Paris outcome: challenges and possibilities for land managers

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Paris agreement & LAND MANAGEMENT

In Article 2:

ADAPTATION

…"Increasing the ability **to adapt to the adverse impacts** of climate change and **foster climate resilience and low greenhouse gas emissions** development, **in a manner that does not threaten food production**"…

MITIGATION

Article 5:

Parties should **take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases** as referred to in Article 4, paragraph 1(d), of the Convention, **including forests.**

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EU Climate Policy for Agriculture and Forestry

Agriculture: **a source**

- methane (non-ETS)
- nitrous oxide (non-ETS)

Forestry: **a sink**

- Carbon dioxide (LULUCF)

Policy framework unfair for agriculture
– need for flexibility – ***Need to take carbon in***

ETS

Non-ETS

LULUCF
Land Use, Land Use Change and Forestry

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Why carbon? = Mitigation by photosynthesis

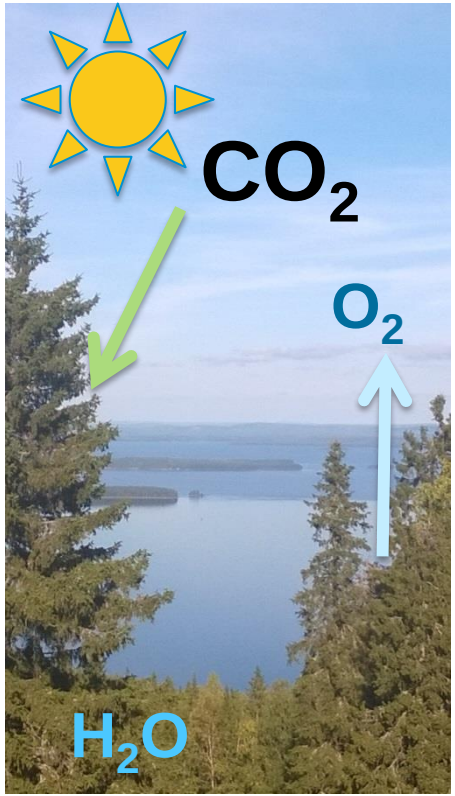
Sun, Carbon dioxide and Water

Carbohydrates and Oxygen

BIOMASS

$6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$

BIOMASS contains 45% carbon



MESSAGE: The principal method for climate mitigation is photosynthesis, enhanced by crop cultivation and forestry

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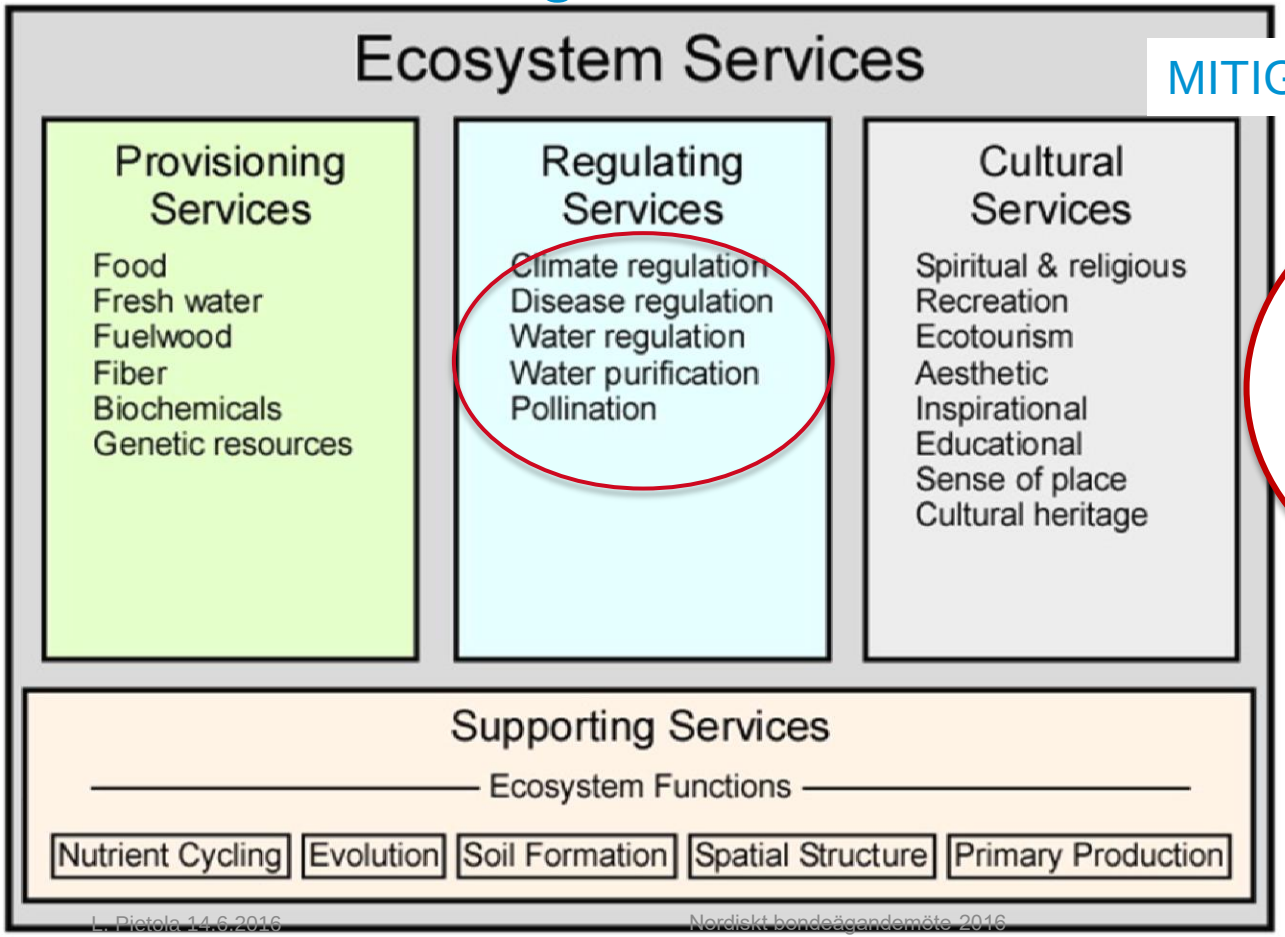
Land management contributes



