

A photograph of a forest landscape. In the foreground, several tall, dark tree trunks stand vertically. The ground is covered with green moss and some fallen branches. In the middle ground, there's a body of water reflecting the sky. The background shows more forested hills under a clear blue sky.

Mixed forest or monoculture: *A question of definition exemplified by data from the Swedish National Forest Inventory (NFI)*

Dr Jonas Fridman

Swedish NFI

SLU

KSLA 130531

Topics

- How can we define a monoculture or a mixed forest type?
- How can we define different forest types?
- Examples on how the Swedish forest area distributed between forest types depends on the definitions applied

Mixed forest or monoculture?

- If not monoculture, then mixed forest?
 - *In general, yes!*
- Monoculture in terms of distinct species or groups?
 - *Pinus sylvestris forest*
 - *Pinus mugo forest*
 - *Pinus sp. forest*
 - *Larix sp. forest*
 - *Pinus contorta forest*
- In the NFI: Forest types “large enough” or of special interest
 - Pine Forest (P. Sylvestris, P. Mugo, P sp., Larix sp.)
 - Lodgepole Pine forest (P. Contorta)
- Depending on the in-data!

Definitions

- To estimate the area of monoculture or mixed forests we have to decide:
 1. The scale, i.e. the reference area, e.g. what radius of plots, area of the stand, landscapes, etc.

Scale or Area of reference

- Sample plots
- Stands
- Entire landscapes

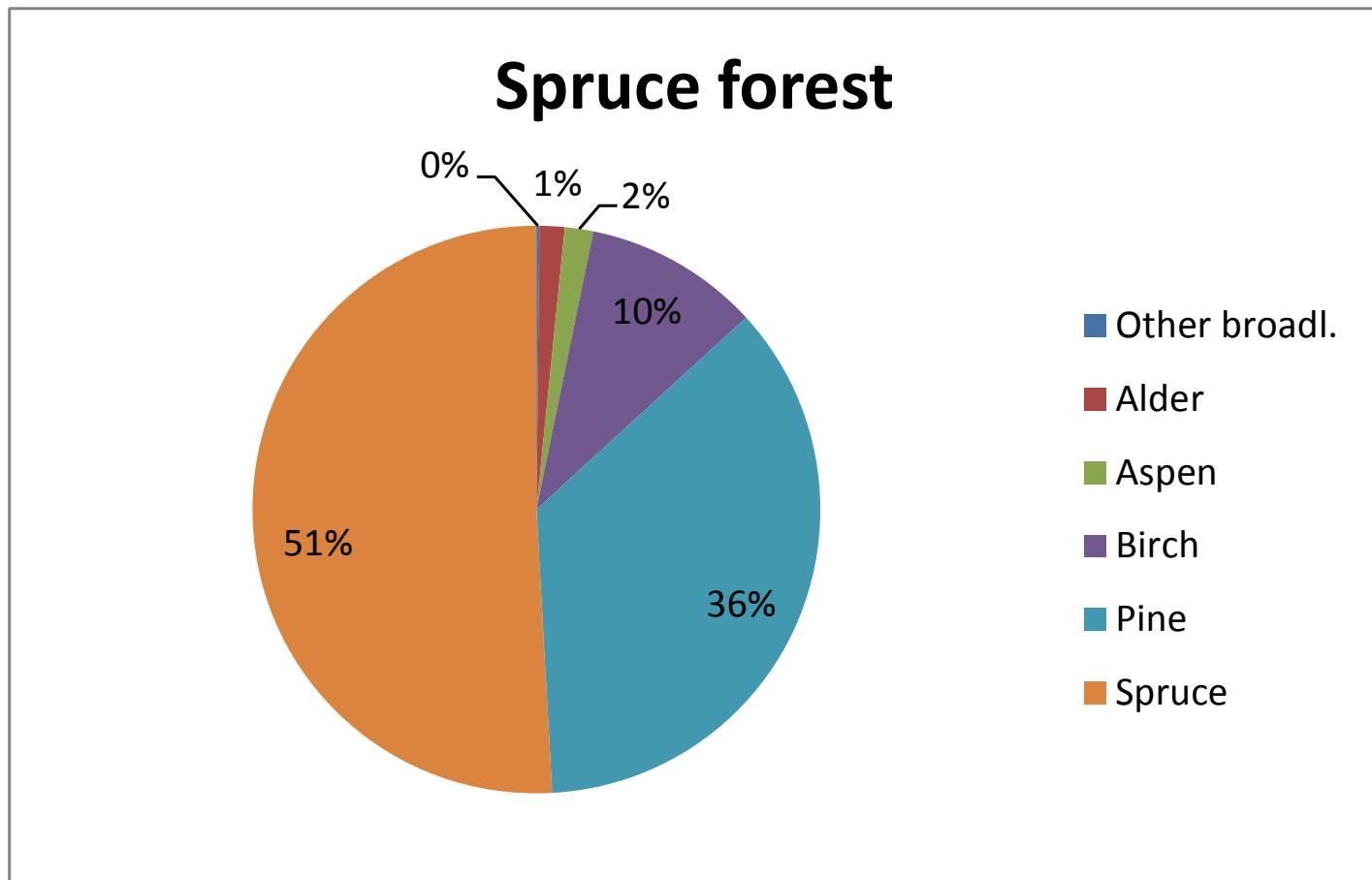


Definitions

- To assess the area of monoculture forests we have to define
 1. The scale, i.e. the reference area, e.g. what radius of plots, area of the stand, landscapes, etc.
 2. At what proportion is a single tree species/group of species deemed dominant and therefore could be defined as a forest type, e.g. 50%, 65% or 100% ?

