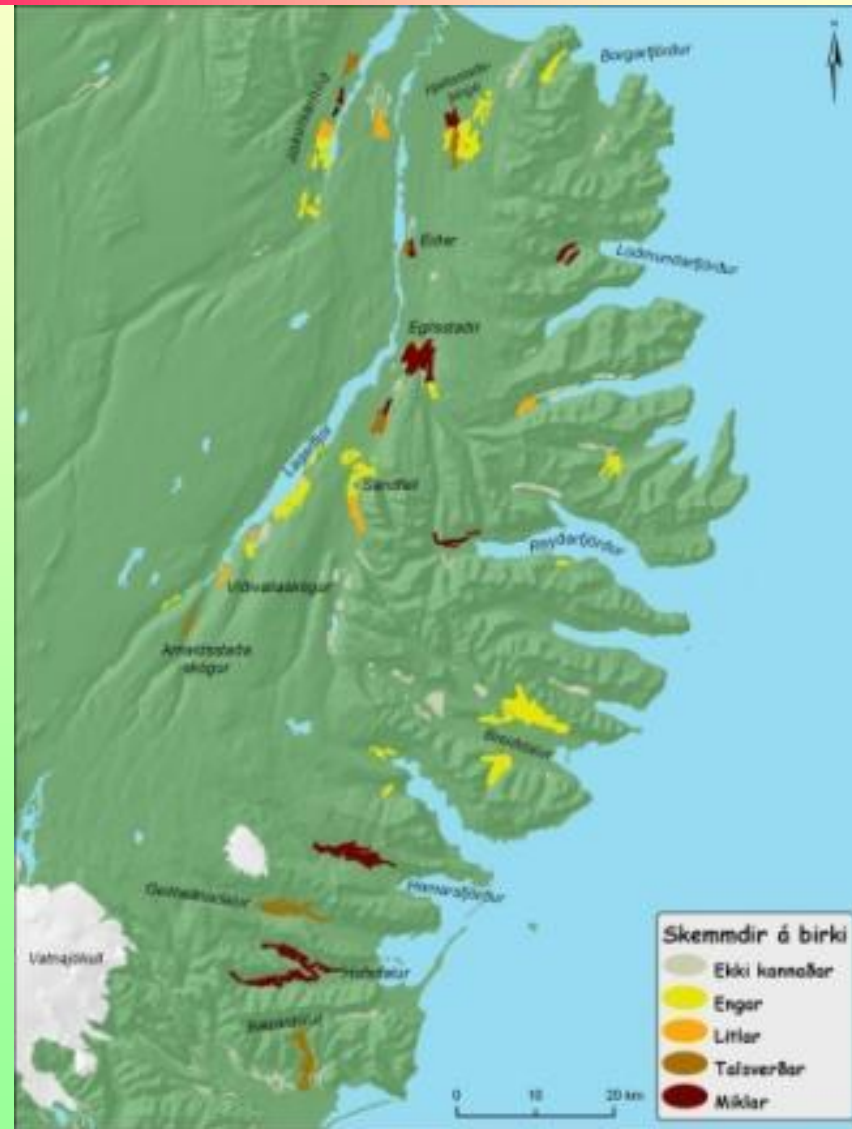
# Outbreaks in birch

During 1998-2005 there were extensive outbreaks in birch in East and Northeast Iceland