Modified, with additions, from the Millennium Assessment

MITIGATION: Photosynthesis

Climate regulation
Disease regulation
Water regulation
Water purification
Pollination

ADAPTATION: Soil & water infiltration

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MITIGATION:
Closing yield gaps by land use optimization

Diverse land use:

Soil productivity matters in cultivated areas

Arable soils:

1. **High yield level parcels**
2. Set-asides
   - for biodiversity
   - for fertility recovery
     - for soil care, rest

Photo: Airi Kulmala

Adaptation by water management

Extreme weather conditions

- Floods
- Heat and Drought

Water Management

- **Irrigation**
- **Drainage**

Soil Structure Care

- **Soil organic matter**

90 % of our arable soils need ditches

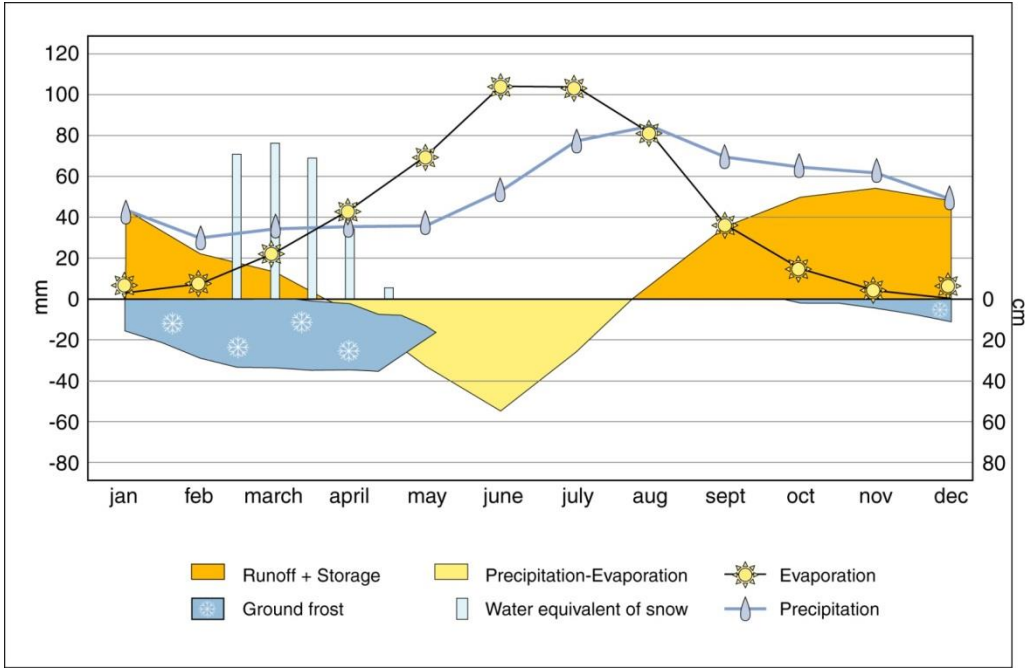


Figure: Finnish Drainage Foundation

Soil and sustainable intensification a key for

Climate mitigation

1) Photosynthesis: **CO_2 removal by closing yield gaps**

- make most use of yield potential
- set aside non-productive plots

2) **Soil** management:

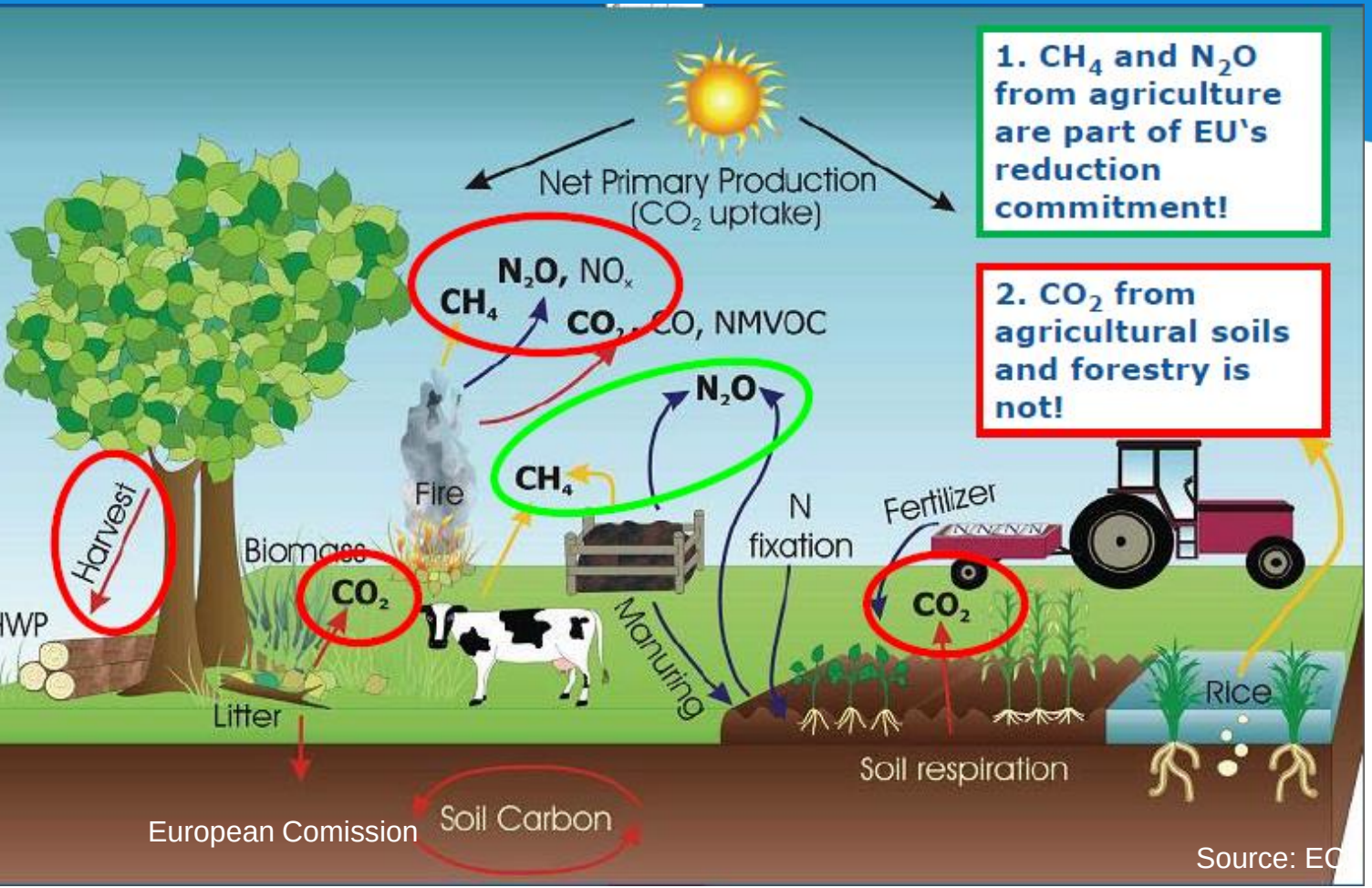
Reduction of GHG- emissions

- by crop cover, reduced tillage
- vigorous crop growth

Climate adaptation

3) **Soil** resilience: **crop growth conditions**

- Soil structure: carbon storage
- Soil hydrology: water management
- Soil biological activity
- Soil chemical fertility



?