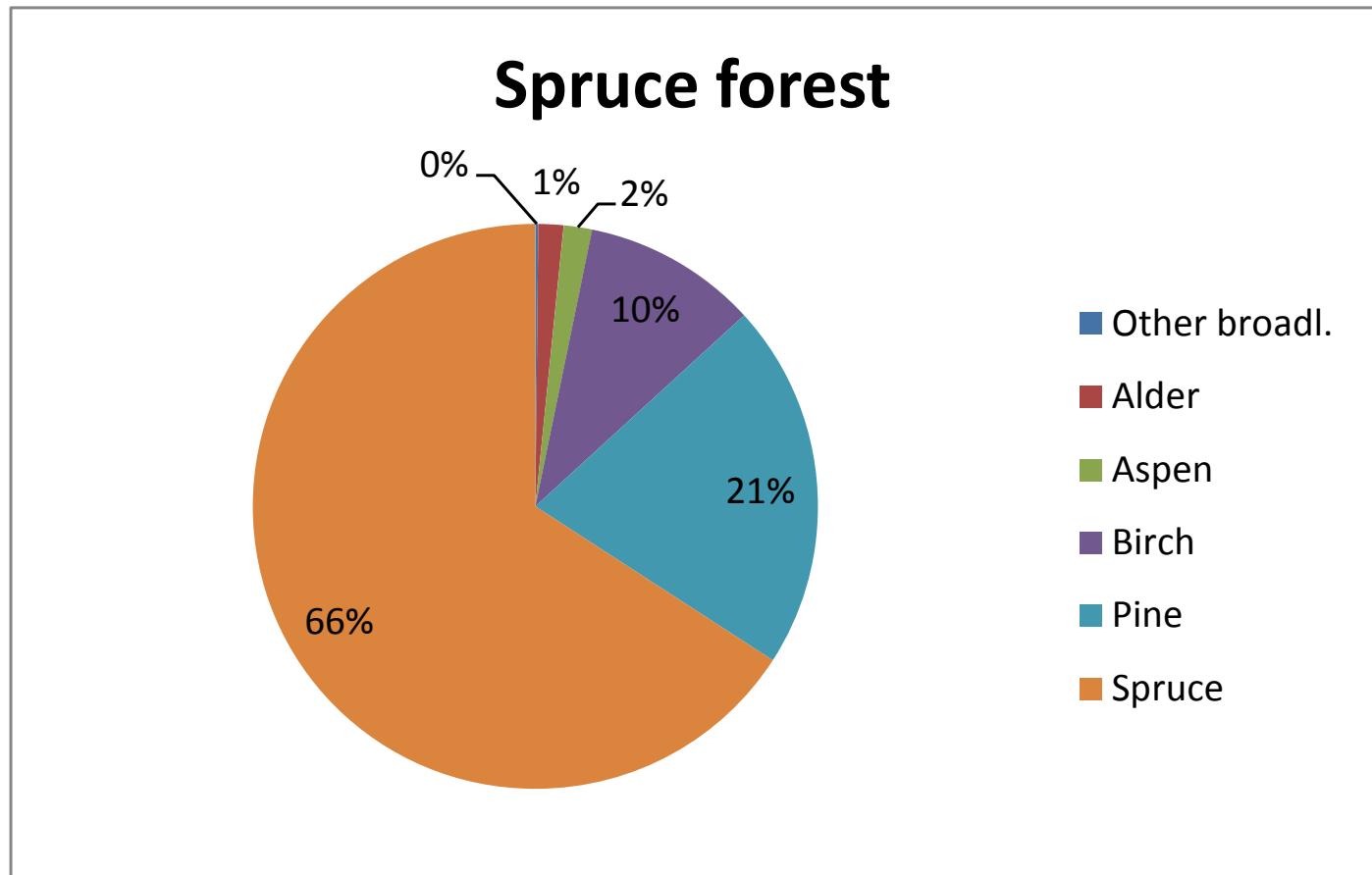
Threshold for a dominant species

>50%



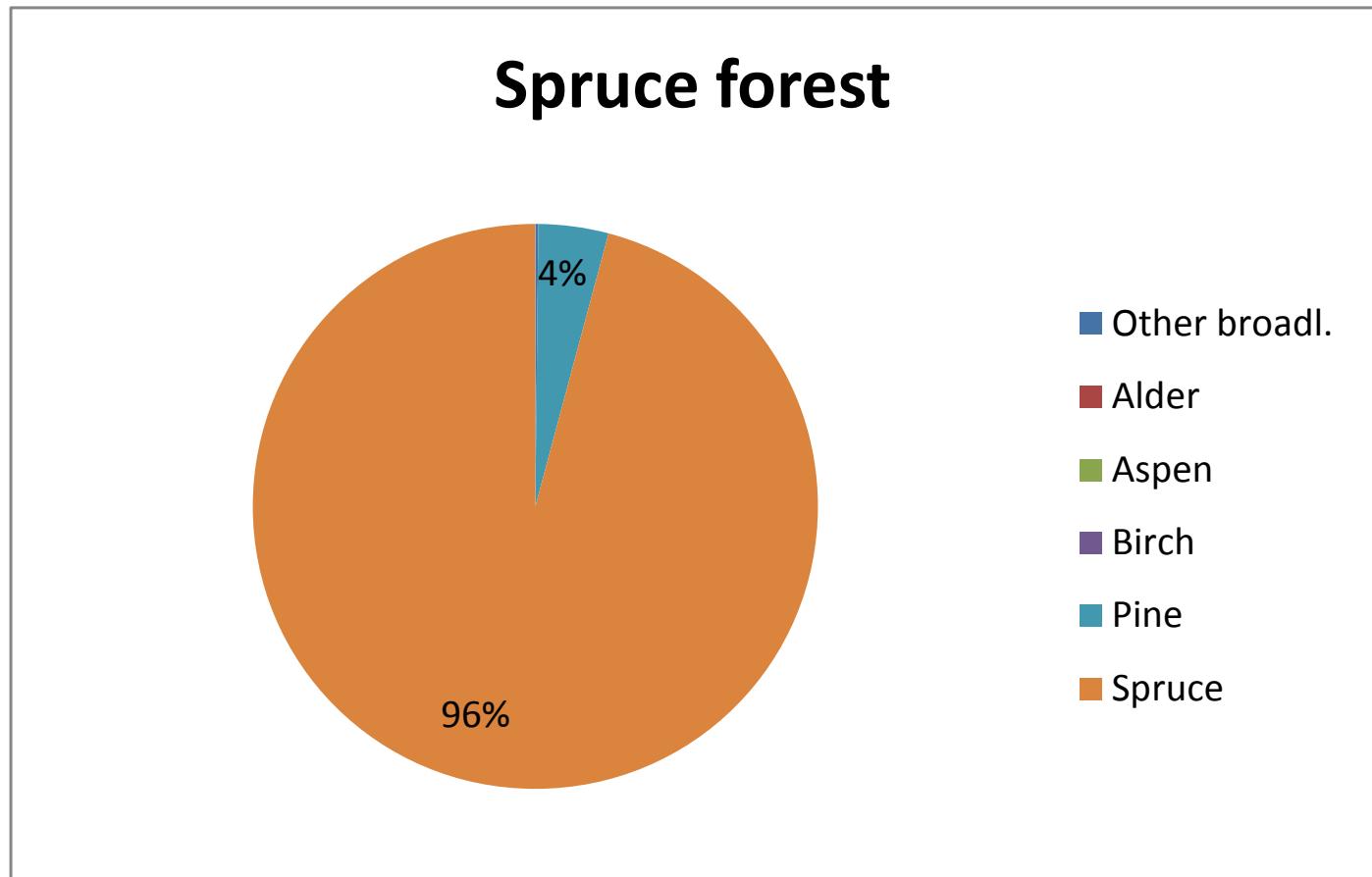
Threshold for a dominant species

>65%



Threshold for a dominant species

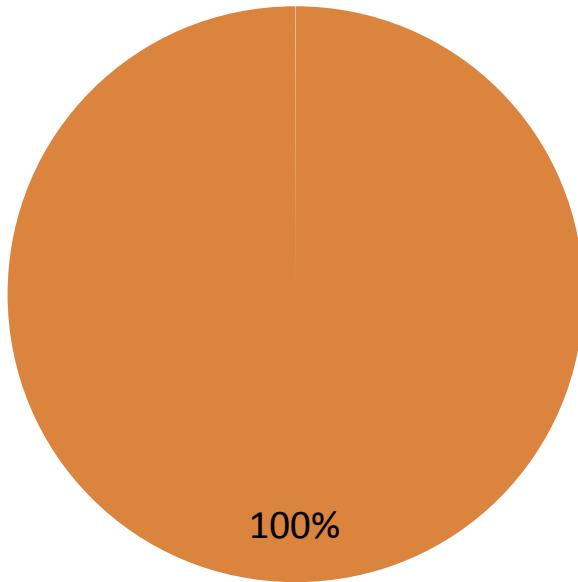
>95%



Threshold for a dominant species

100%

Spruce forest

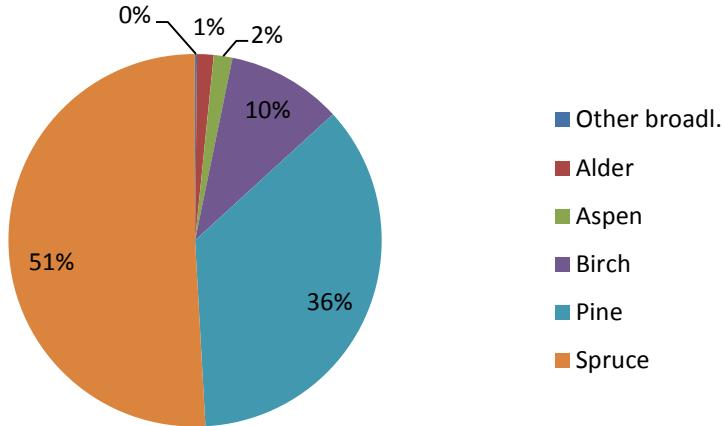


- Other broadl.
- Alder
- Aspen
- Birch
- Pine
- Spruce

Examples of very different Spruce forests in relation to species composition

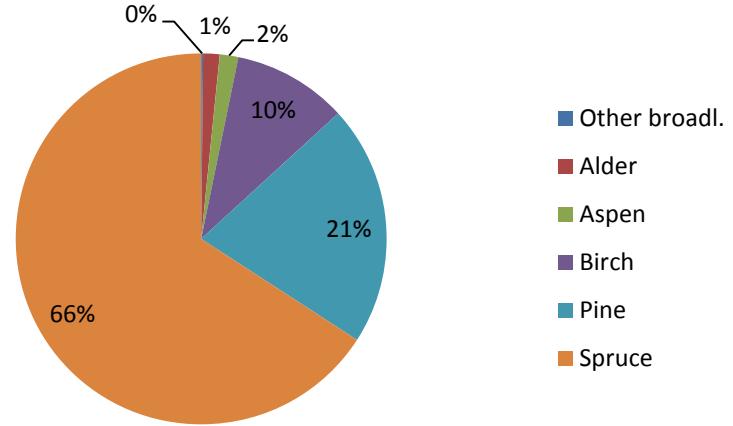
>50%

Spruce forest



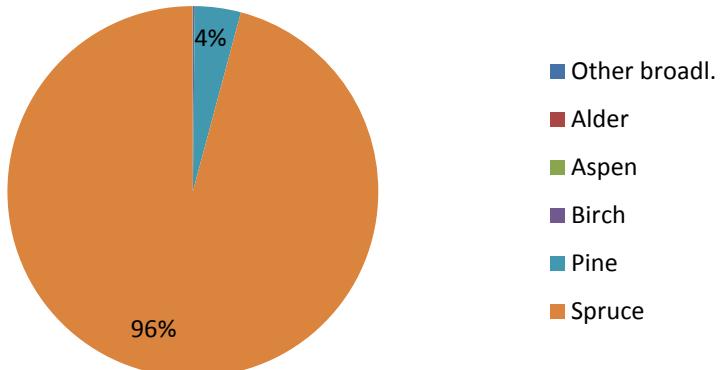
>65%

Spruce forest



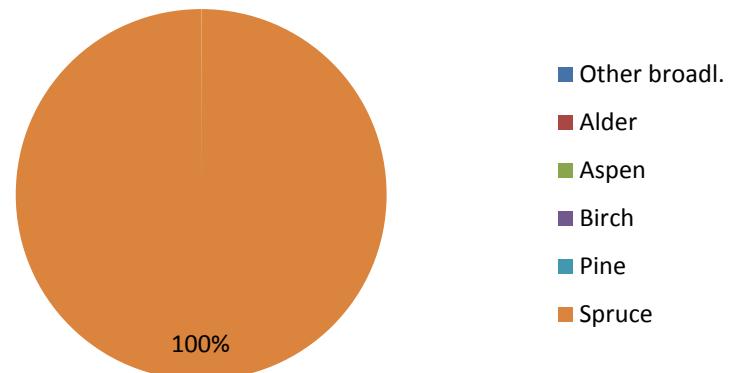
>95%

