

# Diversiteit en Complexiteit als Sleutels tot Droogteresistentie

Thünen Institut

Ute Sass-Klaassen, Juriaan Zandvliet & Linar Akhmetzyanov



**van hall  
larenstein**  
university of applied sciences

## Demo areas

# Southern Netherlands

In the Netherlands, SUPERB will support a wide transformation by enabling nature to thrive once again in a mosaic of forested and agricultural lands in the country's southernmost province of Limburg (municipality of Horst aan de Maas). In addition,

In the Netherlands, SUPERB will support a wide transformation by enabling nature to thrive once again in a mosaic of forested and agricultural lands in the country's southernmost province of Limburg (municipality of Horst aan de Maas). In addition, we will monitor the soil conditions, tree vitality and biodiversity in recently restored Scots pine forests and in young forest on former agricultural lands in the province of North Brabant (municipality of Maashorst) and in the region of Kempen, on the border with Belgium.

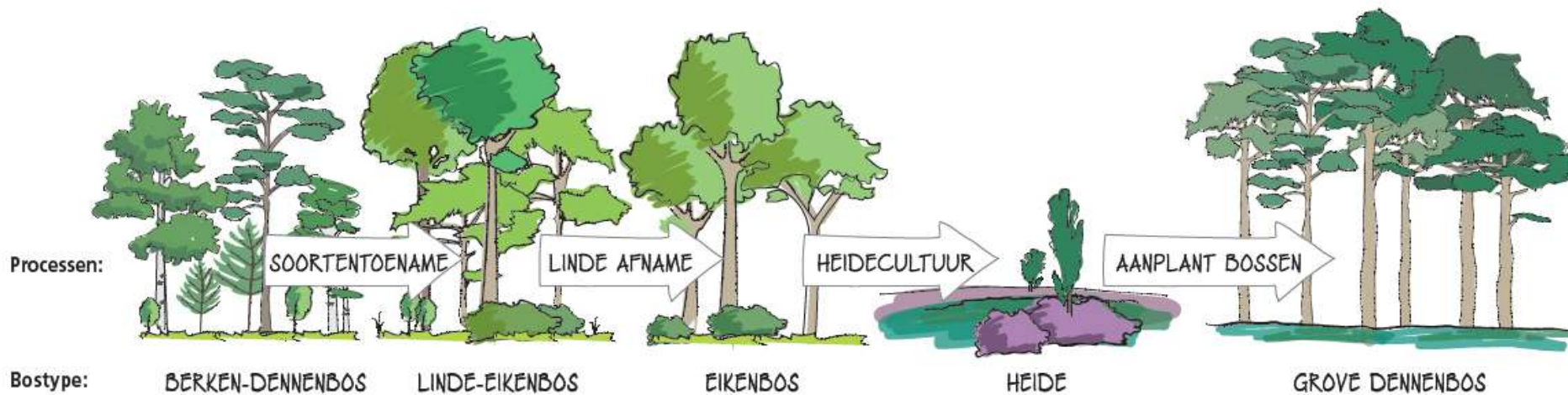
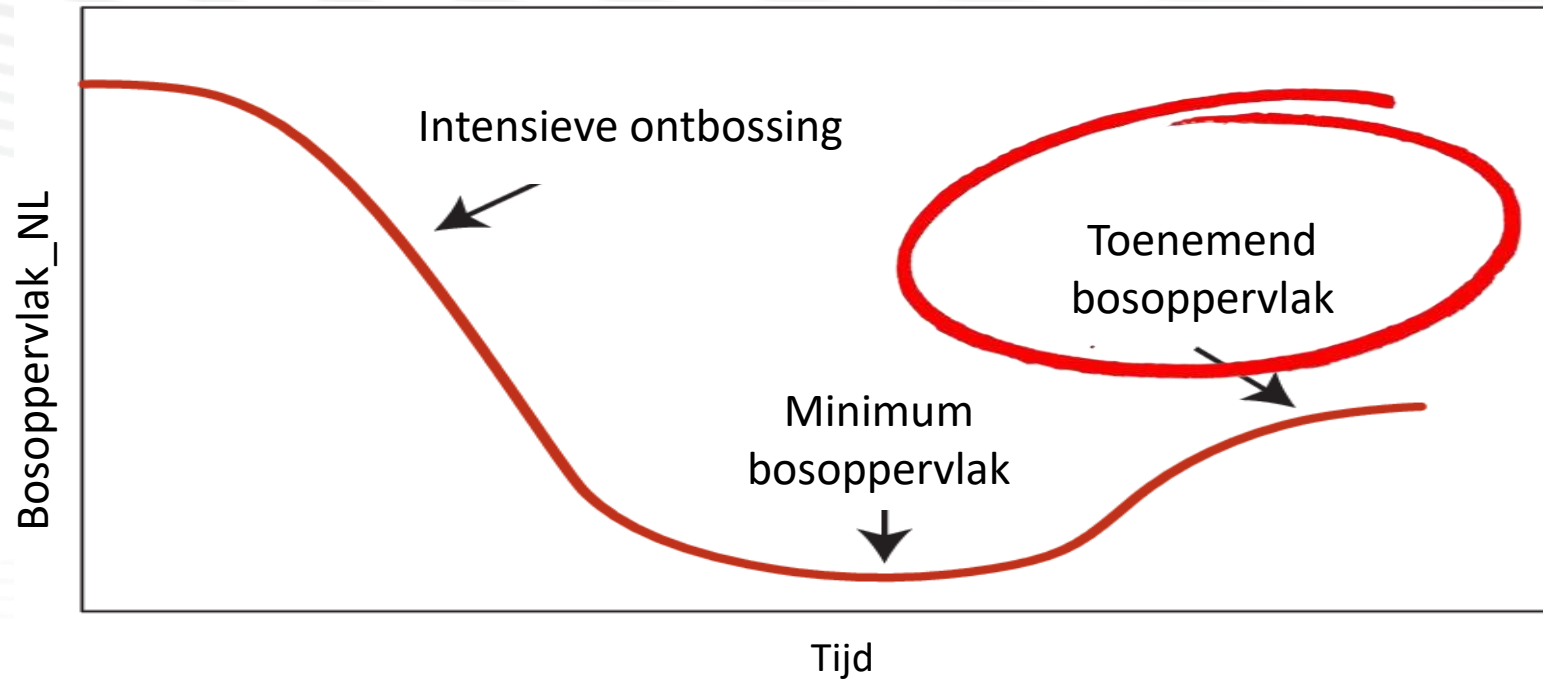




# Ecologie in Boomgericht Bosbeheer



Pascal Sauren, Wim Buysse, Sander Wijdeven, Jan Seynaeve,  
Martin Winnock, Lotte van Nevel, Bart Nyssen