STILL EXCLUDED?

CO_2 removal by photosynthesis of harvested yields

= CROP YIELD

+ RESIDUES
+ ROOTS

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To adapt and mitigate:

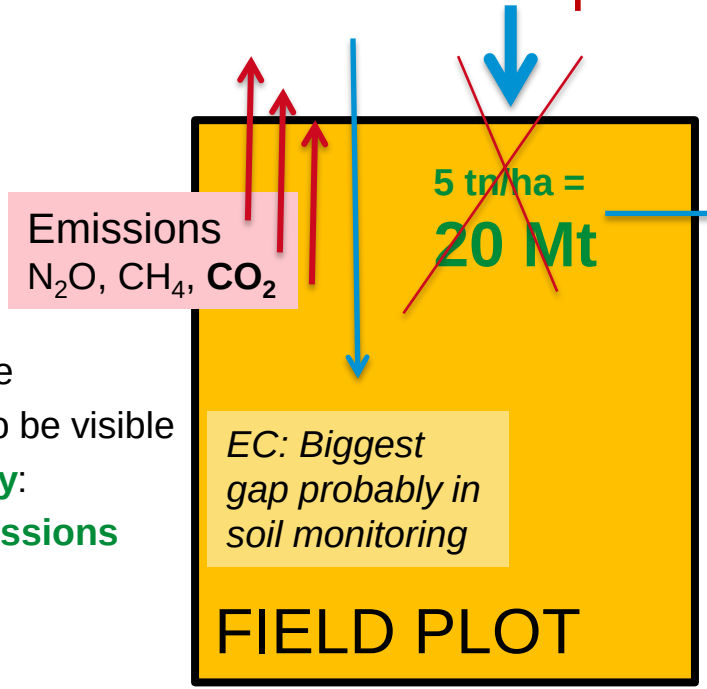
The point is how much and how we produce

How much = yield

How = emissions

Carbon removed by the harvested yield need to be visible for **resource efficiency**:

= carbon in **yield / emissions**



HARVESTED YIELD – 20 Mt CO_2 /v

But harvesting zero the carbon sequestration – the removal outside the plot.

…the sequestrated carbon will sail the seas in cargo ships – once consumed when emission are zero

- Is that fare?

