

Soil compaction

Good soil condition leads to healthy crops

Soil

- One of the most significant conditionally renewable natural resource
- The reasonable and sustainable use, protection, maintaining its condition and multifunctionality is a general interest of mankind

Soil

- 3 or 4 phases heterogeneous polydisperse system
 - Solid
 - Water
 - Gas
 - Biological



Soil

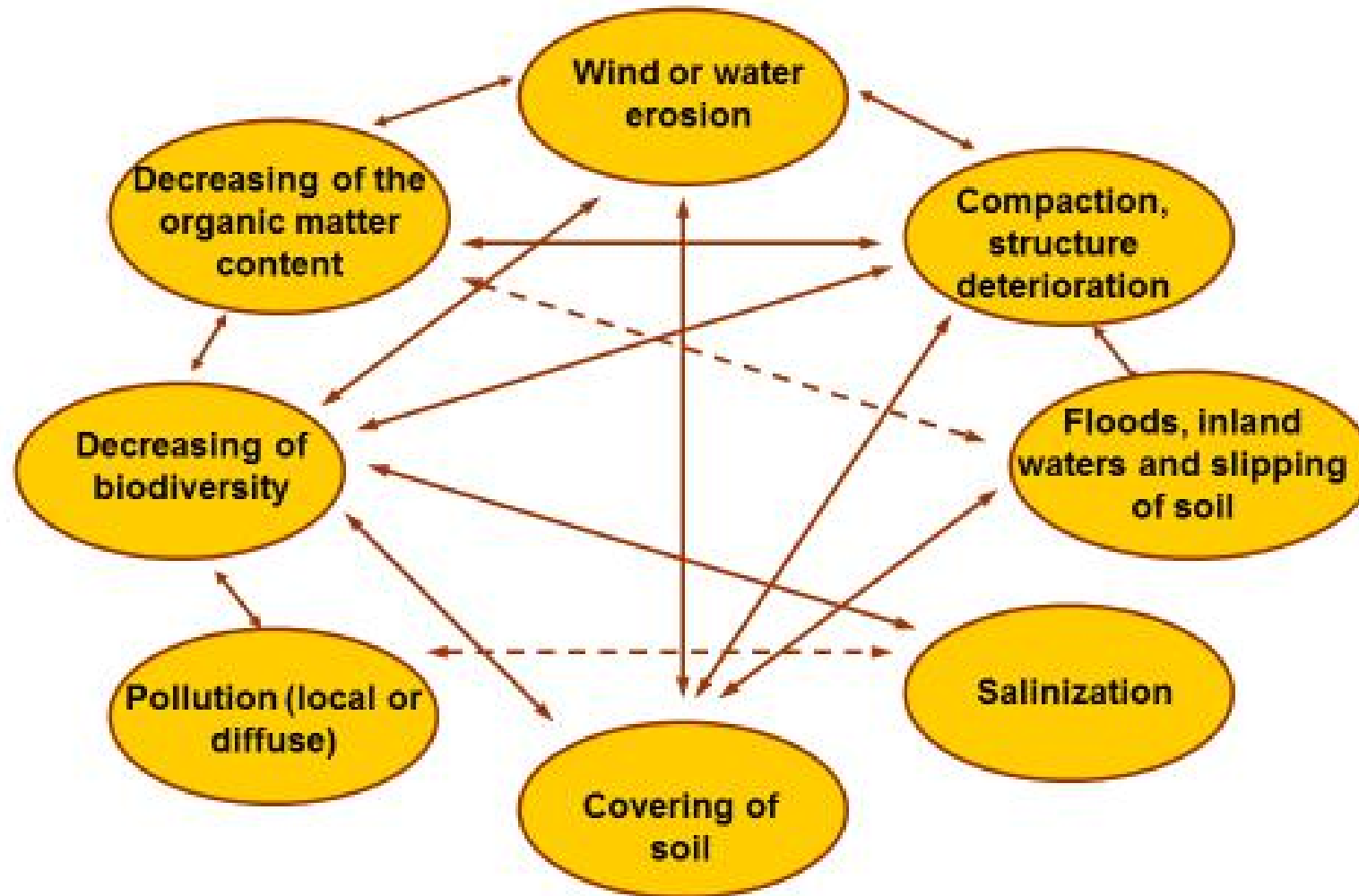
- A major component of the Earth's ecosystem
- Important carbon reservoir
- Recycling system for nutrients and organic wastes
- Regulator of water quality
- Modifier of atmospheric composition
- Medium for plant growth