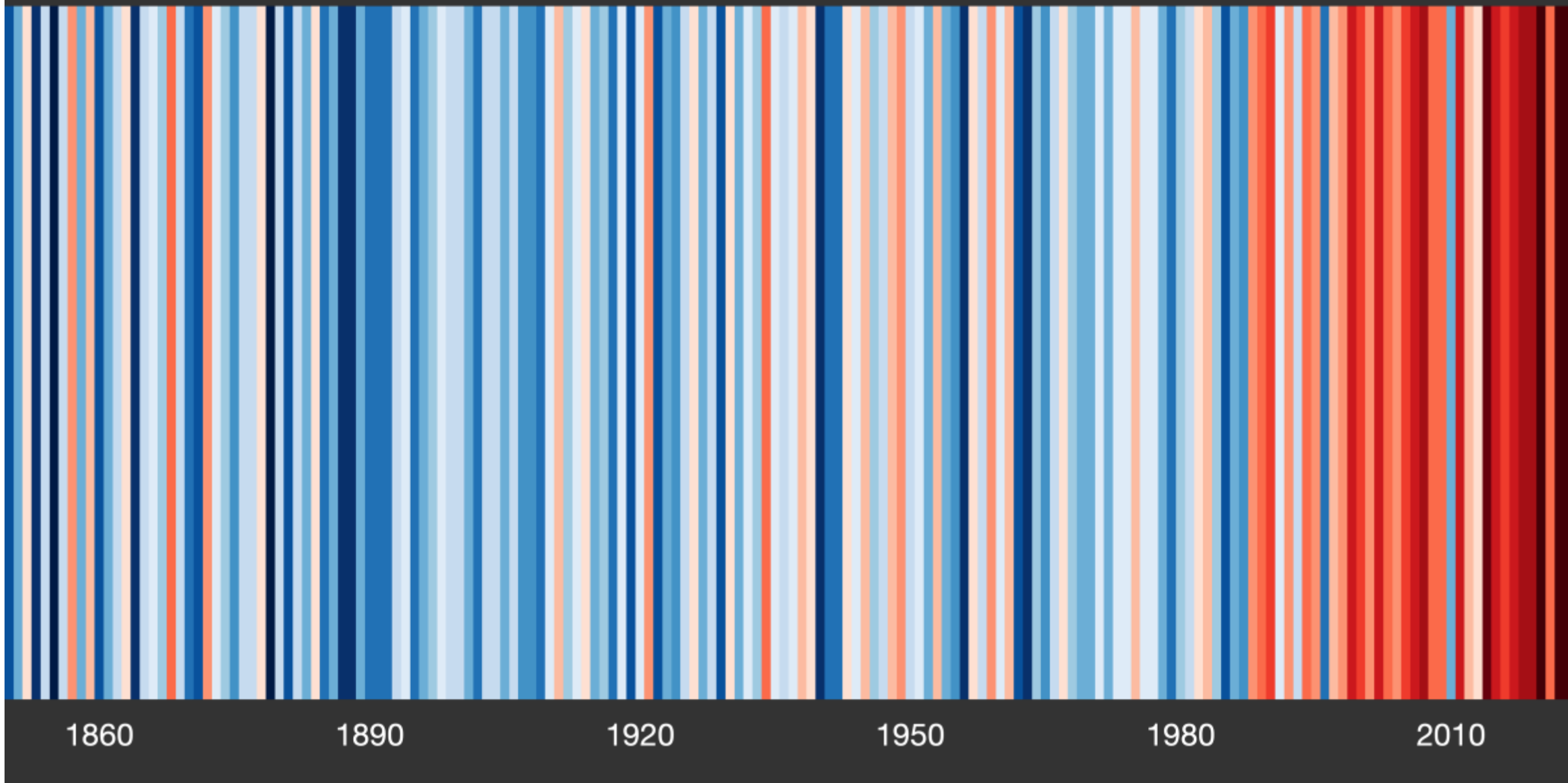






Wandelenopdeveluwe, Kootwijkerzand

# Temperatuur veranderingen in Nederland sinds 1850





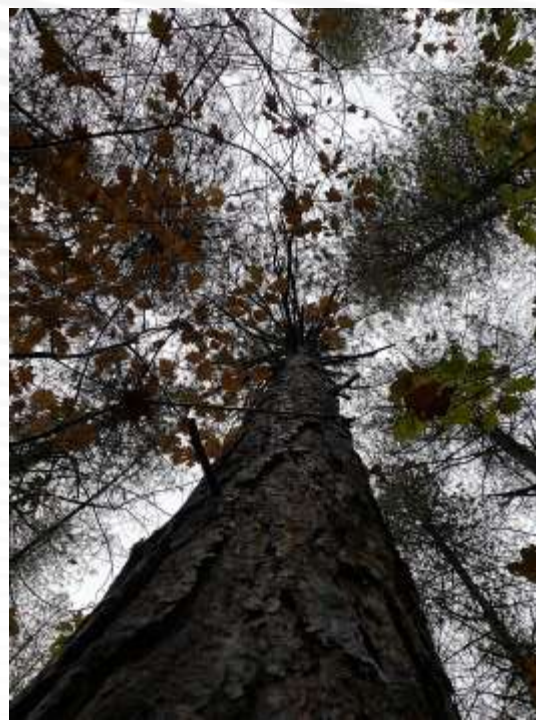
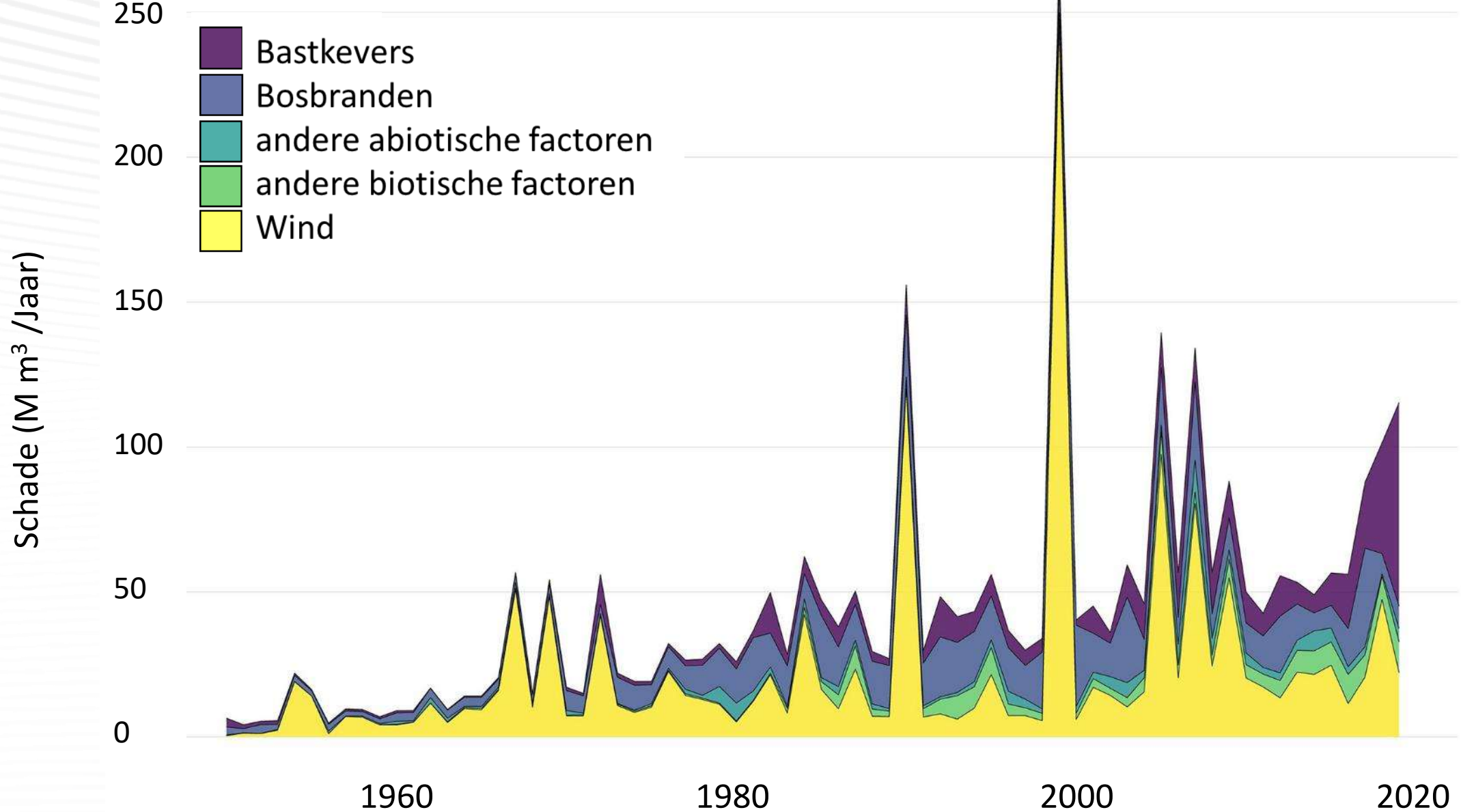


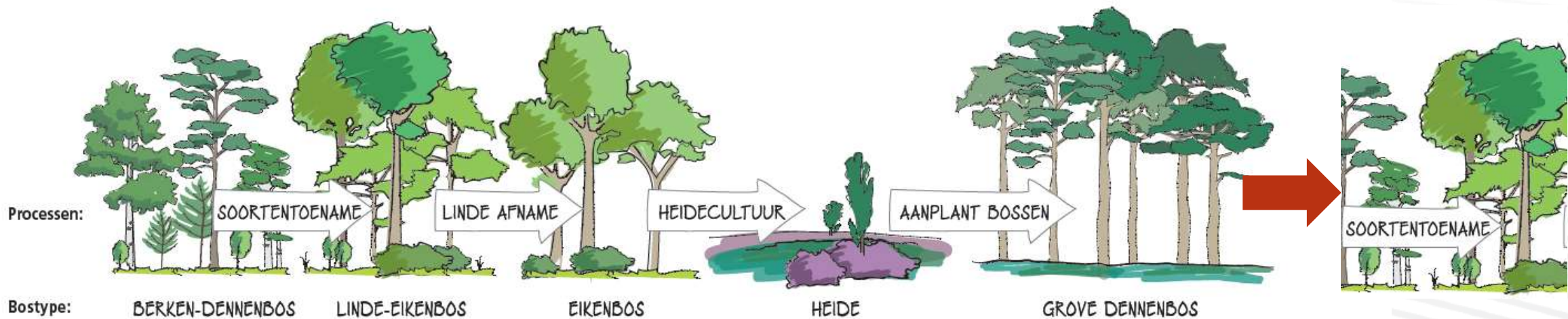
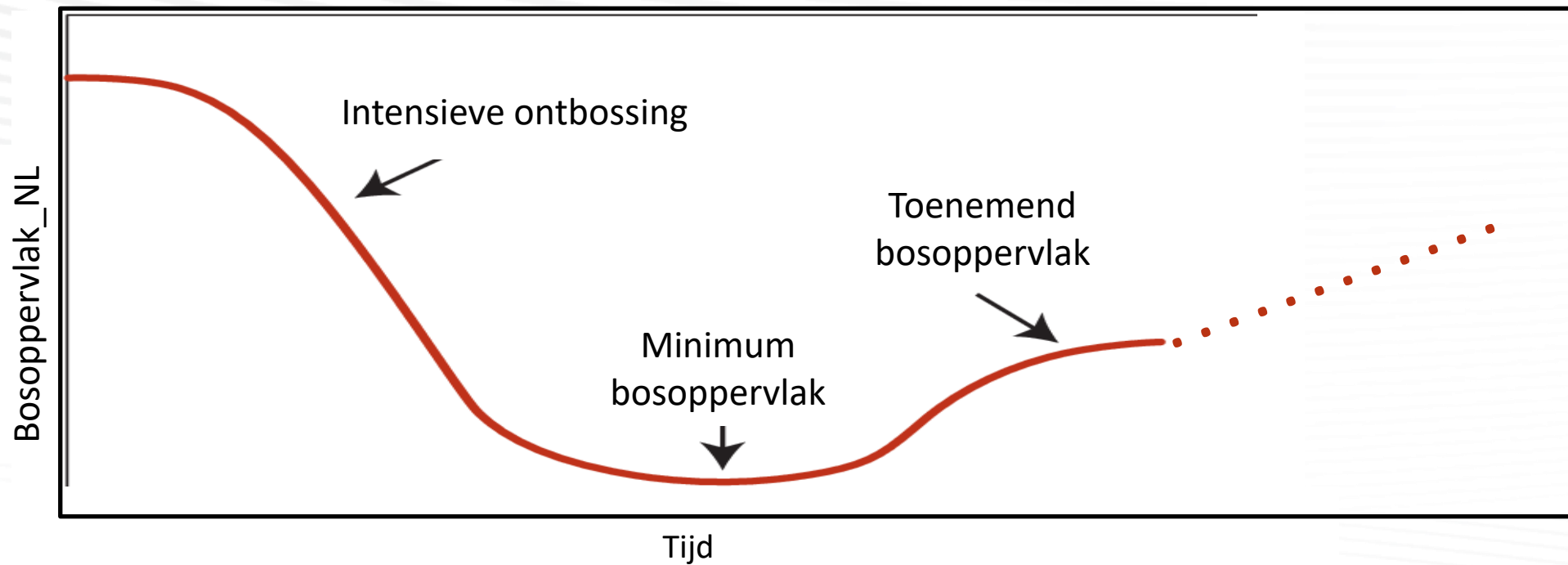
Foto: Etienne Thomassen

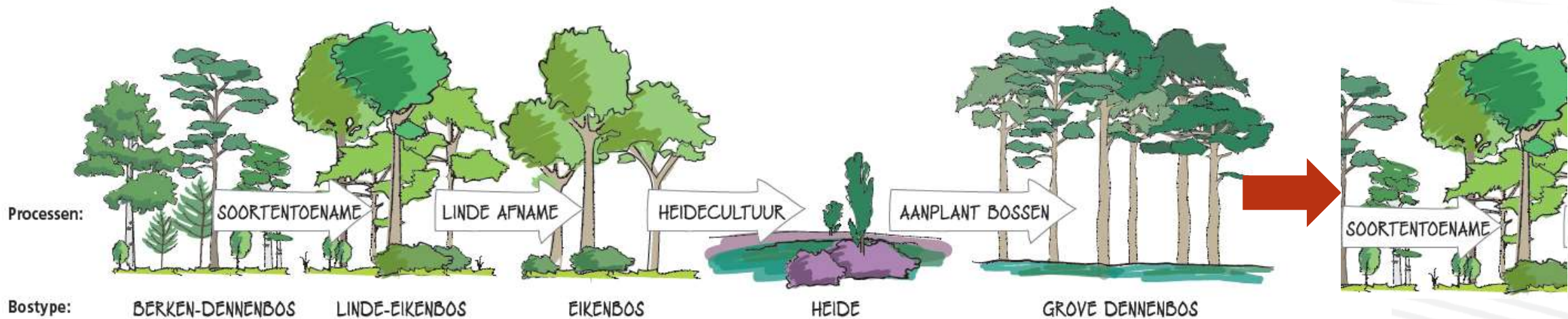
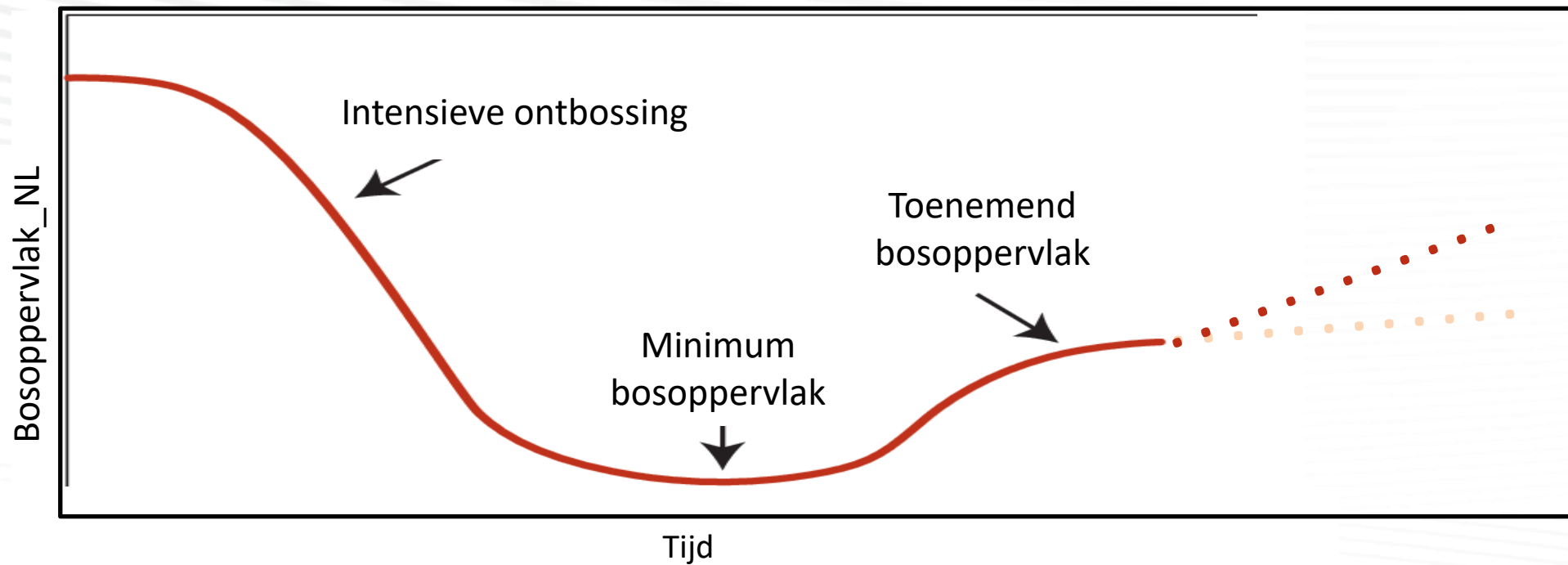


<https://www.np-utrechtseheuvelrug.nl/stormschade/>

# Verstoringsen in Europese bossen







# Weerbare bossen!

## Structuurherstel

Horizontale en verticale structuur

- Soorten/herkomstenpool (droogteresistent)
- Mengingen

# Onderzoek droogtegevoeligheid

## Monitoring

**Welkom gebruiker**

U bevindt zich in het dashboard klimaat in bosbeheer waar reeds gemonitorde eenheden weergegeven zijn binnen een overzichtelijke omgeving. Het doel van het dashboard is het u als gebruiker kan leren van ervaringen met aanplant van (nieuwe) boomsoorten elders in Nederland.

Er is een handleiding voor het gebruik van dit dashboard in de vorm van 3 filmpjes die per functie een korte uitleg geven over het gebruik en nut ervan. Deze kan u vinden onder de basiskaart (zie afbeelding).