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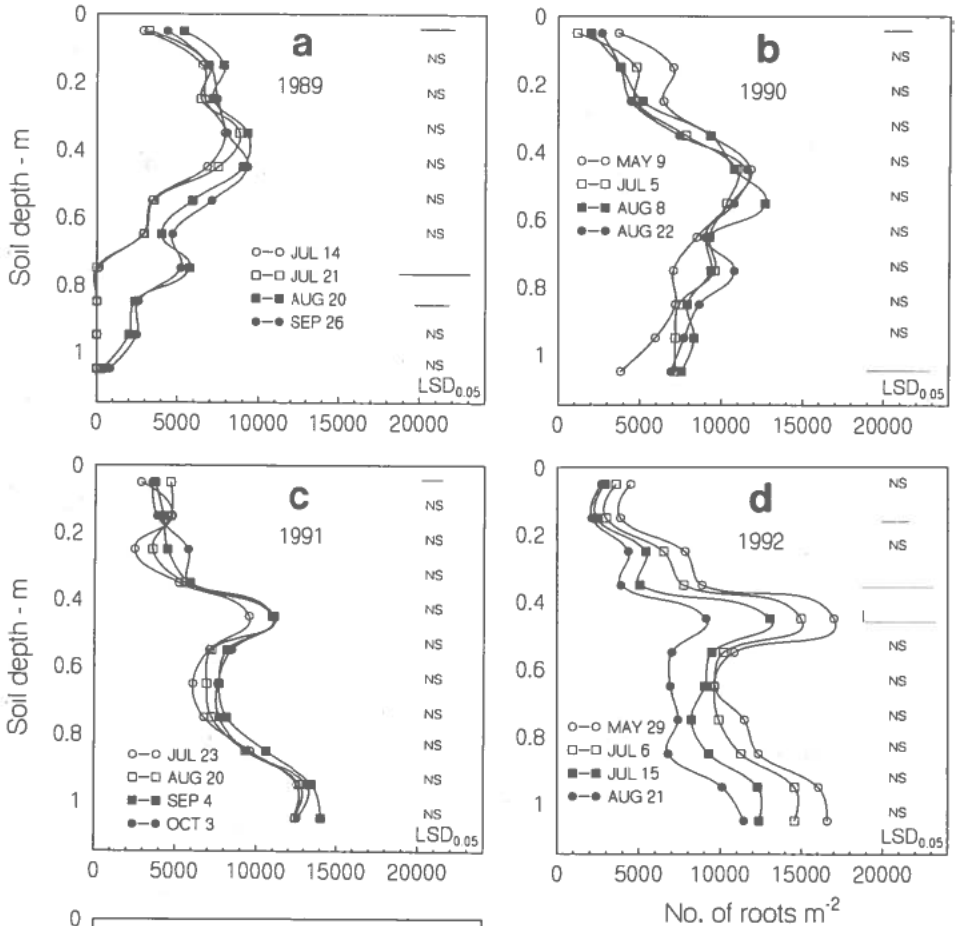
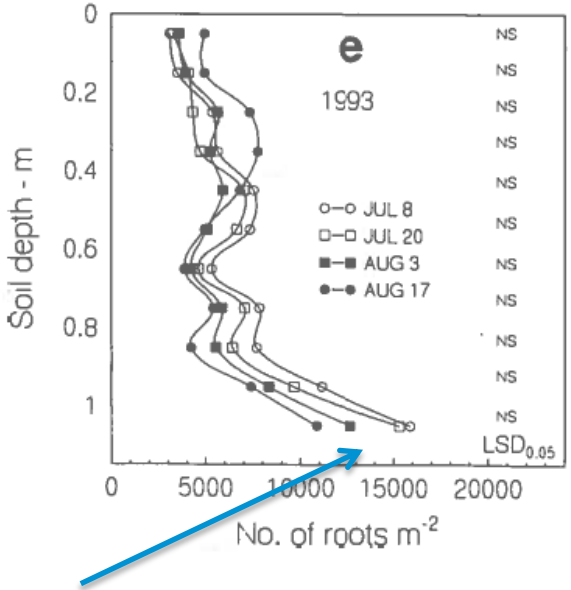
AGRONOMY JOURNAL, VOL. 87, NOVEMBER–DECEMBER 1995





Majority of alfalfa root growth below 1 m soil depth after 5 years

Source: Pietola & Smucker 1995

IPCC undermines herbaceous biomass

IPCC: Plant biomass constitutes a significant carbon stock in many eco-systems. Biomass is present in both above-ground and below-ground parts of annual and perennial plants. Biomass associated with annual and **perennial herbaceous** (i.e., non-woody) plants is relatively ephemeral, i.e., it decays and regenerates annually or every few years. So **emissions from decay are balanced by removals due to re-growth making overall net C stocks in biomass rather stable in the long term.**

Thus, the **methods focus on stock changes in bio-mass associated with woody plants and trees**, which can accumulate large amounts of carbon (up to hundreds of tons per ha) over their lifespan.

We need to see carbon recycling & soil storage

Case Finland

Reported Emissions from agriculture
15 Mt CO_2-ekv

Soil CO_2: 6.5
Soil N_2O: 4
Animal CH_4: 2
Energy use: 1.5
(MTT Report 127, 2014)

Lacking fast CO_2 release from decaying biomass **~ 10 Mt?**

Arable soils with plants remove
35 Mt CO_2-ekv annually

if production 9 tn /ha dry matter
i.e. 4.3 tn C*
i.e. 9.5 tn CO_2 **
for 2.3 milj. ha

* C content in dry biomass 45%
** CO_2 = 44/12 x C

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Farmers have keys to remove and recycle C

We have potential for photosynthesis = major climate measure

Are we allowed to use our options for green growth?