Spruce forest



100%

Spruce forest



Examples of different forest types



Mixed forest: Spruce, birch

A photograph of a dense forest dominated by tall, slender beech trees. The trees are closely packed, creating a vertical pattern of trunks and canopy. The leaves are a vibrant green, and the overall scene is one of a mature, undiverse woodland.

Monoculture, beech



Monoculture, common alder



Monoculture, Lodgepole Pine



Mixed forest, pine and spruce



Mixed forest, pine, pruce, birch

A photograph of a dense forest dominated by birch trees. The trees have characteristic white bark with dark, peeling lichen. They grow in a tight, uniform cluster, illustrating a monoculture. The ground is covered with fallen leaves and some green undergrowth.

Monoculture forest, birch



Monoculture forest, spruce



Bare land

Definitions

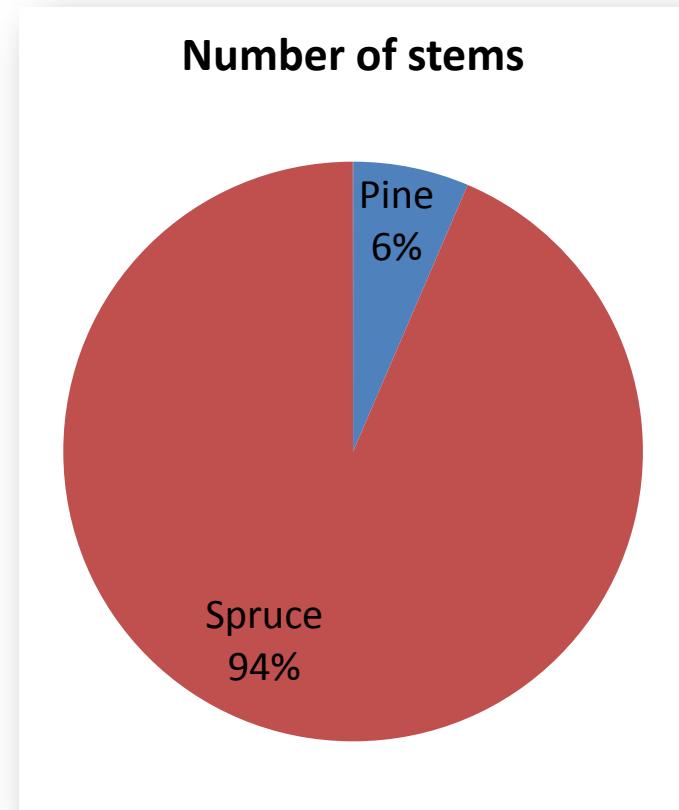
- To assess the area of monoculture forests we have to define
 1. The scale, i.e. the reference area, e.g. what radius of plots, area of the stand, landscapes, etc.
 2. At what proportion is a single tree species/group of species deemed dominant and therefore could be defined as a forest type, e.g. 50%, 65% or 100% ?
 3. Which measure to use when defining a dominant species?
 - number of stems
 - basal area
 - volume