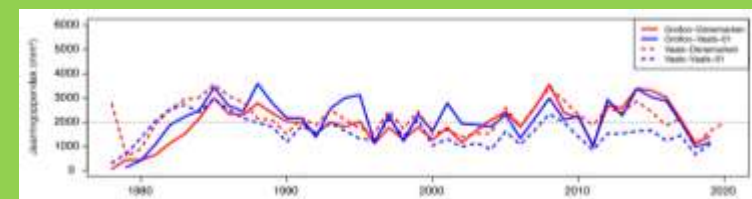
Waar aanvullende informatie kan u klikken op de drie hartvormige icoontjes in de rechterbovenhoek van het dashboard. Hier vindt u koppels die verwijzen naar de volgende sites:

- Monitoring nieuwe boomsoorten: [Wet van 1 september over monitoring \(artikel\)](#)
- Huidschadeverloop naerlog (tabel): [Huidschade van jonge boomsoorten](#)
- Voortbrengprojecten: [Projecten](#) | [Evaluatie](#) | [Nieuw](#) | [Huidschade](#) | [Aanpak](#)
- Boomtabel: [Overzicht](#) | [Aanpak](#) | [Nieuw](#) | [Huidschade](#) | [Aanpak](#)
- Bossoortenportaal: [Overzicht](#) | [Aanpak](#) | [Nieuw](#) | [Huidschade](#) | [Aanpak](#)

Don't show this message again



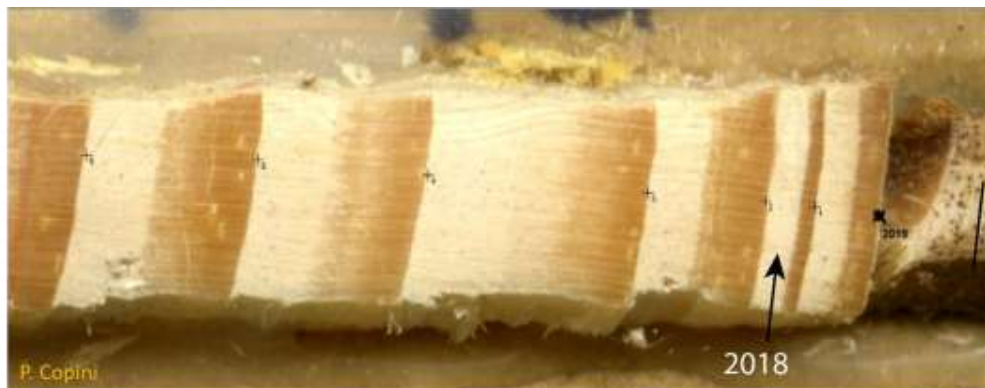
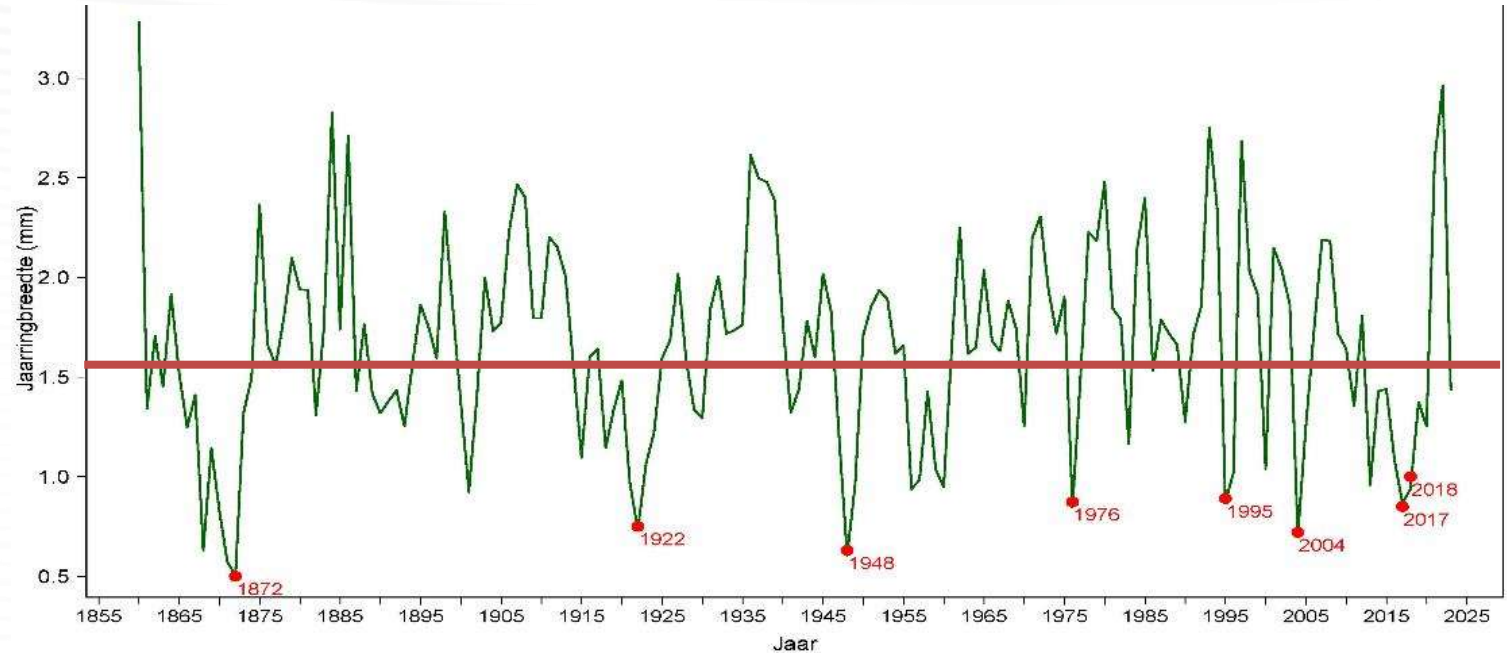
## Jaarringonderzoek





# Jaarringonderzoek Droogtegevoeligheid

## Groeireductie/Resistentie



Beuk: 28.5 %

Japanse Lariks 24.6 %

Zomereik 21.5%

*Bouwman et al. 2025; Forest Ecol. & Management*

# Groeireductie in droogtejaren [%] - Beuk & Grove Den Monocultuur *versus* menging

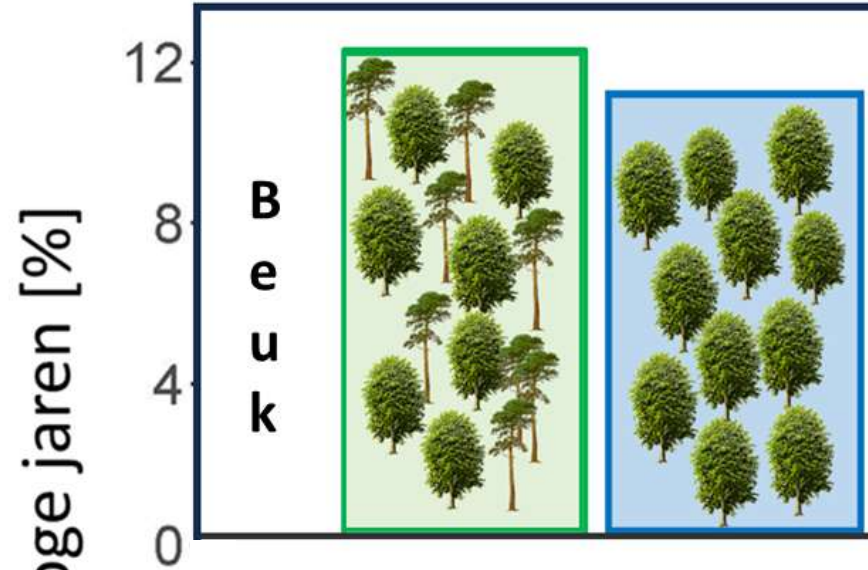


Onderzoek: J. Kalter, R. Uijlenhoet, J. Bolink

# Beuk & Grove den

Mix

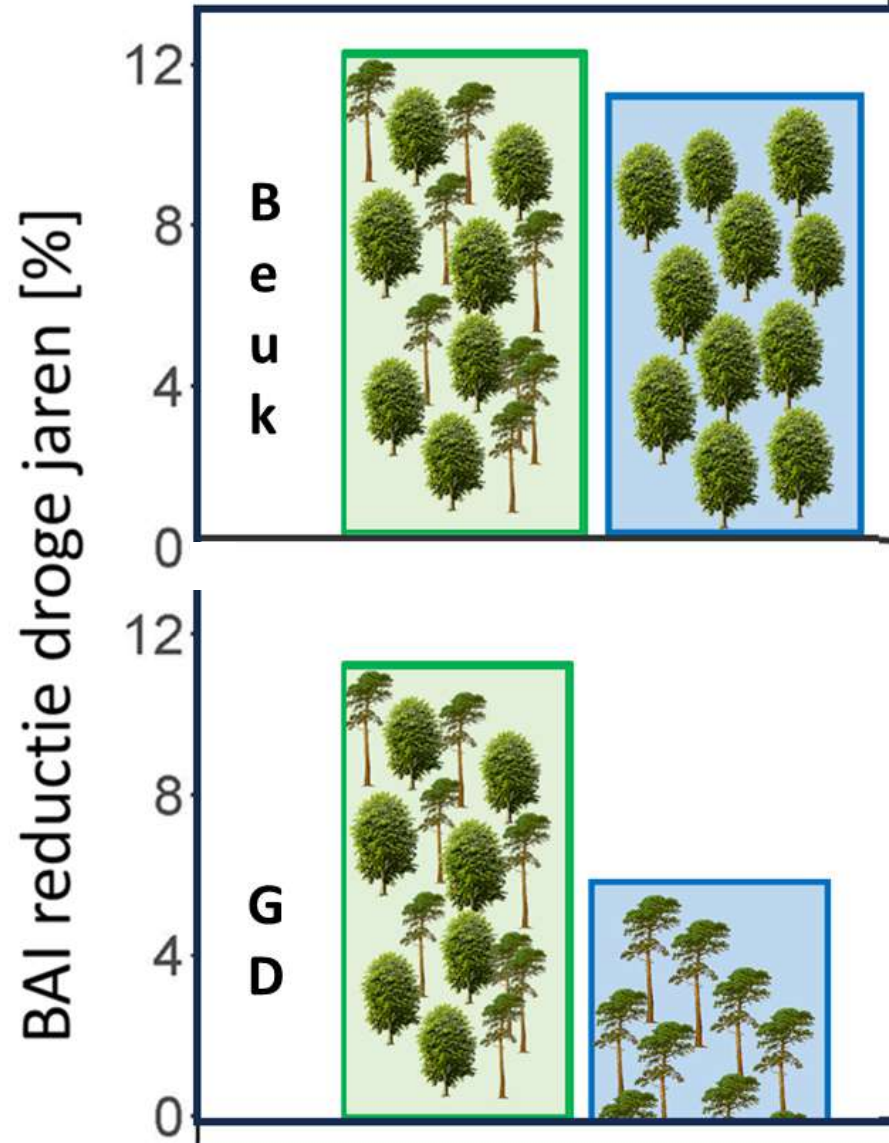
Mono



# Beuk & Groveden

Mix

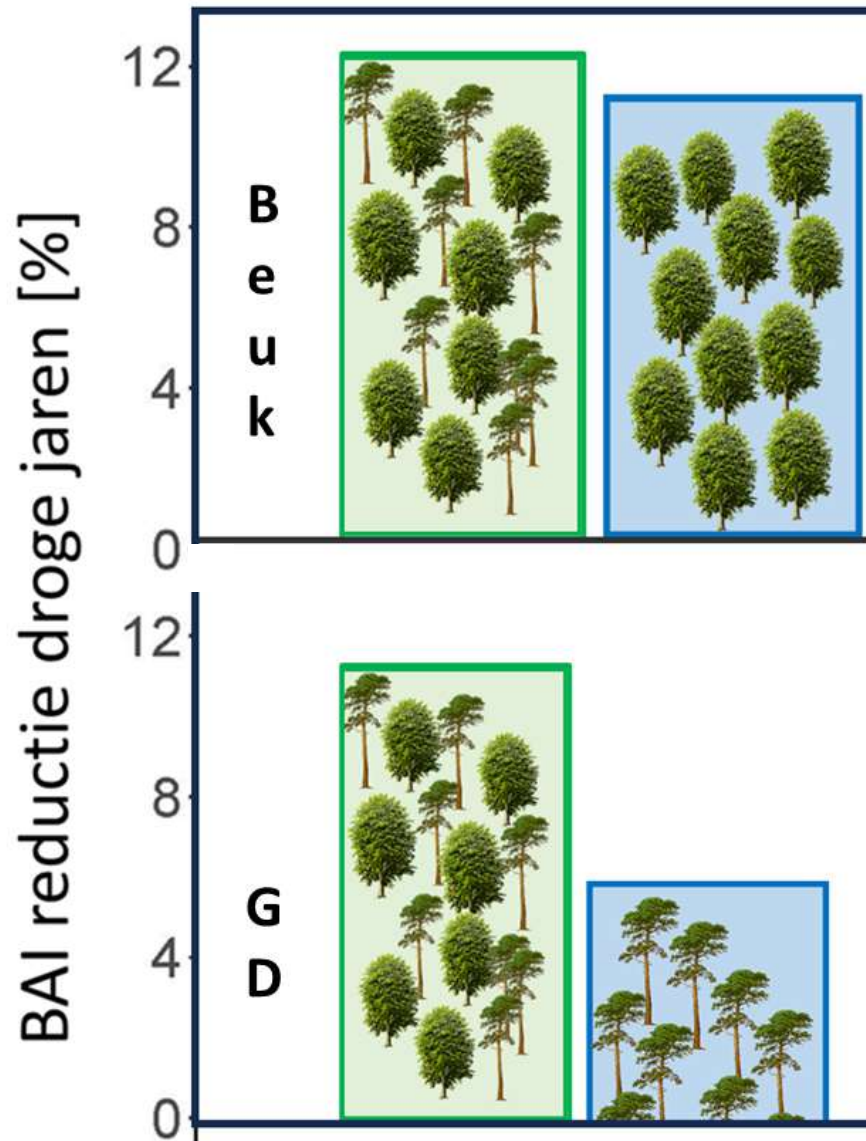
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## Beuk & Grove den