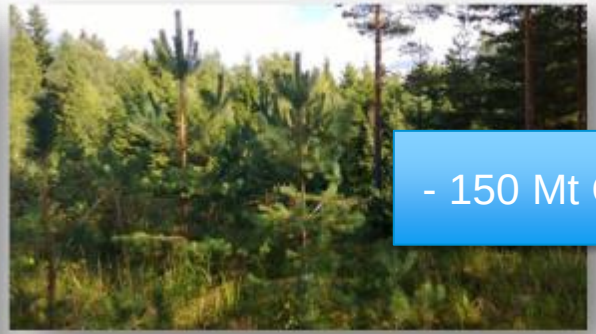
EU emissions <5000
Global 50 000 Mt CO_2-ekv /a

Figures from Finland:

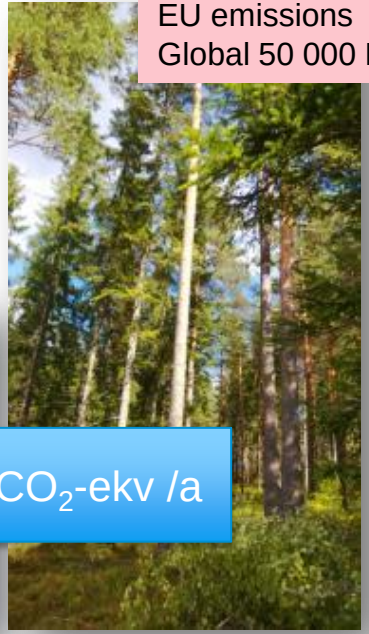
In diverse land use we have ecosystem services like climate regulation

- 35 Mt CO_2-ekv /a

+ 2 Mt CO_2-ekv /a



- 150 Mt CO_2-ekv /a



Future climate policy and CAP set the limits and incentives

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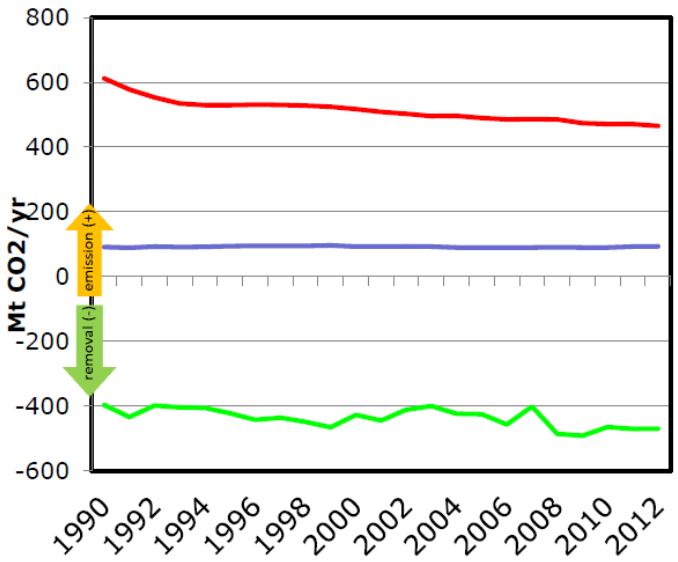
Agriculture has some potential to mitigate

Agriculture reduced GHGs by ± 24% since 1990

MTK: More potential if CO_2 would be monitored correctly



In 2012:

→ **Agriculture (CH_4, N_2O)**
≈10% of total EU GHGs

→ **Croplands (CO_2, under LULUCF)**
≈2% of EU GHGs

→ Forests (LULUCF) absorbs
≈10% of total EU GHGs

(data from MS GHG inventories)

Conclusions

Photosynthesis: A key to reverse climate change

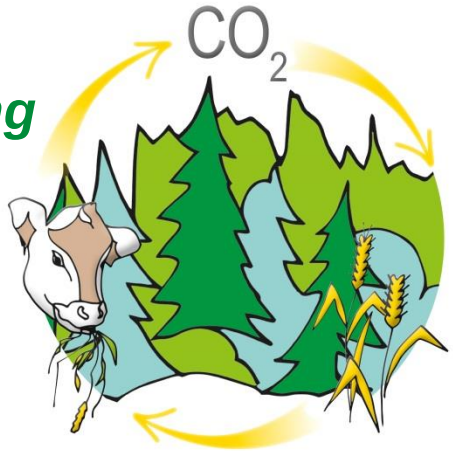
- Do we have a indicator for this major mitigation?
- Do we have fair accounting? Today harvest zero carbon removal effect
- We do have reduced tillage, set asides… but no measures for real carbon removal

Photosynthesis need adaptation for excess water in then North

- But do we support drainage enough? Drainage cost 2000 €/ha
- Do we support soil management
    - As landowners for farmers?

Thank you for your attention

We put carbon circulating



by cultivating land
& producing wood