Tree-list

Measure for proportion

Number of stems

(Threshold for monoculture: 65%)



Spruce forest!

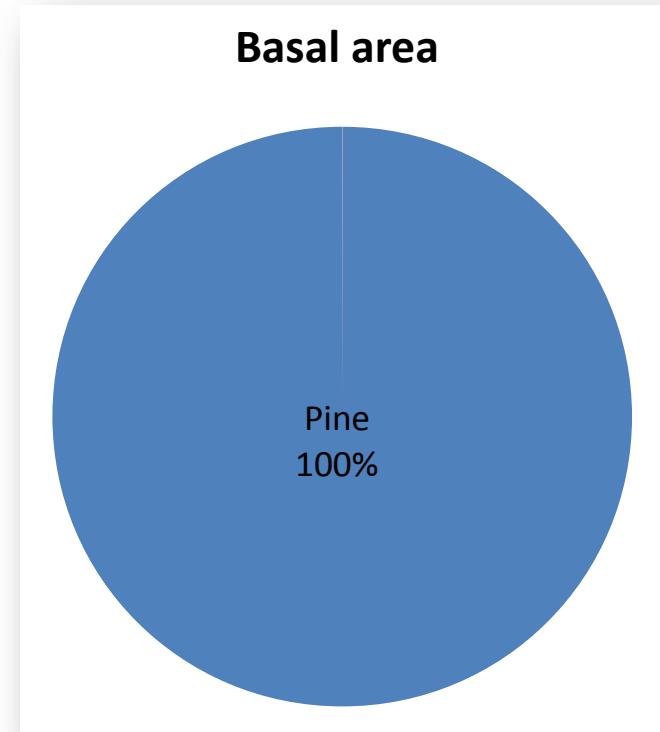
Same tree-list!

Measure for proportion

Basal area

(Threshold for monoculture: 65%)

Species	dbh (m)	Basal area (m ²)
Pine	0,24	0,05
Pine	0,41	0,13
Spruce	0,001	0,00



Pine forest!

Monoculture pineforest or Monoculture spruceforest?



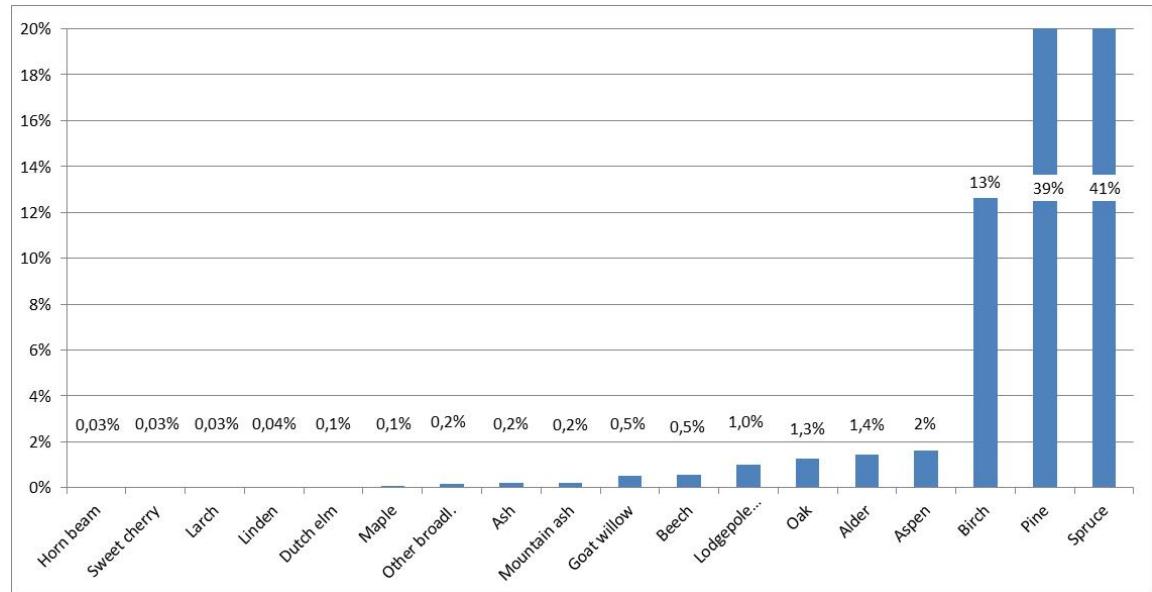
Effects on the estimated area of mixed forests/monoculture using two diametrically opposed examples