Mix

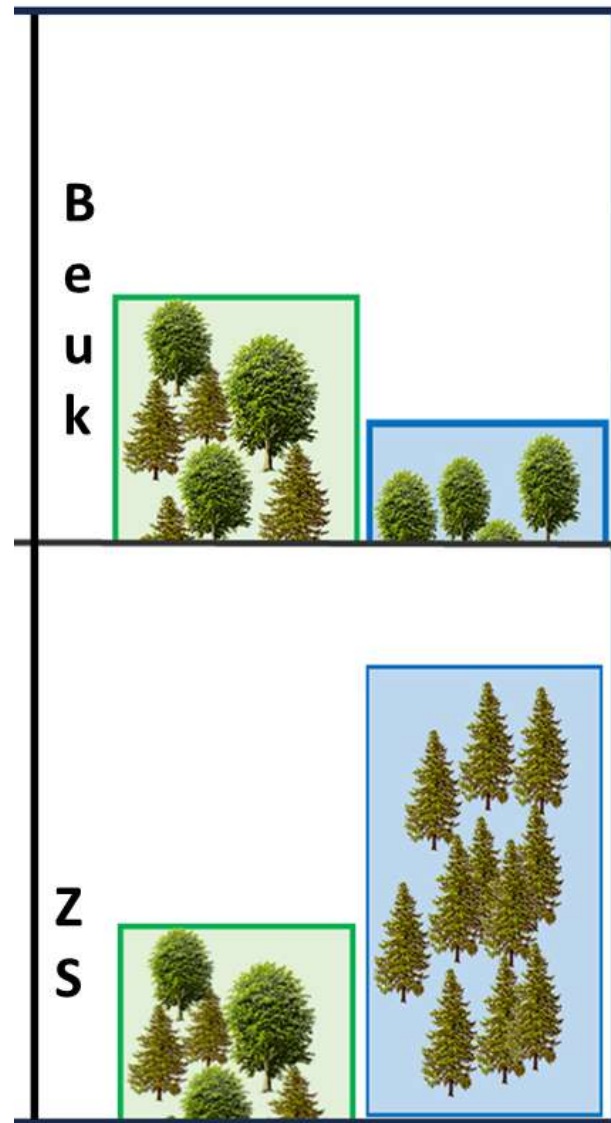
Mono



## Beuk & Zilver spar

Mix

Mono

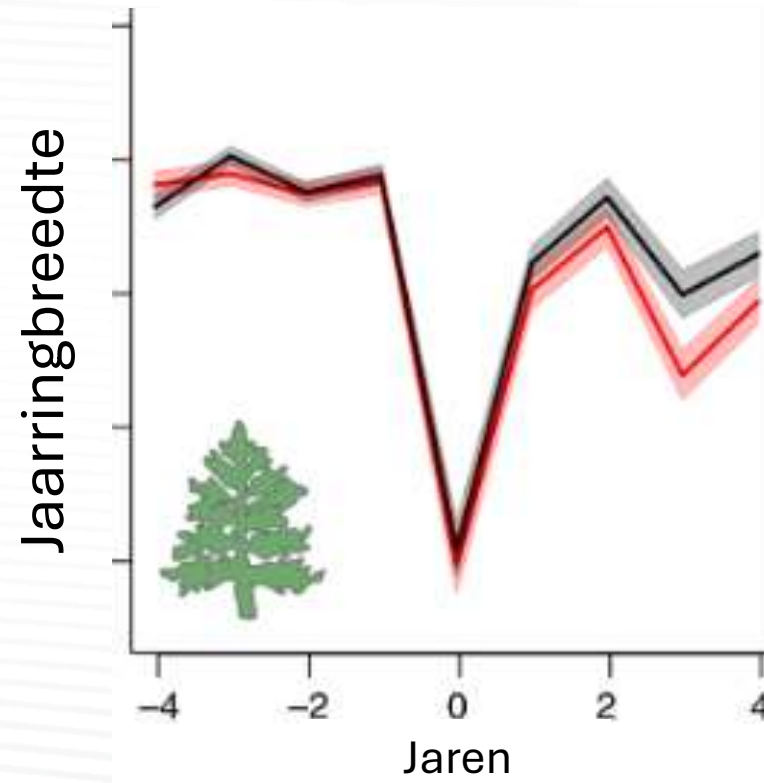
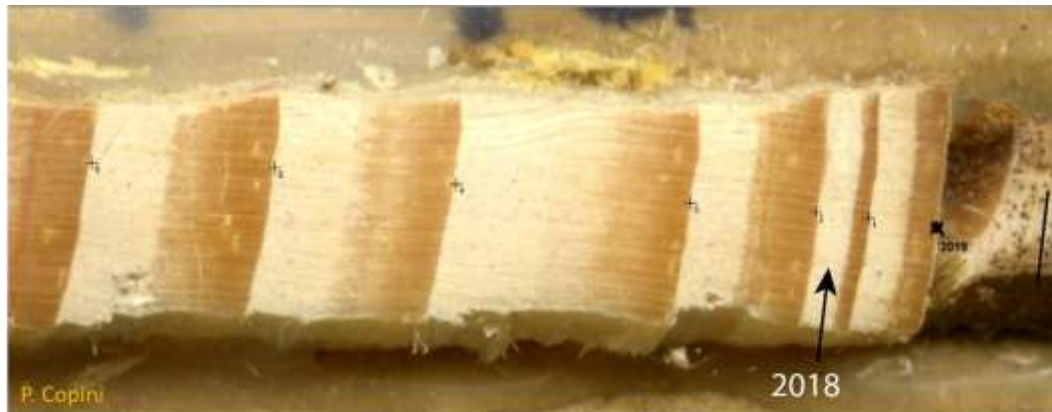




