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Contribution of agroforestry to climate change adaptation and other ecosystem services: Understanding the drivers, underlying processes and relevancy for policy targets

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Agroforestry can make positive contributions to a multitude of ecosystem services and policy targets

Climate adaptation

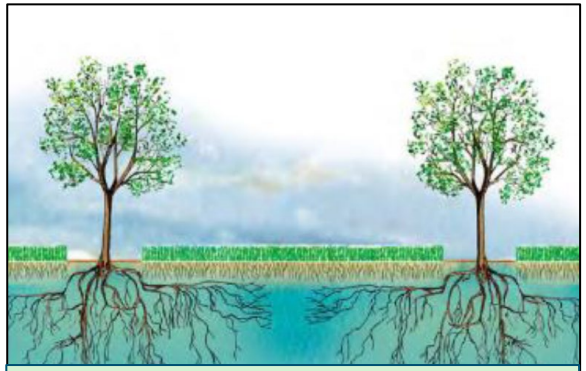
Biodiversity increase

New business models

Landscape value

Carbon sequestration

Animal welfare



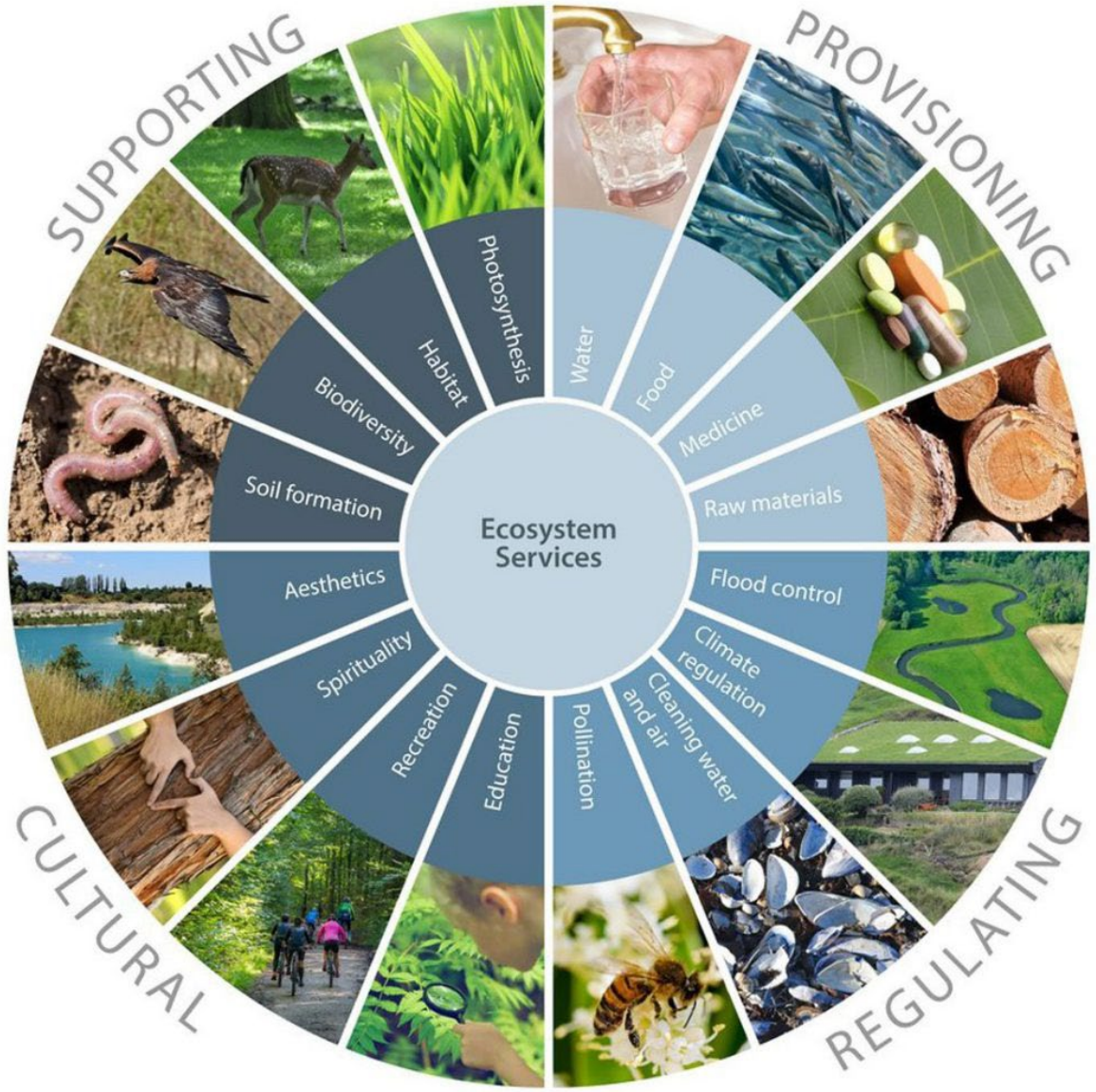
Soil, water & air quality

No news so far ;-)

How to quantify these effects?