- Scale/area of reference:
 1. The whole country of Sweden
 2. Points, i.e. infinite numbers of points in Sweden
- Threshold for a dominant species
 - >50%
- Measure for defining the dominant species
 - Proportion of the total stem volume (m^3sk)



Reference area=all Sweden

- In SKOGSDATA 2012 (table 2.1) the total growing stock for all Sweden is distributed by tree species

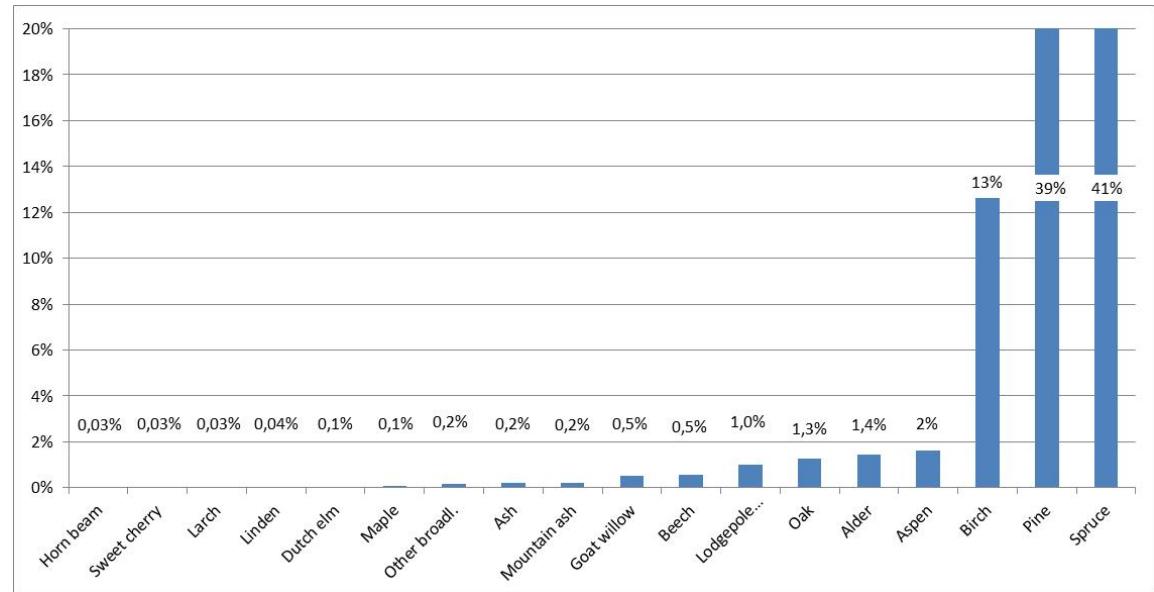


- No single tree species amounts to more than 50% of the volume

100% of the Swedish forests are mixed forests with this definition!

Reference area= infinite numbers of points

- In SKOGSDATA 2012 (table 2.1) the total growing stock for all Sweden is distributed on tree species



- All single tree species amount to 100% of the volume within each point (and consequently also >50%)

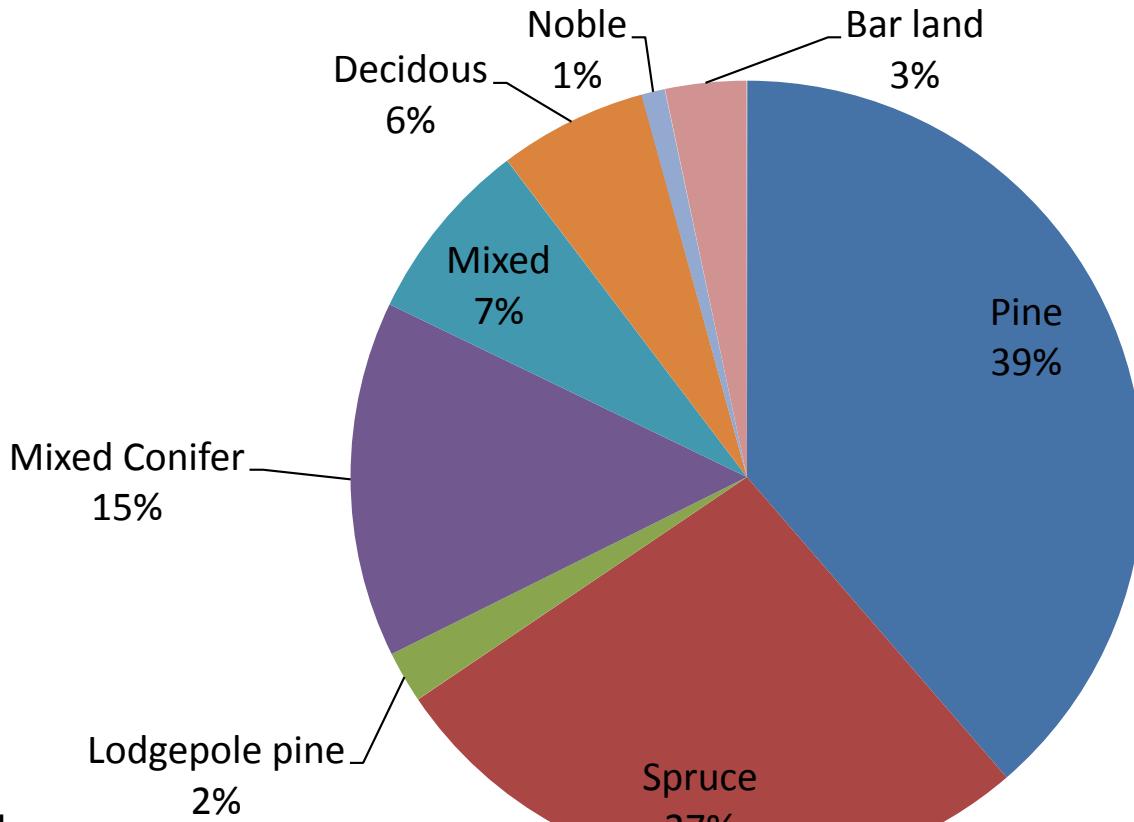
100% of the Swedish forests are monoculture forests with these definitions!