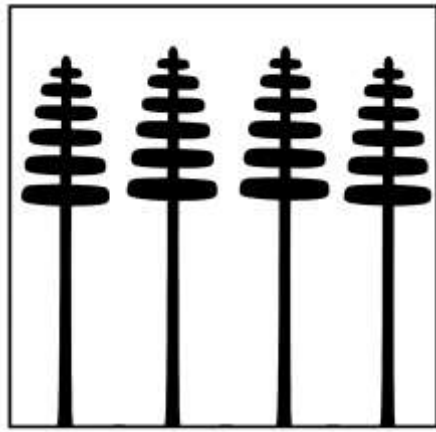
Juriaan Zandvliet

# Jaarringonderzoek Droogtegevoeligheid

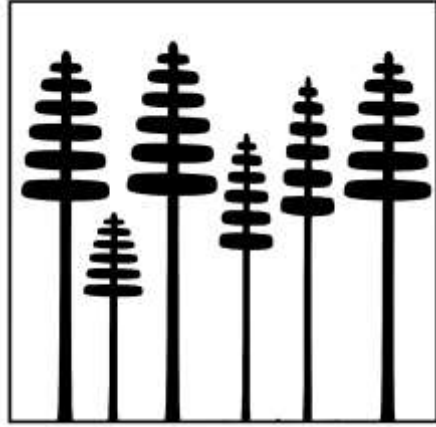
## Groeiresilientie/herstel



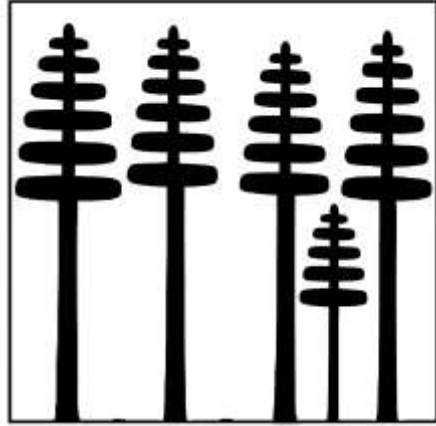
T-boom beheer



Uitkapbeheer

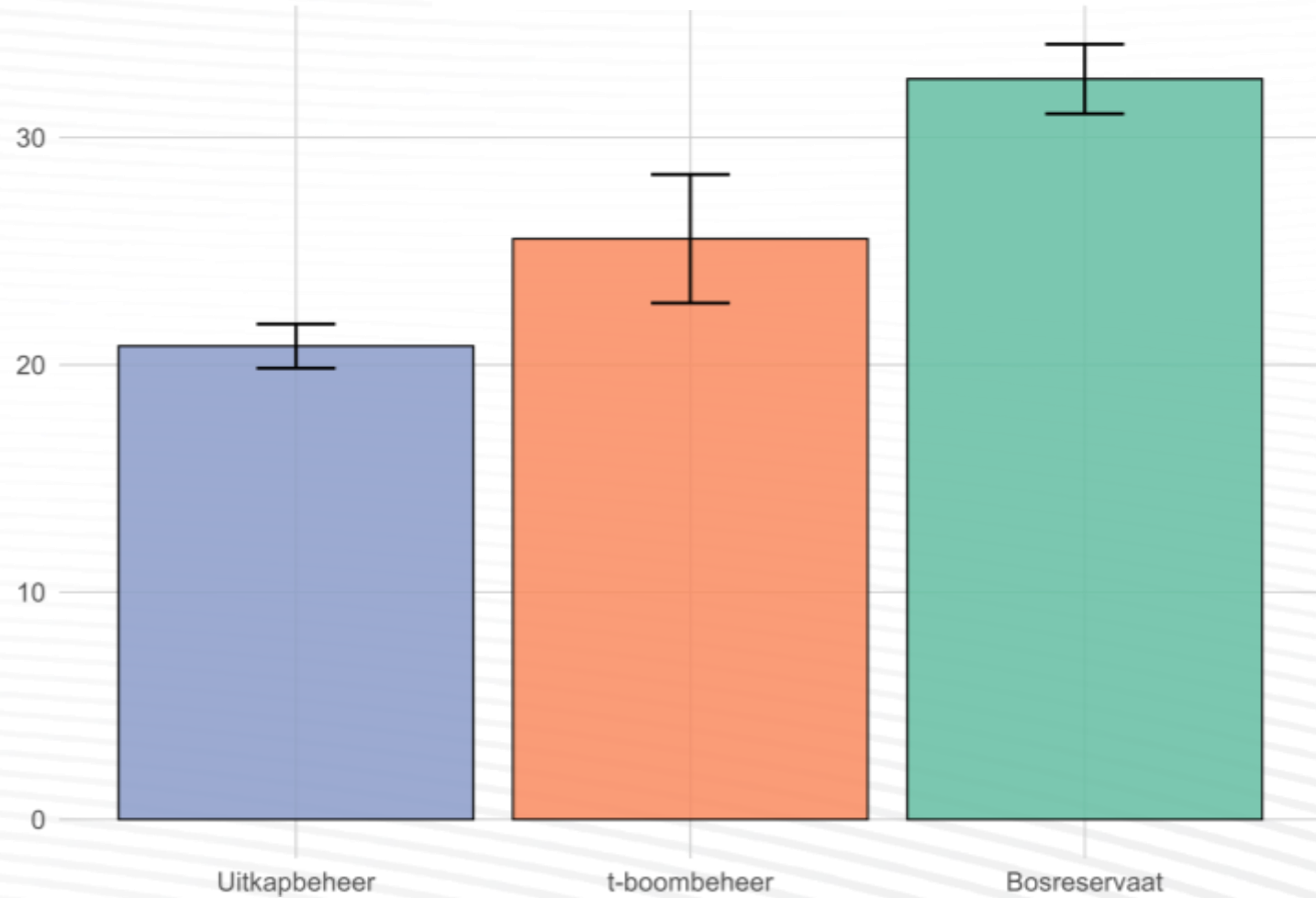


Bosreservaat

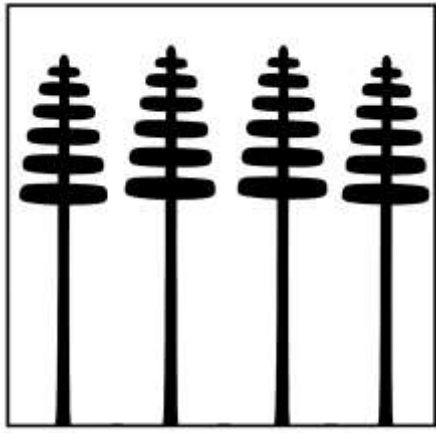


# Groeiresilientie – Beheersystemen

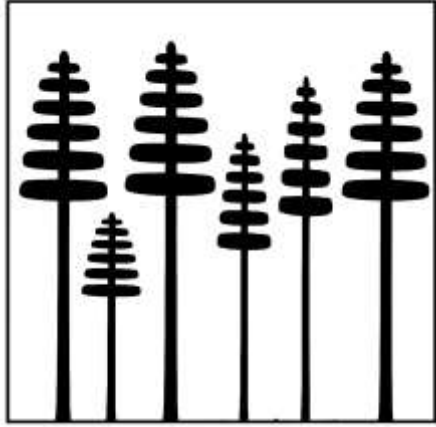
Grondvlak m<sup>2</sup>/ha



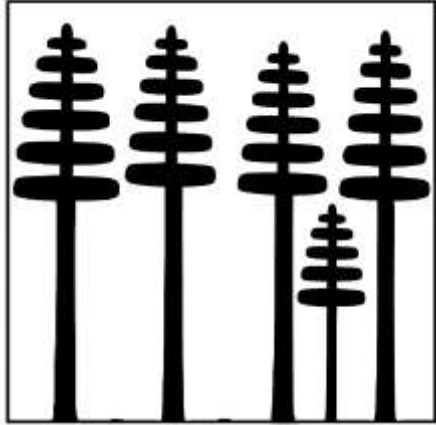
T-boom beheer



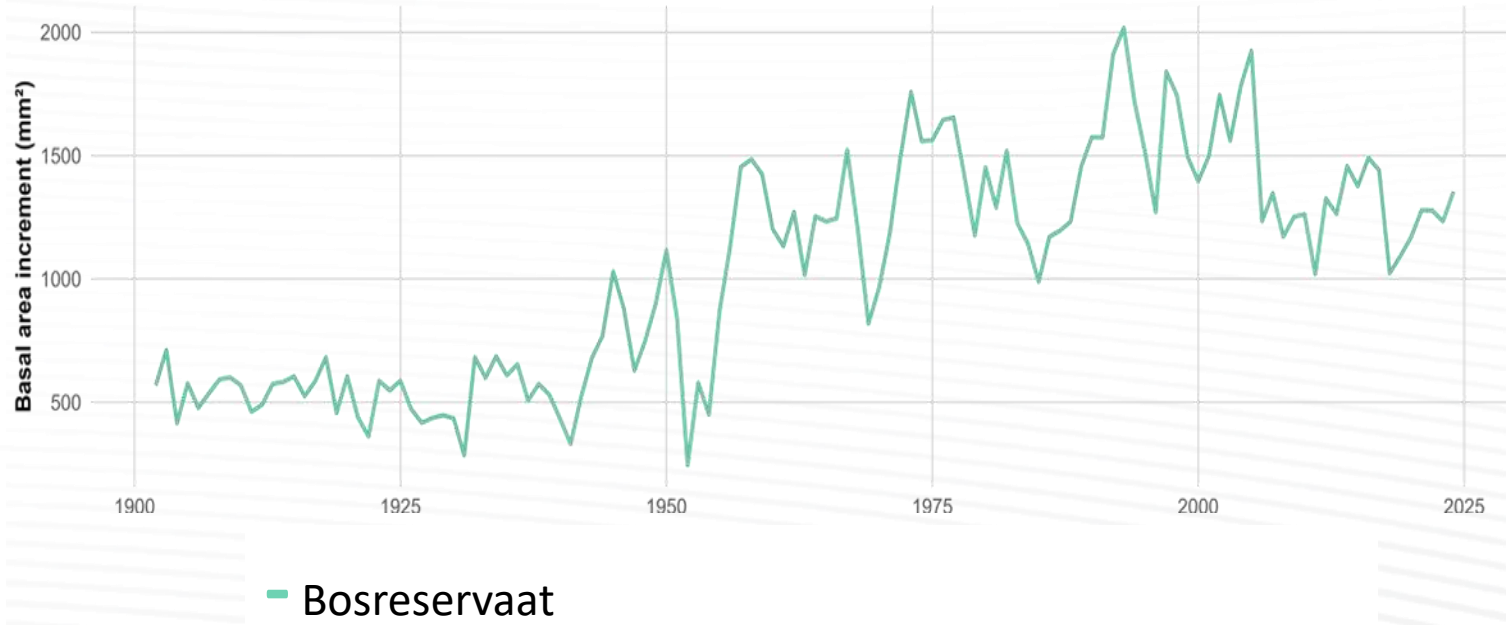
Uitkapbeheer



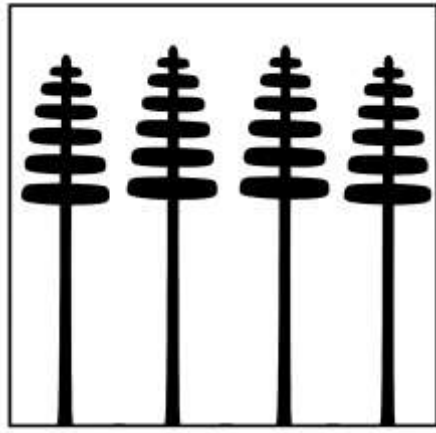
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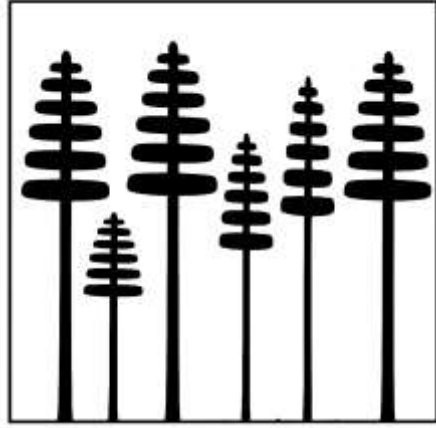
# Groeiresilientie – Beheersystemen



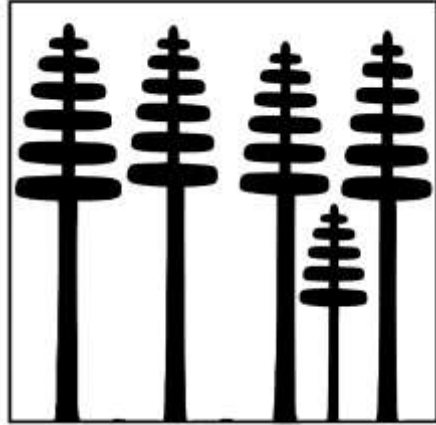
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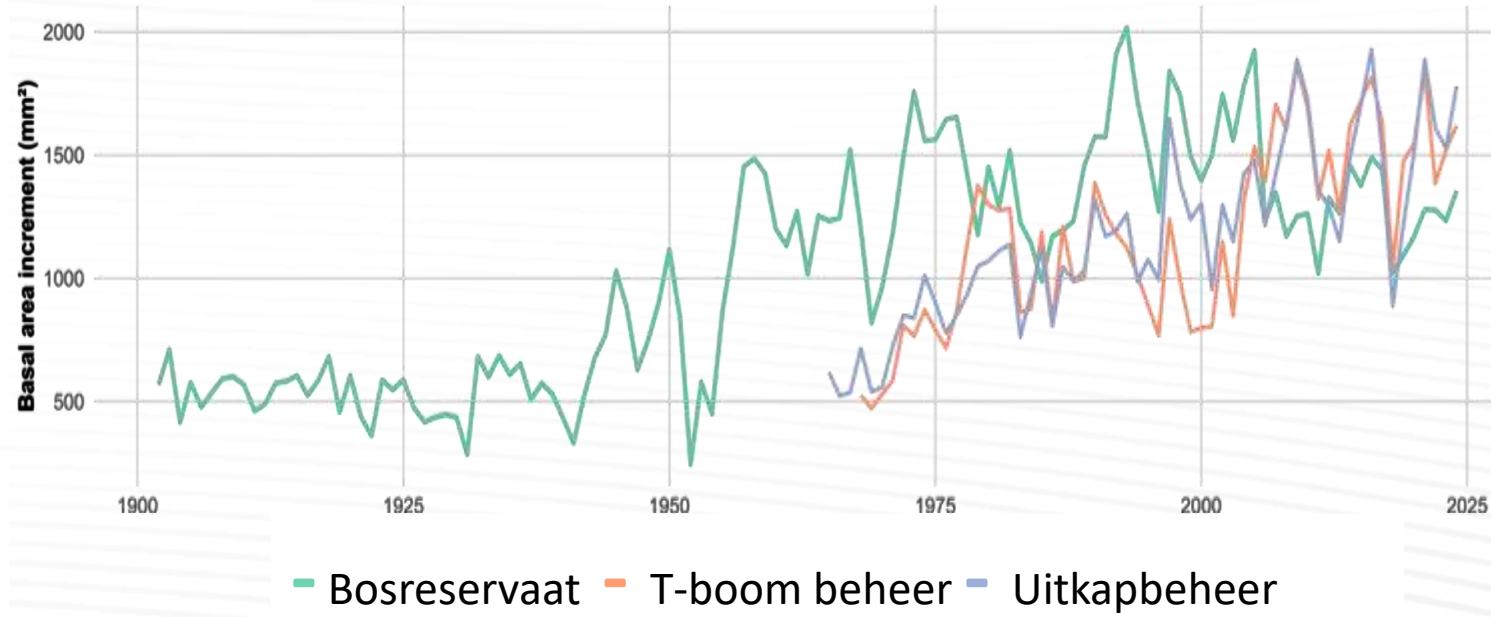
Uitkapbeheer



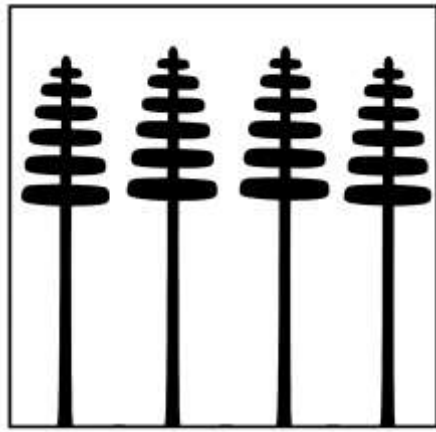
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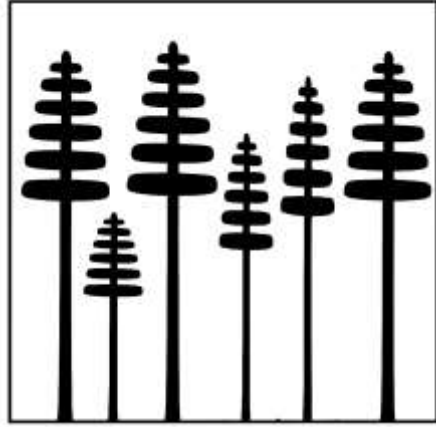
# Groeiresilientie – Beheersystemen