Making generic quantifications is impossible → too much variation

- What are the underlying processes and drivers that cause the effects?
- How to make valid estimations on these effects?
- How can I design my AFS to optimise for specific ecosystem services?



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Agroforestry is like a multi-tool

- It has a lot of potential, but its functionality is determined by what you pull out
- Not every combination and configuration is as successful in reaching all the different goals
- When you pull out a lot, it becomes more complex and difficult to manage

Let's disentangle the multi tool to understand the working mechanisms behind the services

And to give more hands-on info to practitioners, advisers and policy makers

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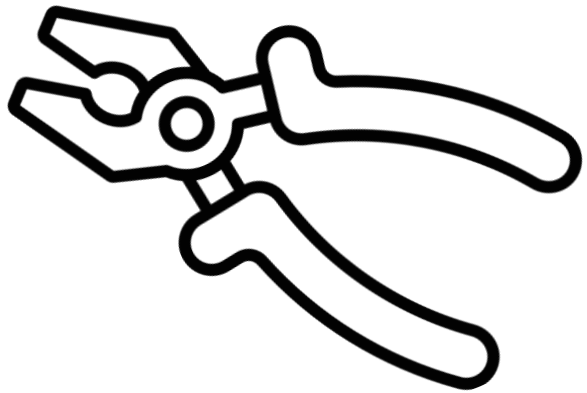
Climate adaptation



→ Agroforestry as a climate robust system?

- Water shortage/drought
  - **Windbreaks** to reduce evaporation in crops
  - **Shadow** to reduce heat stress → crops & livestock
  - Avoid strong competition trees-crops
- Excess water
  - Deep and extensive rooting **trees spread** over the field
    - Improved soil structure and pores for infiltration
  - Trees on contour lines to avoid soil erosion
- Diversified production and income

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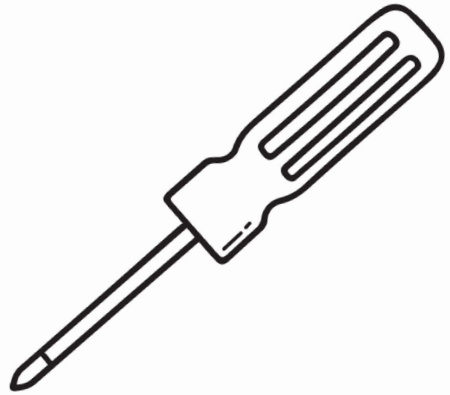
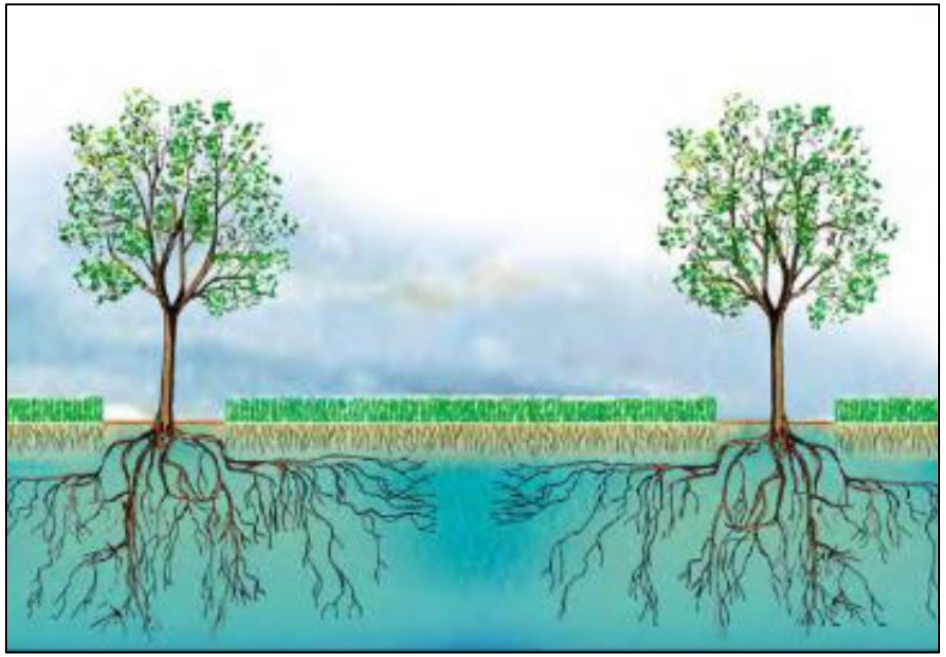
Water quality