Brown areas on the map show the most damaged woodlands

Defoliation was mainly caused by the introduced *E. solandriana*

Significant tree death occurred after the outbreaks



# The pine woolly aphid

Almost eradicated all Scots pine in Iceland

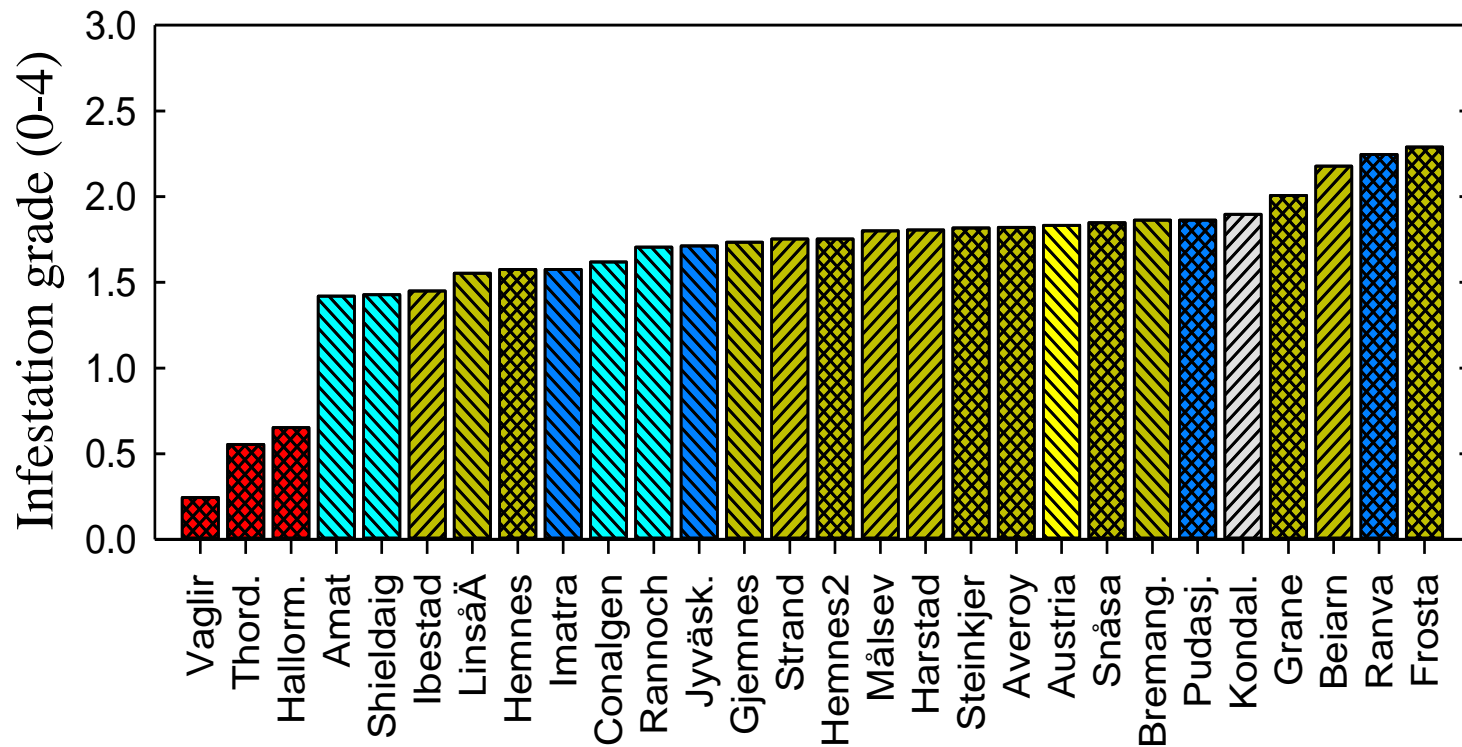
Distribution facilitated by extensive import of Scots pine seedlings

Seeds from surviving trees were collected and a trial established in 2004-6 with:

- 3 Icelandic provenances
- 27 foreign provenances



# *P. pini* infestation on different Scots pine provenances





# Mitigation

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In order to reduce the danger of introducing new forest pests a regulation on import and export of plant material was issued by the Ministry of Agriculture in 1990.

This regulation prohibited the import of seedlings of all species of:

- elm, birch, pine, spruce, larch, willows and poplars

- as well as import of seedlings of all conifer species outside Europe.

Furthermore, the regulation specified a quarantine list of harmful organisms which may not be found on imported plant material.

# Mitigation cont.

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This regulation has clearly not been able to stop the increasing flow of new forest pest species, due to:

- Lack of manpower inspecting imported goods (one person)

- Loopholes in the regulation – soil on other imported plants

- Increased import of other plant material

- Vastly increased tourism

Lack of surveillance of new forest pest and mitigation strategies is also of high concern

# Conclusions

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We need to:

- analyse the threat towards Icelandic forestry
- improve our methods of intercepting new pests
- improve our methods eradication and mitigation of new pests
- breed resistant plant material for use in forestry
- avoid monocultures and develop more self sustainable forestry



Thank you for  
your attention