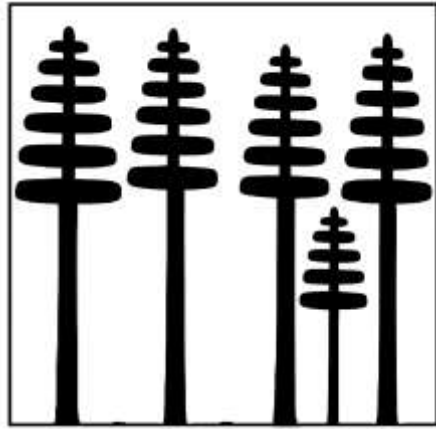
T-boom beheer



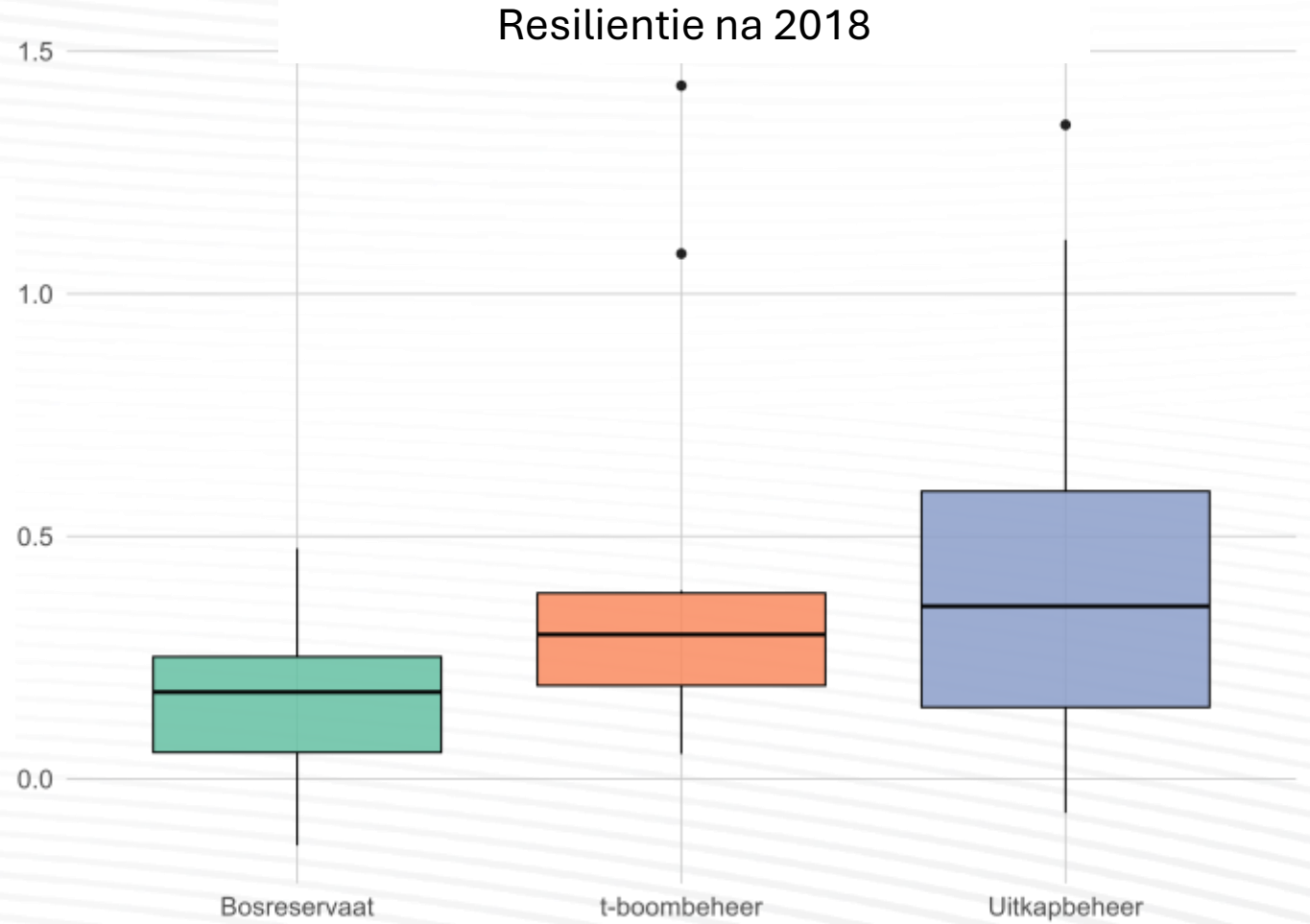
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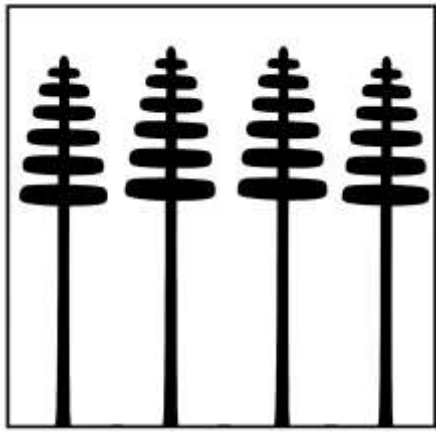
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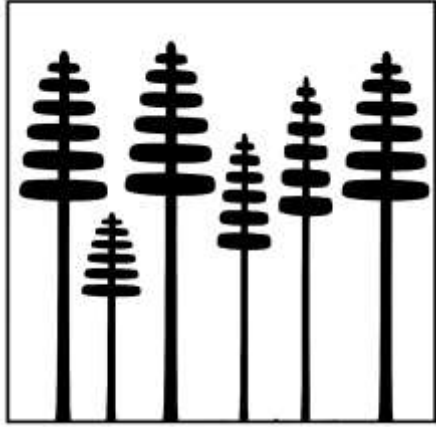
# Groeiresilientie – Beheersystemen



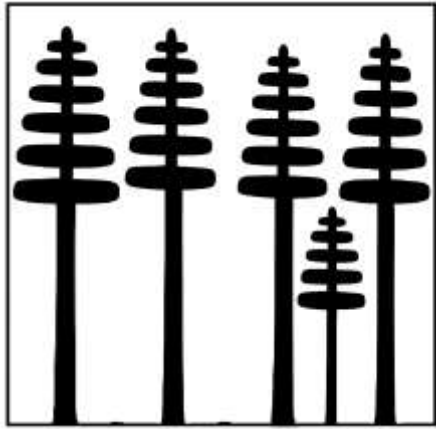
T-boom beheer



Uitkapbeheer



Bosreservaat



# Groeiresilientie – Beheersystemen

Effect van sociale status op resiliëntie



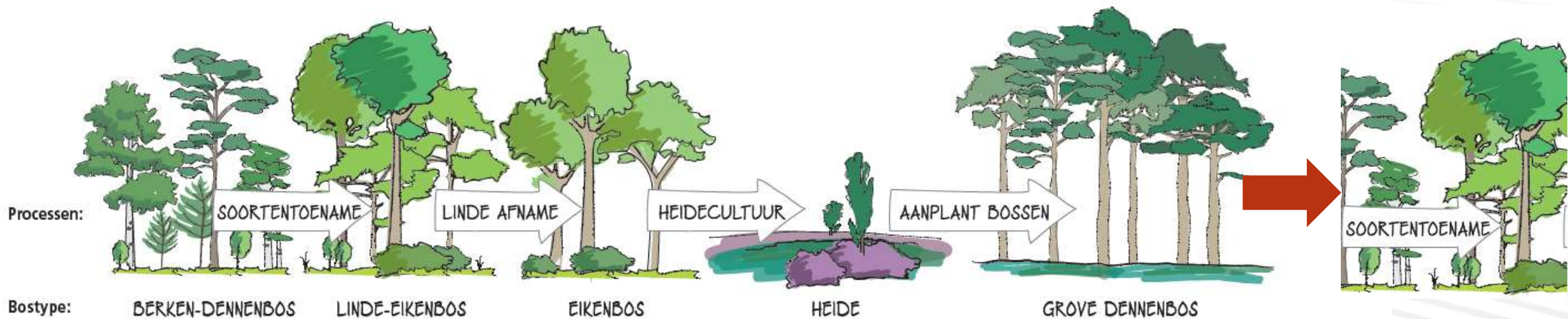
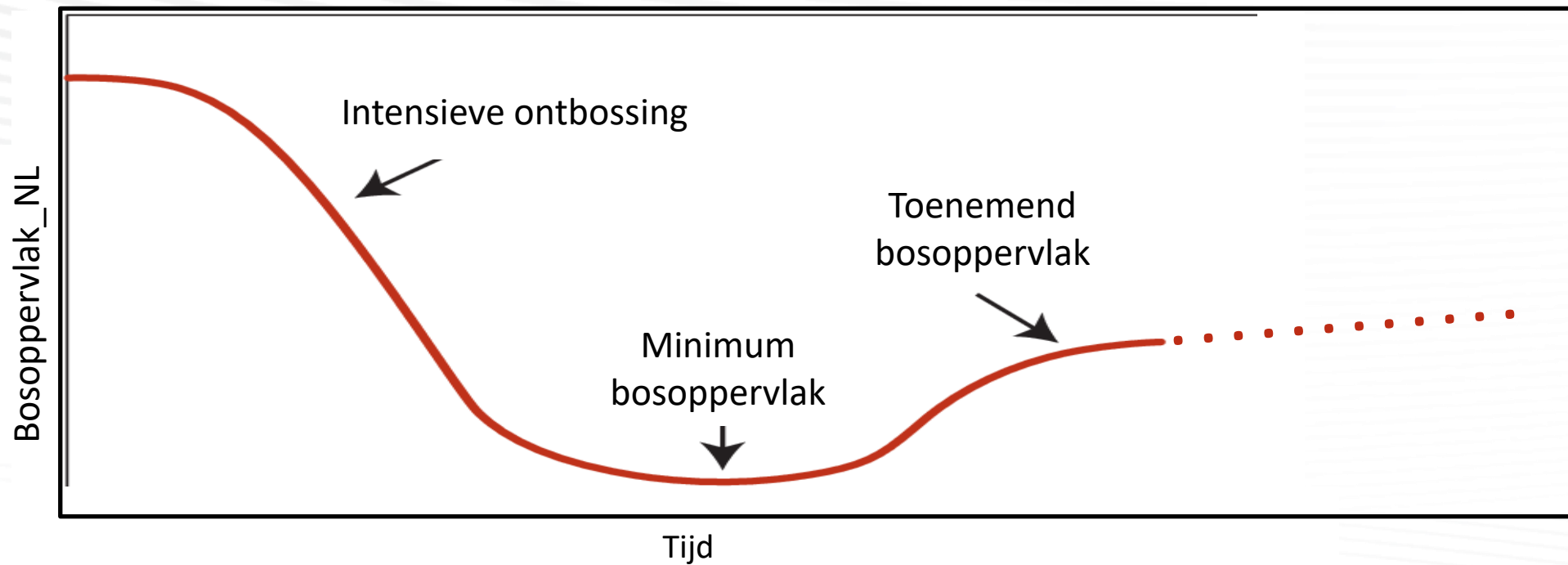
— Bosreservaat — T-boombeheer — Uitkapbeheer

# Structuurherstel

- Horizontale en verticale structuur
- Soortenpool
- Mengingen
- Beheer

## Adaptief beheer

Complex adaptieve systemen gericht op aanpassing

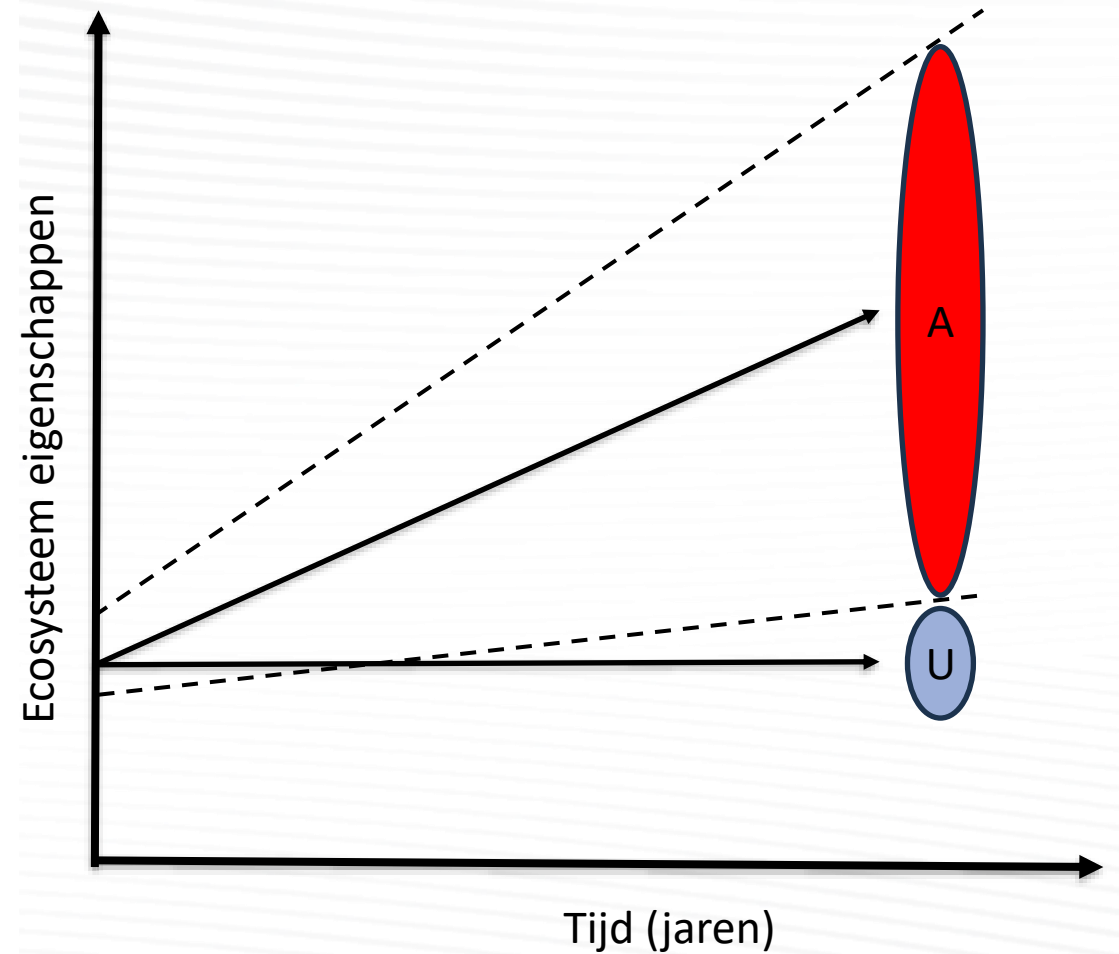
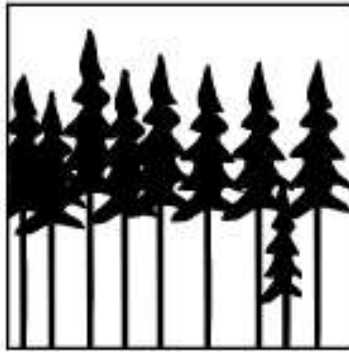
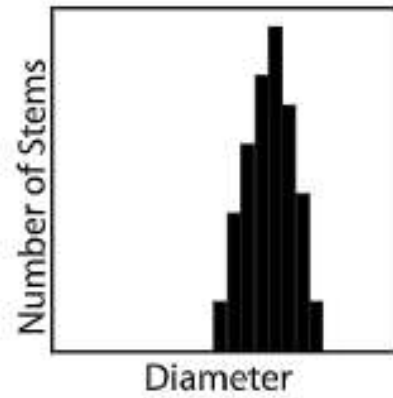
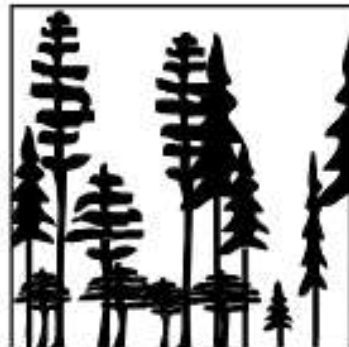
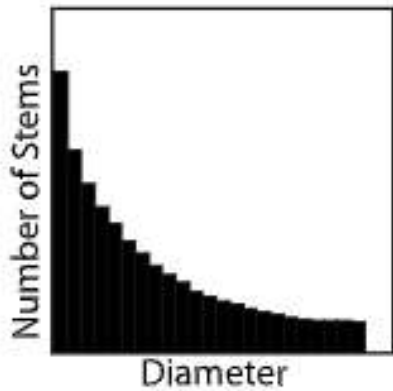
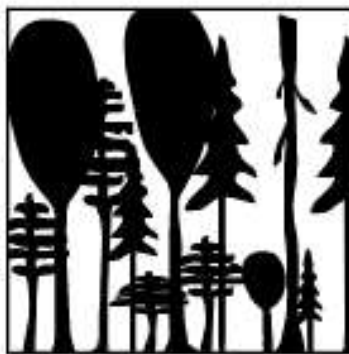
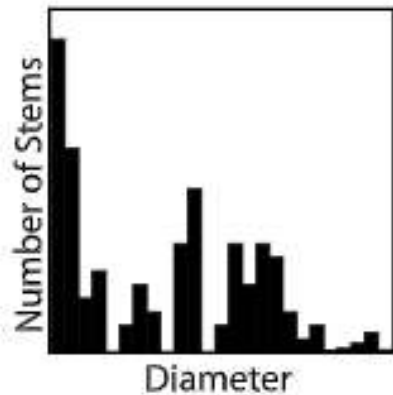




