Conservation agriculture

W. Sukkel, september 2008 (based on presentation T. Friedrich FAO)

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The combination of
• Continuous zero tillage
• Permanent soil cover and
• Crop rotations
has become known as
Conservation Agriculture

Why conservation agriculture?

- Degradation of arable soils all over the world
  - Erosion (wind, water), decreasing o.m.
- Climate change
  - Adaptation and mitigation
- Water management
- Biodiversity
- Costs

Total area under Conservation Agriculture worldwide 95 Million ha

(Derpsch, 2005)

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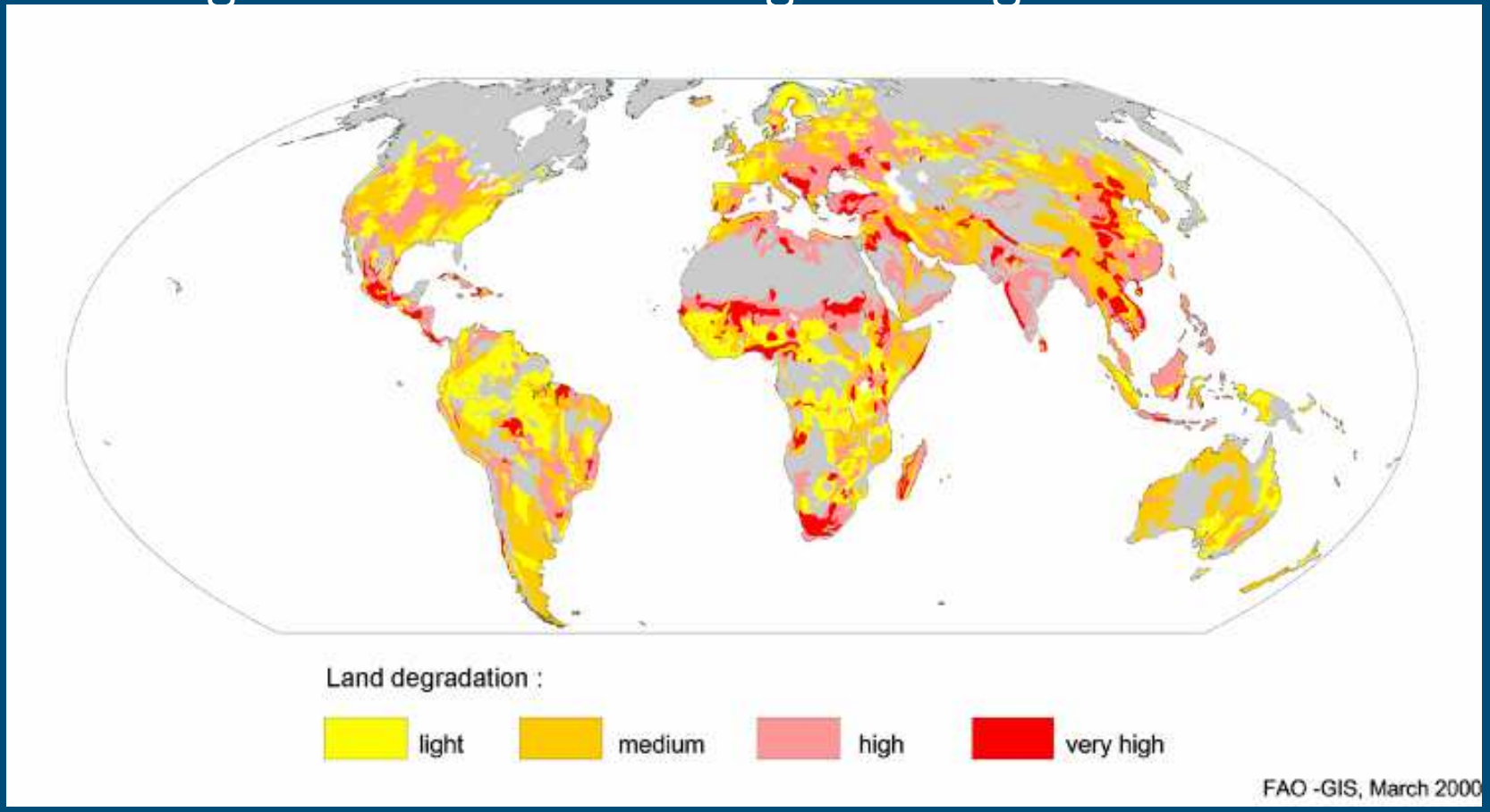
Degradation of soil resources:

All agricultural soils show signs of degradation



World map of severity of land degradation – GLASOD (FAO 2000)

Erosion

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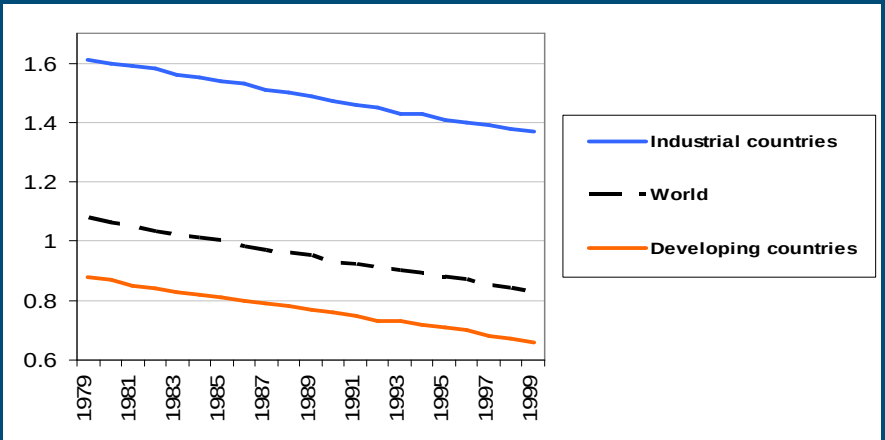
Degradation of water resources:

- In 2025 the water consumption will exceed the available „blue water“
- 70% of actual water use is for agriculture
- Falling groundwater tables are common
- Drought periods and floods are increasing
- Increased temperatures and more erratic rainfall will affect rainfed agriculture

Degradation of land resources:

- In Asia 90% of potential land is already used
- 1.3 Million ha of agricultural land are lost every year (urbanization)
- Available land per person is declining



Agricultural land per capita (ha)
(FAO statistics, 2001)

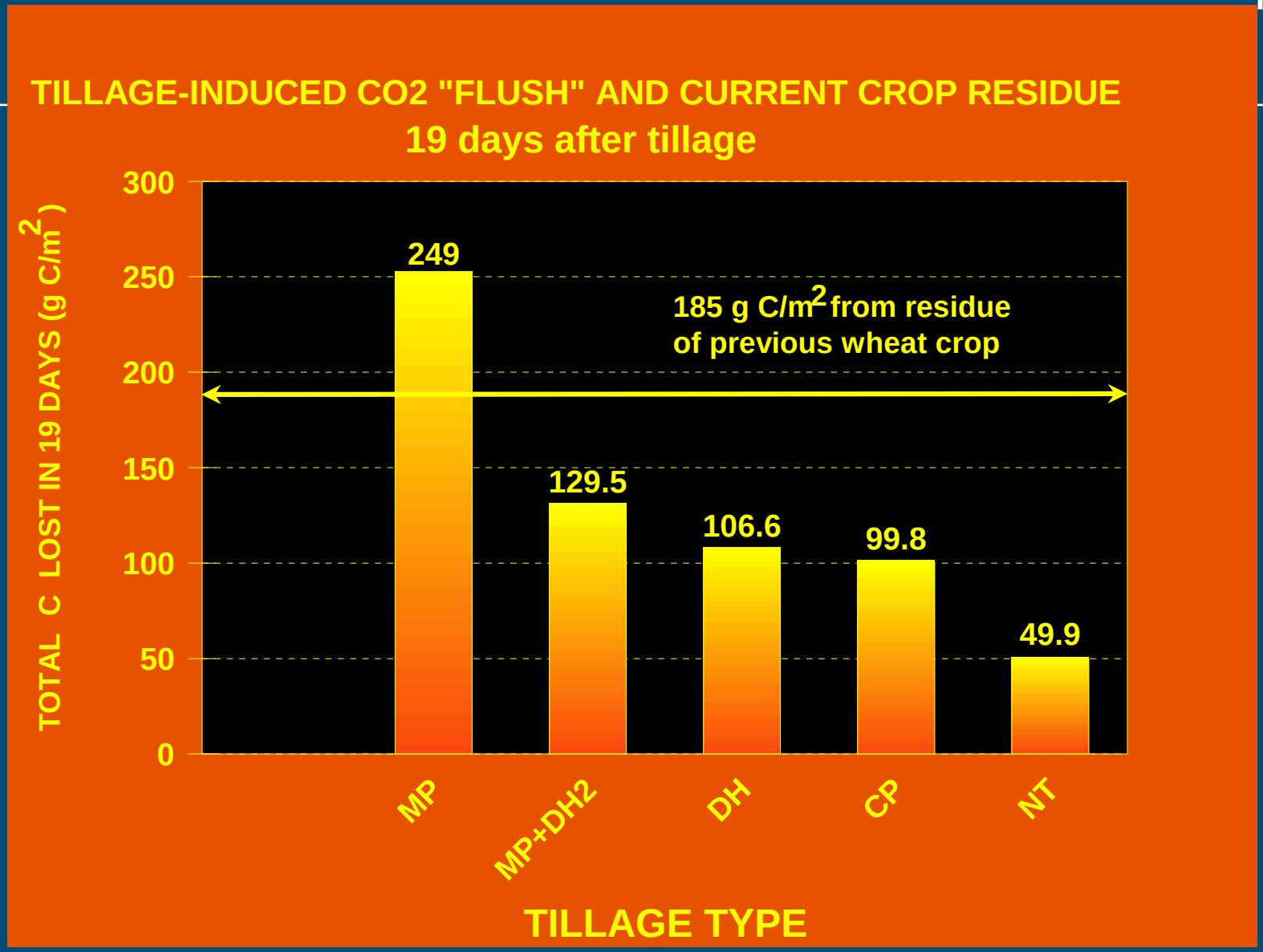
Degradation of biodiversity:

- Reduced biodiversity resulting from high yielding varieties, monocultures, intensive use of agrochemicals and tillage
- Increased vulnerability of cropping systems
- Reduced efficiency and profitability of input use

Climate and Climate Change

- extreme precipitation
- extended drought periods
- agriculture is directly affected by CC
- agriculture handles 40% of land
- agriculture is contributing to CC
- agriculture can mitigate and adapt to CC

Tillage-induced Carbon Dioxide Loss


TILLAGE-INDUCED CO2 "FLUSH" AND CURRENT CROP RESIDUE
19 days after tillage
TOTAL C LOST IN 19 DAYS (g C/m2)
300
250
200
150
100
50
0
249
129.5
106.6
99.8
49.9
185 g C/m2 from residue
of previous wheat crop
MP
MP+DH2
DH
CP
NT
TILLAGE TYPE

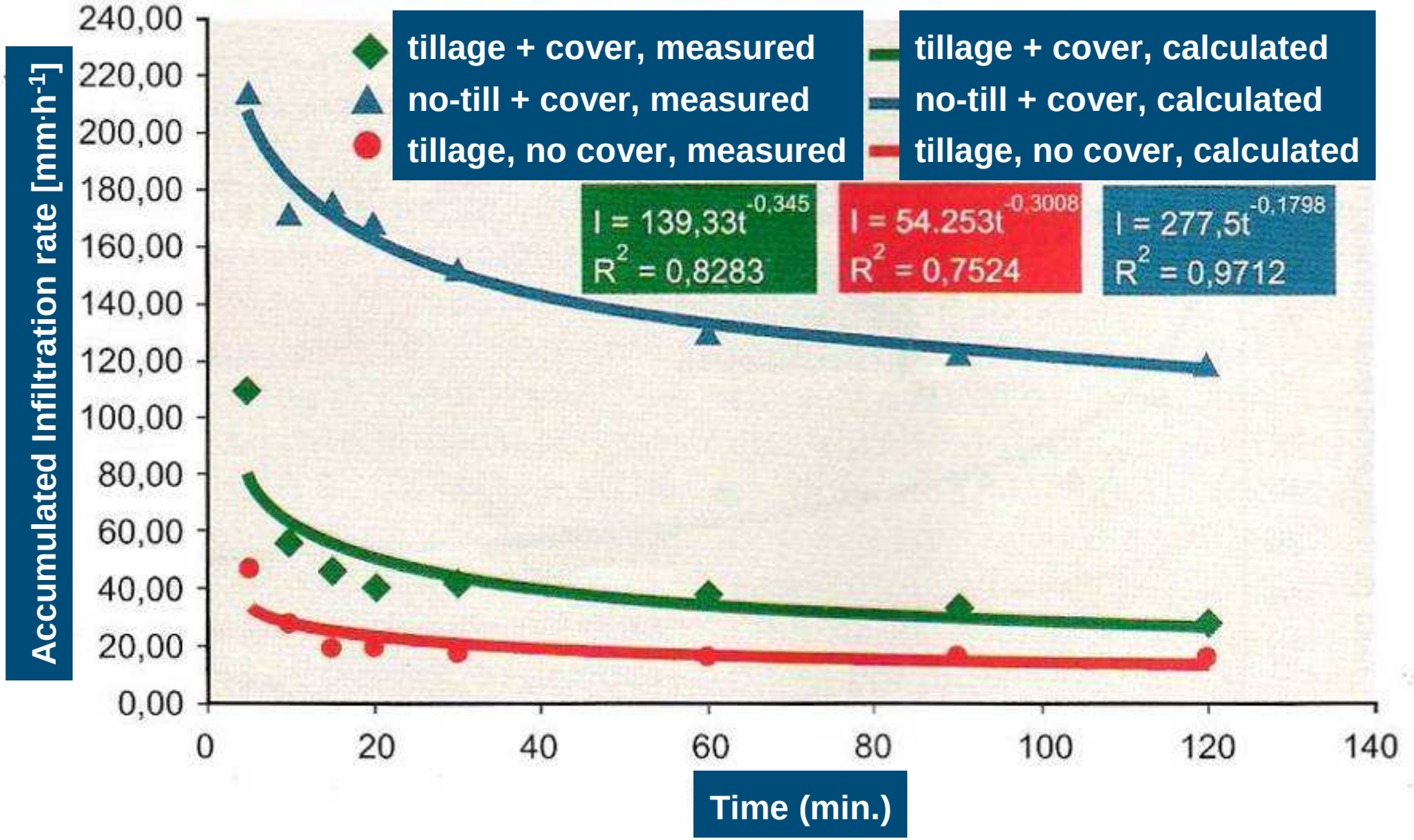
effect of CA on soil:

- CA adds up to 1 mm soil per year
- organic matter increase at about 0.1-0.2% per year until reaching a saturation
- different rooting systems for more efficient use of soil nutrients
- soil structure more stable
- erosion and degradation stopped/reversed

effect of CA on water:

- recharge of aquifer (permanent macropore structure in soil)
- improved water quality (less leaching and erosion)
- more available water in soils (1 % OM = 150 m^3/ha)
- reduced water losses (evaporation), better water efficiency (requirements -30%)

Gains in Rainfall Infiltration Rate with CA



CA and climate change:

- mitigation through emission reductions (fuel, N_2O, CH_4)
- mitigation through carbon sequestration up to 0.2 $t \cdot ha^{-1} \cdot y^{-1}$ C
- adaptation through better drought tolerance