In the official statistics from the Swedish NFI the following definitions are used:

- Area of reference: **Sample plots radius 20 m**
- Threshold for a dominant species/groups: **65%**
- Measure defining dominating species
 - Mean stand height on the plot< 7 m:
number of main stems
 - Mean stand height on the plot \geq 7 m: **basal area of all living trees except retention trees, seed-trees and undergrowth**

Stand types defined in the Swedish official statistics SKOGSDATA 2012

- **Pine forest**
Pine $\geq 65\%$
- **Spruce forest**
Spruce $\geq 65\%$
- **Lodgepole pine forest**
Lodgepole pine $\geq 65\%$
- **Mixed Conifer forest**
None of the above,
but conifer species
constitute $\geq 65\%$
- **Mixed forests**
Deciduous trees $\geq 35\%$
and $< 65\%$
- **Deciduous forest**
Deciduous trees $\geq 65\%$ and
 $< 45\%$ noble
- **Noble**
Deciduous trees $\geq 65\%$ and
 $\geq 45\%$ noble
- **Bare land**



Monoculture => Spruce+Pine+Lodgepole Pine=68%

Spruce forest, monoculture!

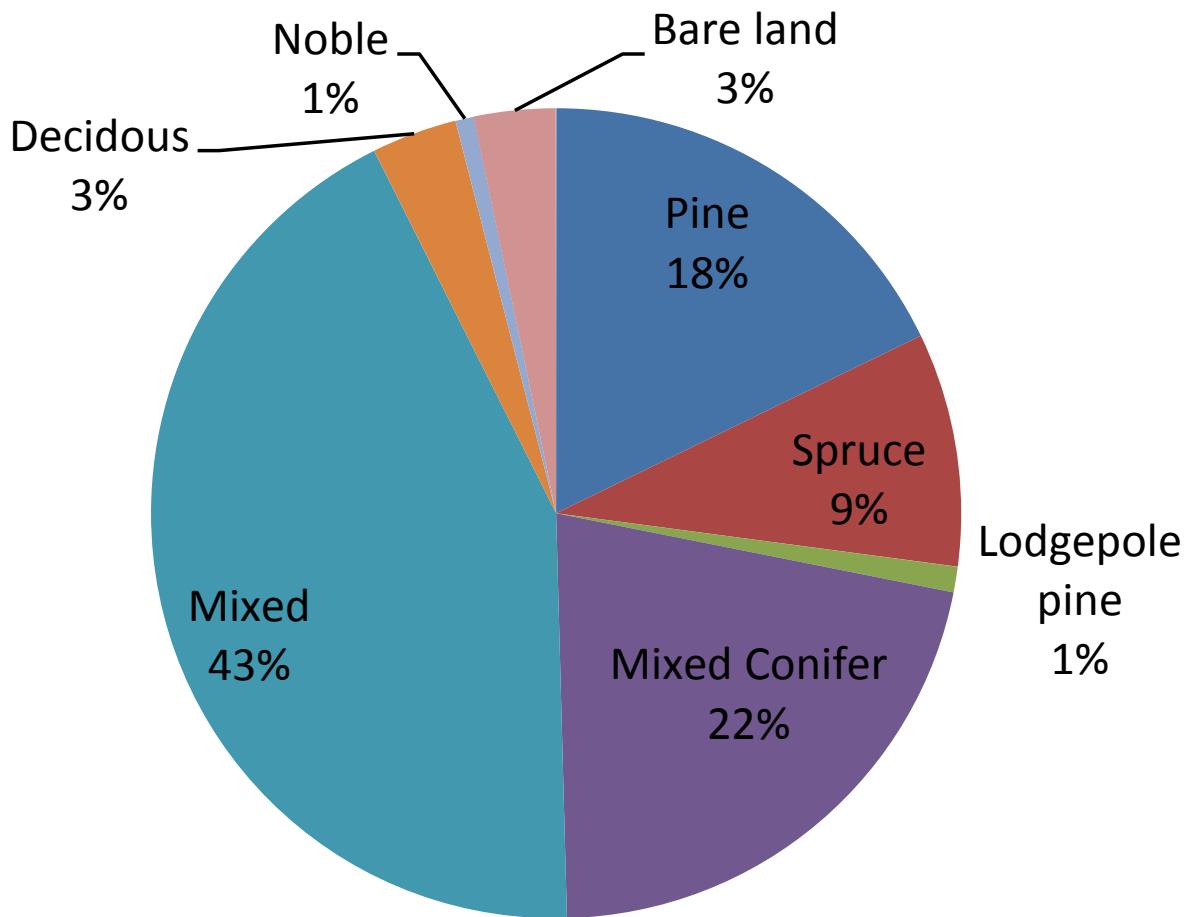


Natura 2000-habitat 9040, monoculture!