# Adaptief systeem

# Uitkapsysteem

# Monocultuur



	Structuurvariatie	Soortenrijkdom
Monocultuur	-	-
Uitkapsysteem	+	+/-
Adaptief systeem	+	+

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## Forests Are Like Teenagers

There are many analogies between managing a forest as a complex adaptive system and raising teenagers to reach their full potential as adults. Like a forest, teenagers have the attributes of complex adaptive systems. Although parents endeavor to understand them, we cannot predict their future behavior, which makes some parents

**If we instead relax our grip and accept that we have given our teenagers the best upbringing possible, it is very likely that our son or daughter will develop into a responsible individual, although perhaps they will not become the person we had wished for or anticipated.**

best upbringing possible, it is very likely that our son or daughter will develop into a responsible individual, although perhaps they will not become the person we had wished for or anticipated. But if the main attractor (i.e., our education, moral support, love, role modeling, and encouragement) is strong, the child we thought we knew so well is likely to surprise us (i.e., develop emergent properties) in many wonderful ways. They may actually develop into someone beyond our wildest dreams because their upbringing has prepared them to find their own specific solutions to challenges and surprises.

Stormbos reportage | Vier jaar na een verwoestende valwind ligt het bos bij Leersum er prachtig bij. Tenminste, voor liefhebbers van natuurlijke processen. "Het is geweldig om te zien wat hier allemaal gebeurt!"

Na de **valwind** krijgt natuur de vrije hand in Leersums bos



## BEHOUD – Beheerstrategieën voor oude boskernen in Nederland

Oude boskernen in Nederland



**Verbreden kennisbasis**  
Cursusmodule, onderwijsmateriaal, leerbos, MasterClass (docenten, studenten, beheerders)



## Hoogwaardig Houtgebruik

Bos

Hout

Bouw



Groei-potentiaal, droogte-gevoeligheid, menging ...



Opwaardering modificeren, lamineren...



Praktijkvoorbeelden met ketenpartijen



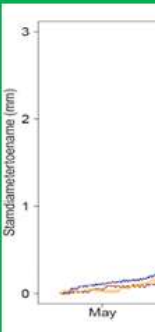
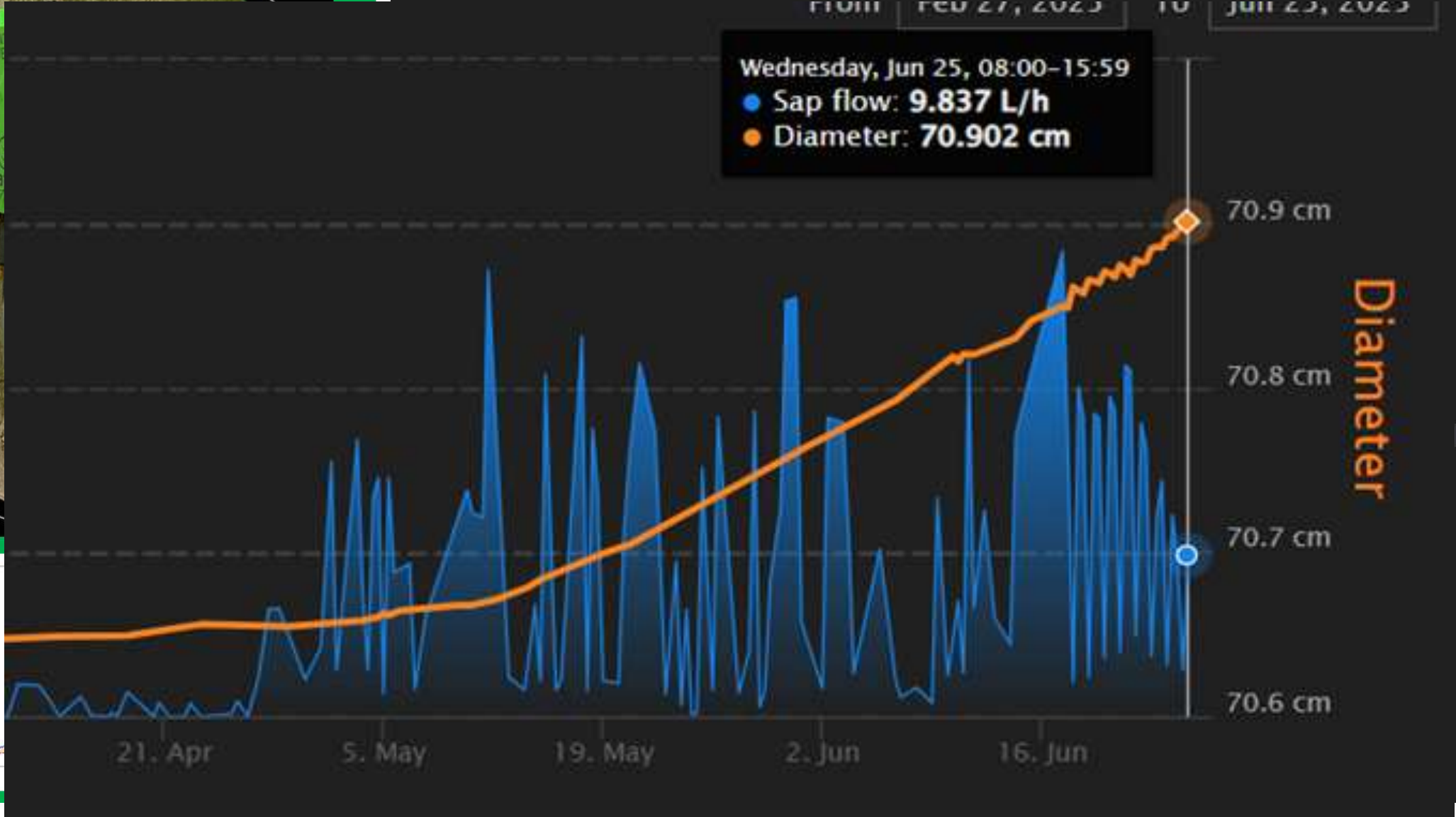
# Sensoronderzoek



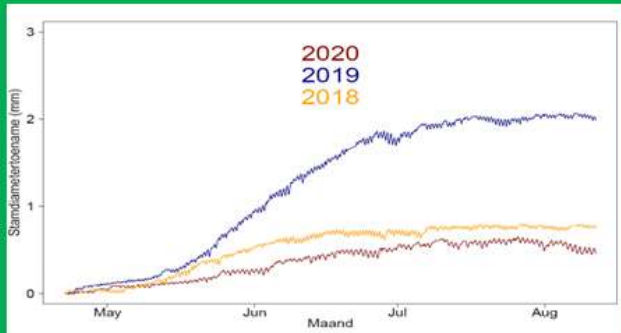
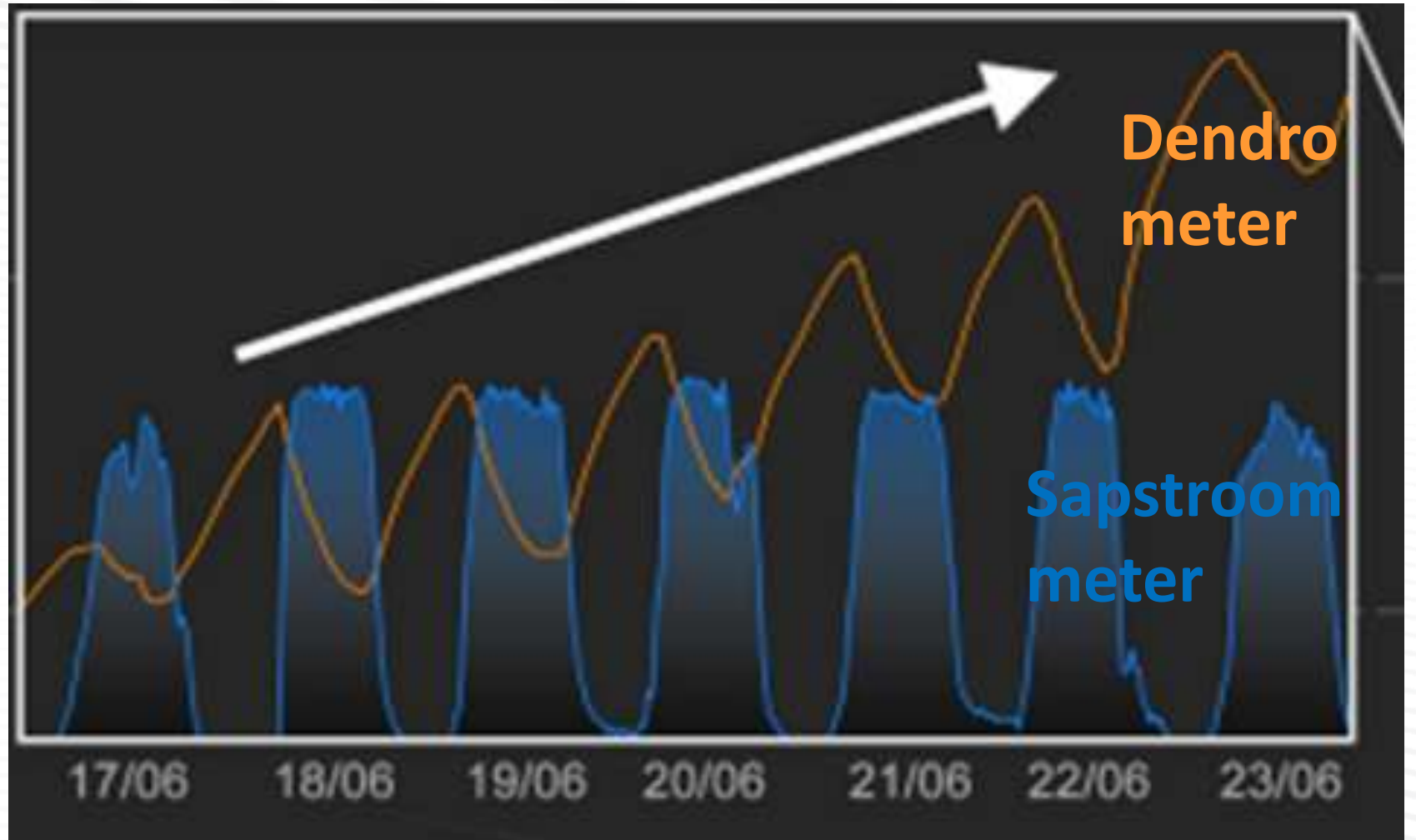
@TW\_Schovenhorst