- adaptation through better water infiltration (less flooding)

Advantages for the farm:

- Higher yields. 0-30%
- Input savings (N fertiliser, pesticides)
- 50% saving in machine capital (tractors)
- 3-fold lifetime of tractors
- 40% smaller tractors
- 50% labour saving
- 70% fuel saving

The knife roller to flatten the crops

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Pest management in CA:

- Establishment of new balance takes 2 years
- Crop rotations and mulch cover provide elements for natural pest and disease control (IPM)
- Healthier soil = healthier plants
- Pesticide use is after change to CA not higher than conventional
- Over the long term pest and disease problems decrease (less pesticides)
- Pesticide use must not interfere with biological processes in the system

Weed management in CA:

- First two years critical when changing over
- General rule: avoid weeds to mature, avoid fallow/open soil surface; let seedbank decay
- Mulch cover, cover crops, crop rotations are the main tools for weed management
- Herbicides are useful for sanitation
- Herbicide use at beginning is equal or slightly increased, declining over time
- CA without herbicides is possible

CA in the Netherlands?

- Erosion doesn't play a dominant role in NL
- CA mostly used in rotations of mowing crops
- Most results are in extensive agriculture
- Motivation for NL is soil quality, system stability, climate change, water, biodiversity

Challenges:

- Root crops
- Crops with small/vulnerable seeds
- Weed control
- Set back in conversion years