→ Trees to reduce leaching and protect water bodies

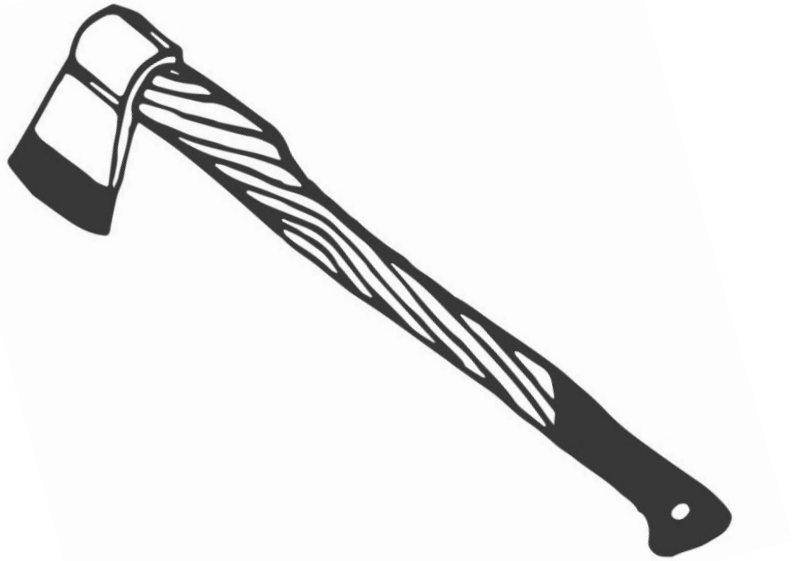


- Deep and **extensive rooting** trees spread over the field
    - Take up nutrients and reduce leaching
- **Placement of trees** to protect water bodies
    - Reduce drift of chemical crop protection
    - Reduce surface run-off into water bodies



Carbon sequestration

→ Trees to sequester carbon in biomass



- Broad range of 1-10 ton CO2/ha/yr (in NL)
    - 75% in tree biomass, 25% in soils
- Mostly dependent on **number of trees** and **growth rate** of trees
- Essential to think of **2nd life** of tree biomass to foster long-term sequestration

Biodiversity

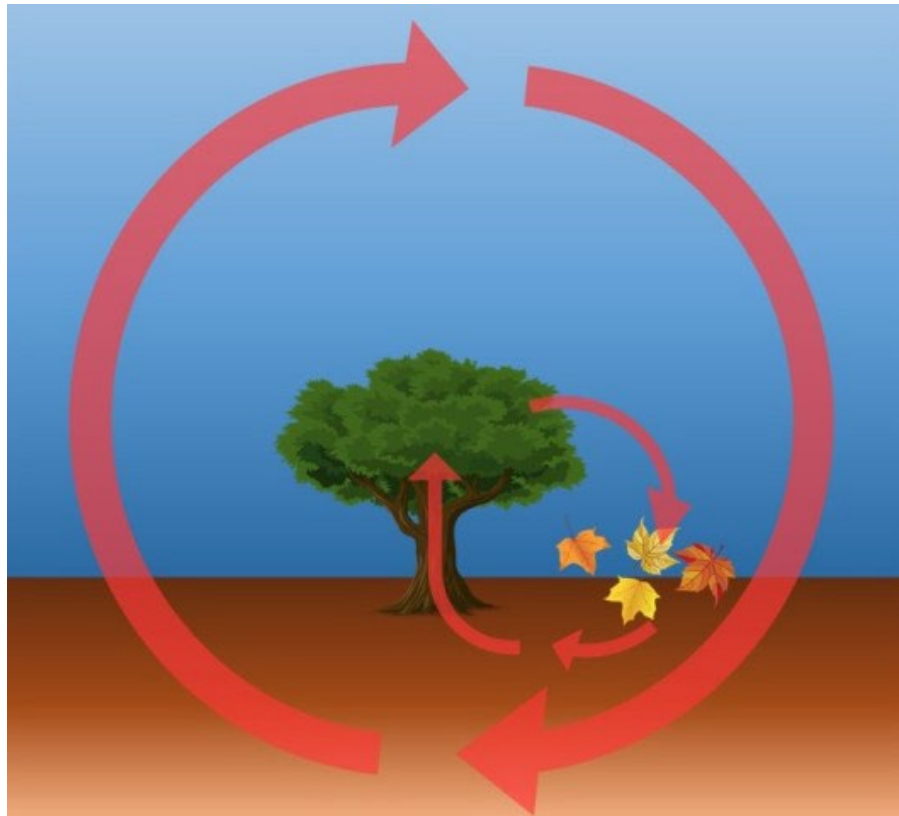
→ more habitats and niches improve species richness

- Diversity of habitats
  - Botanical, structural and spatial **diversity**
  - Understorey vegetation is important!
- Good **integration within local landscape**
  - Connected to existing landscape elements
  - Connected to local 'targeted' nature

Nitrogen dynamics

→ improve nutrient cycling & fix N

- Deep and **extensive rooting** of trees
    - Take up nutrients from deeper layers
- Litterfall
    - Nutrient cycling
    - Organic matter input
- **N fixing trees**
    - Alder, Robinia, sea-buckthorn etc.



Take home messages

- This might not be revolutionary ‘science’, but I dare you to stay curious about the working mechanisms behind certain functions of AFS
- This will help us and other to better understand the functioning of AFS
- We can’t optimise for all benefits at the same time

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