FROM FEB 27, 2023 TO JUL 23, 2023

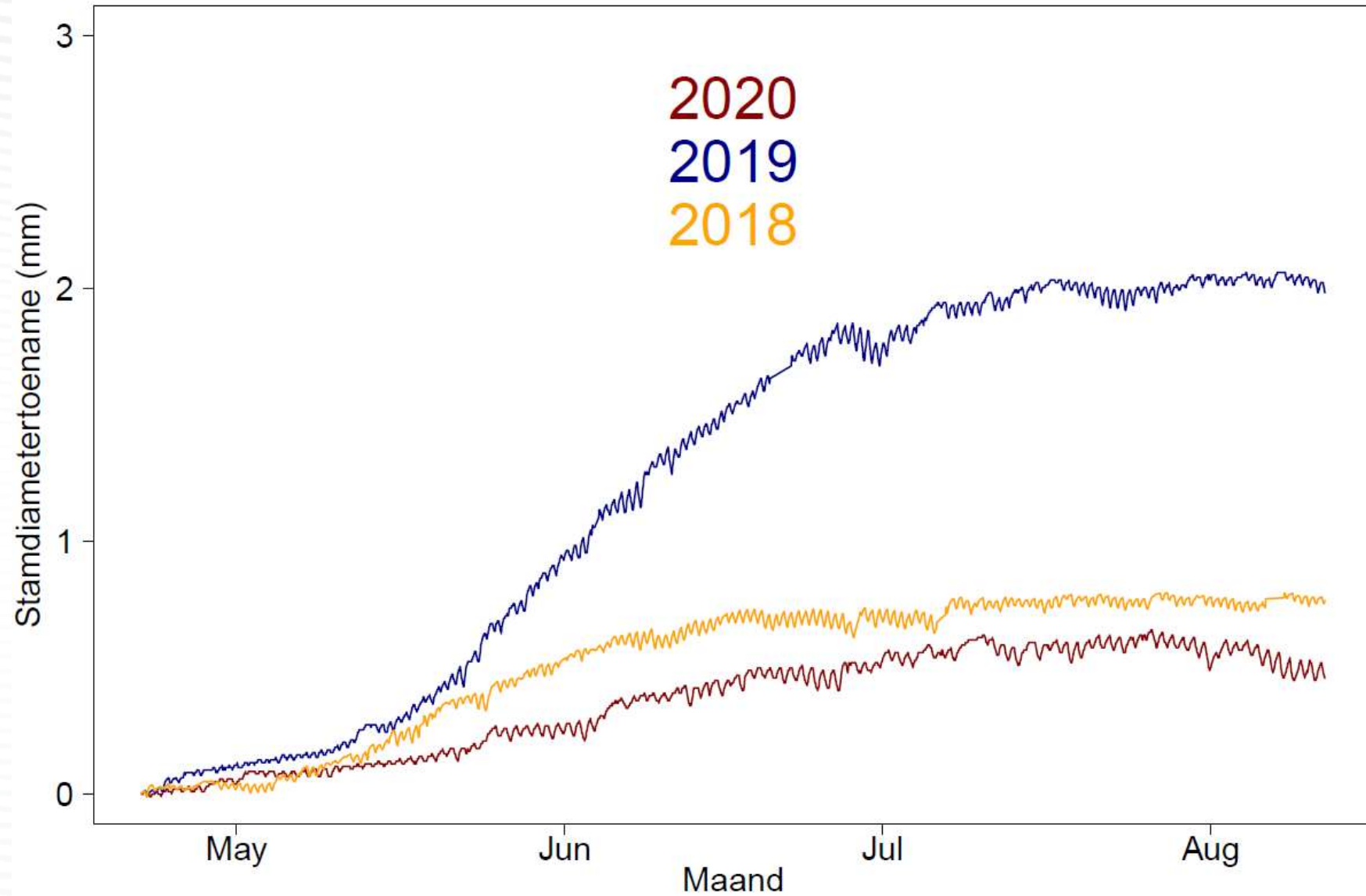
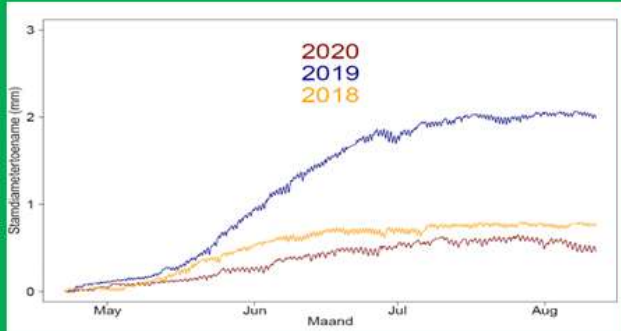
Wednesday, Jun 25, 08:00-15:59  
● Sap flow: 9.837 L/h  
● Diameter: 70.902 cm



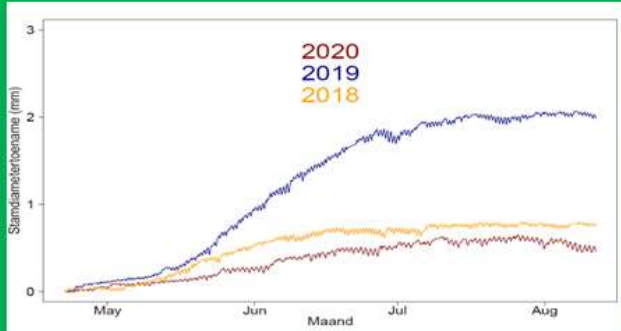
# Sensoronderzoek



# Sensoronderzoek



# Sensoronderzoek



Home Overzicht

## DendroPortaal

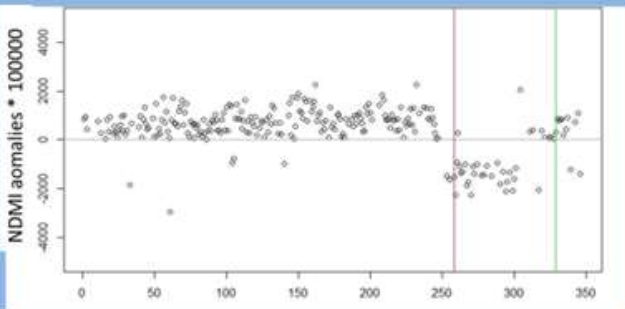
Het DendroPortaal houdt een vinger aan de pols van het Nederlandse bos!

Sinds 2008 wordt de groei van tientallen bomen in Nederlandse bossen nauwkeurig gevolgd. Dit wordt gedaan met dendrometers, die elk uur of zelfs elk kwartier vastleggen hoeveel een boom is gegroeid. Dat gebeurt met een nauwkeurigheid van een duizendste millimeter. Met deze informatie kunnen we inzien hoe bomen reageren op weersextremen, zoals droogte, en hoe ze daarvan herstellen.

Wil jij gebruik maken van de datasets, bijvoorbeeld voor je thesis? Dat kan! Kies de bomen uit waar je in geïnteresseerd bent via het overzicht en mail naar [bas.lerink@wur.nl](mailto:bas.lerink@wur.nl). Je krijgt de datasets dan zo snel mogelijk toegestuurd.



# Remote sensing

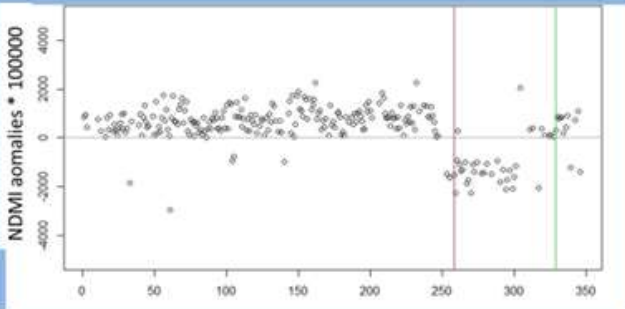


## Opstand Douglasspar

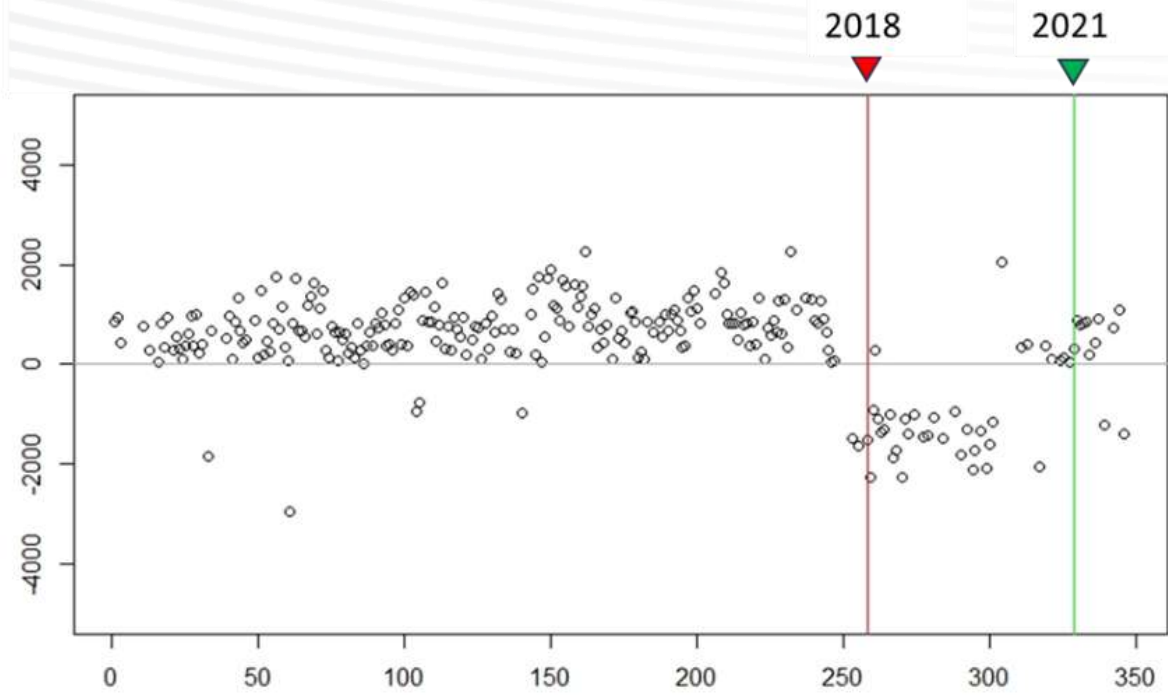


Onderzoek L. Akhmetzyanov, Y. van Duijn (HVHL) & M. Decuyper (WUR)

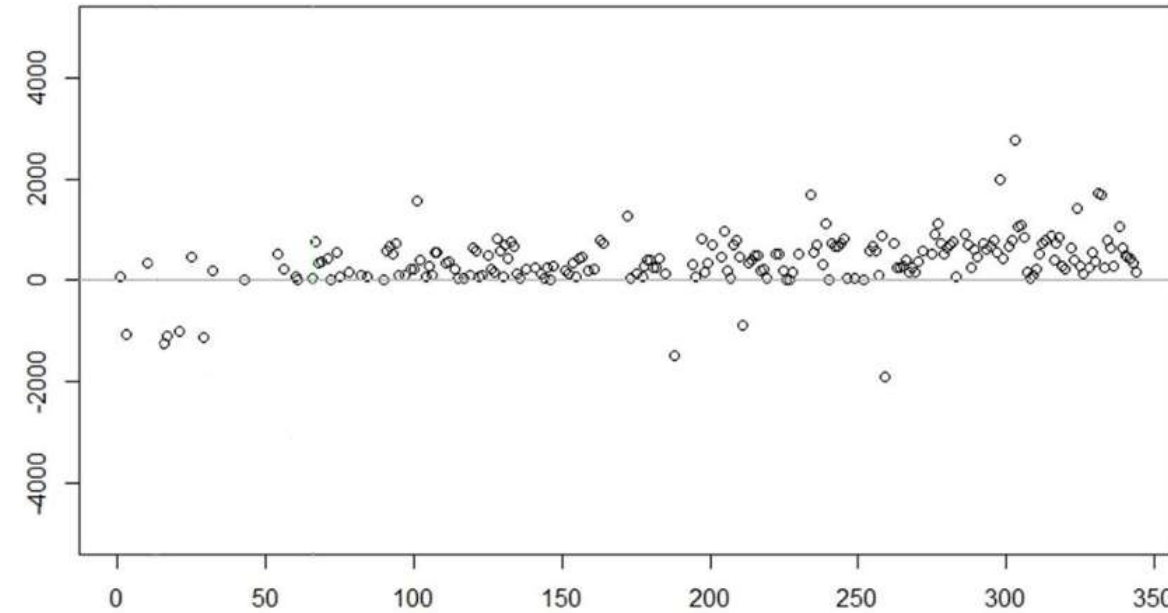
# Remote sensing



NDMI anomalies \* 100000



NDMI anomalies \* 100000



Demo areas

# Southern Netherlands

In the Netherlands, SUPERB will support a wide transformation by enabling nature to thrive once again in a mosaic of forested and agricultural lands in the country's southernmost province of Limburg (municipality of Horst aan de Maas). In addition,

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