Let's change the threshold to 95%!

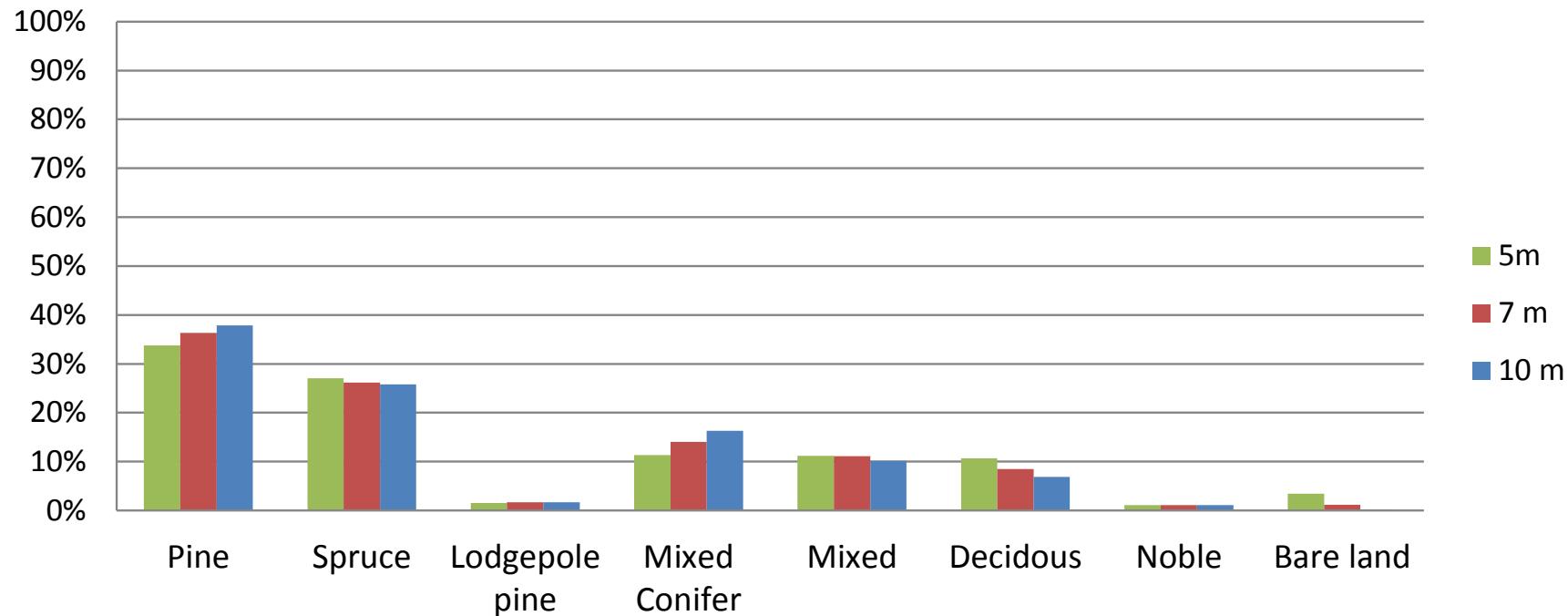
- **Pine forest**
Pine $\geq 95\%$
- **Spruce forest**
Spruce $\geq 95\%$
- **Lodgepole pine forest**
Lodgepole pine $\geq 95\%$
- **Mixed Conifer forest**
None of the above,
but conifer species
constitutes $\geq 95\%$
- **Mixed forests**
Deciduous trees $\geq 5\%$
and $< 95\%$
- **Decidous forest**
Deciduous trees $\geq 95\%$ and
 $< 45\%$ noble
- **Noble**
Deciduous trees $\geq 95\%$ and
 $\geq 45\%$ noble
- **Bare land**



Monoculture => Spruce+Pine+Lodgepole Pine=28%

Let's look at plots with mean height
>= 7 m and change the area of reference:

Proportion of forest type for
different radius of sample plots



Conclusion:

This gradient is not enough to study real effects of different reference areas: i.e. the NFI-data is stable even though different plot-radius are used

Summary

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- Different definitions of monoculture, mixed forest and forest types can be applied to data from the Swedish NFI for further analysis

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- In discussions about monoculture/mixed forests the definitions used should be clearly communicated to avoid misunderstandings
- Different definitions of monoculture, mixed forest and forest types can be applied to data from the Swedish NFI for further analysis
- The intention of the Swedish NFI has not been to set the "National standard" for definitions of monoculture/mixed forest/forest types but to present statistics for one set of definitions



Swedish National
Forest Inventory

Thanks for your attention!