Soil

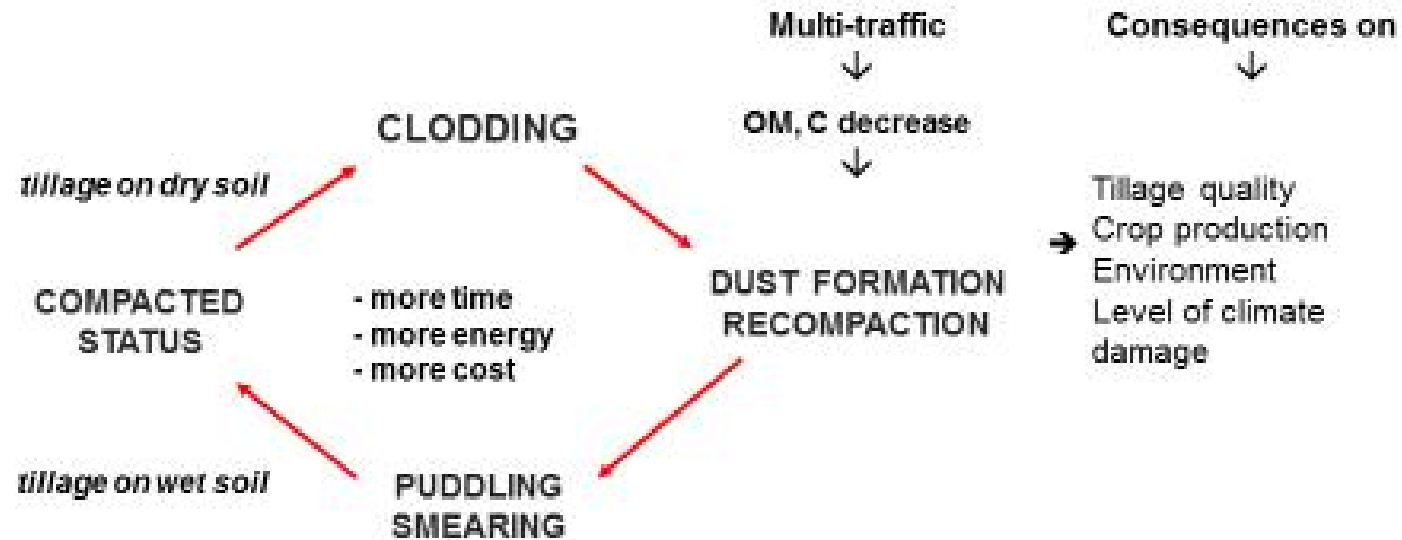
Humanity can survive
the running out of fossil
energy,
but cannot survive the
running out soil



Soil Degradation Processes in Europe



Soil state consequences fulfilling the "crop demands"



- Soil degradation (clod, dust, water and wind erosion)
- Soil compaction
- Crusting, capping
- Declining biological activity
- Decrease/loss of OM
- Soils turning into 'minute soils'
- Deteriorating workability, bearing capacity

**Greater sensitivity
to climate
damages**

Soil compaction

- may develop through **natural** (physical and chemical) **processes** and through human activity
- appears most frequently under natural conditions in soils of low organic and inorganic colloid contents
- Soils are compacted
 - by loss of water,
 - drying out,
 - under the impacts of rain or snow and
 - as a result of persistent water coverage

Soil compaction

- **Tillage induced compaction** is a mechanical stress degrading the structure of the soil and its permeability by water, heat and air, and is affected by the following:
 - traffic on the soil, particularly when wet
 - working of wet soil
 - the weight of machines
 - the pressure
 - tillage to the same depth repeatedly over a longer period of time

Tillage pan compaction

- A variety of **tillage tools** (disk, plough, cultivator with wing share, rotary harrow), while loosening the top soil layer, **create a compact tillage pan** in wet soil on the borderline between the tilled soil layer and the undisturbed soil below.
- **It is not visible on the surface.**
- **Plough pan** appears underneath the ploughed layer at a depth between 20-36 cm
- **Disk pan** appears below the usual depth of disking: 6-18 cm.

Plough pan



Photo: M, Birkás



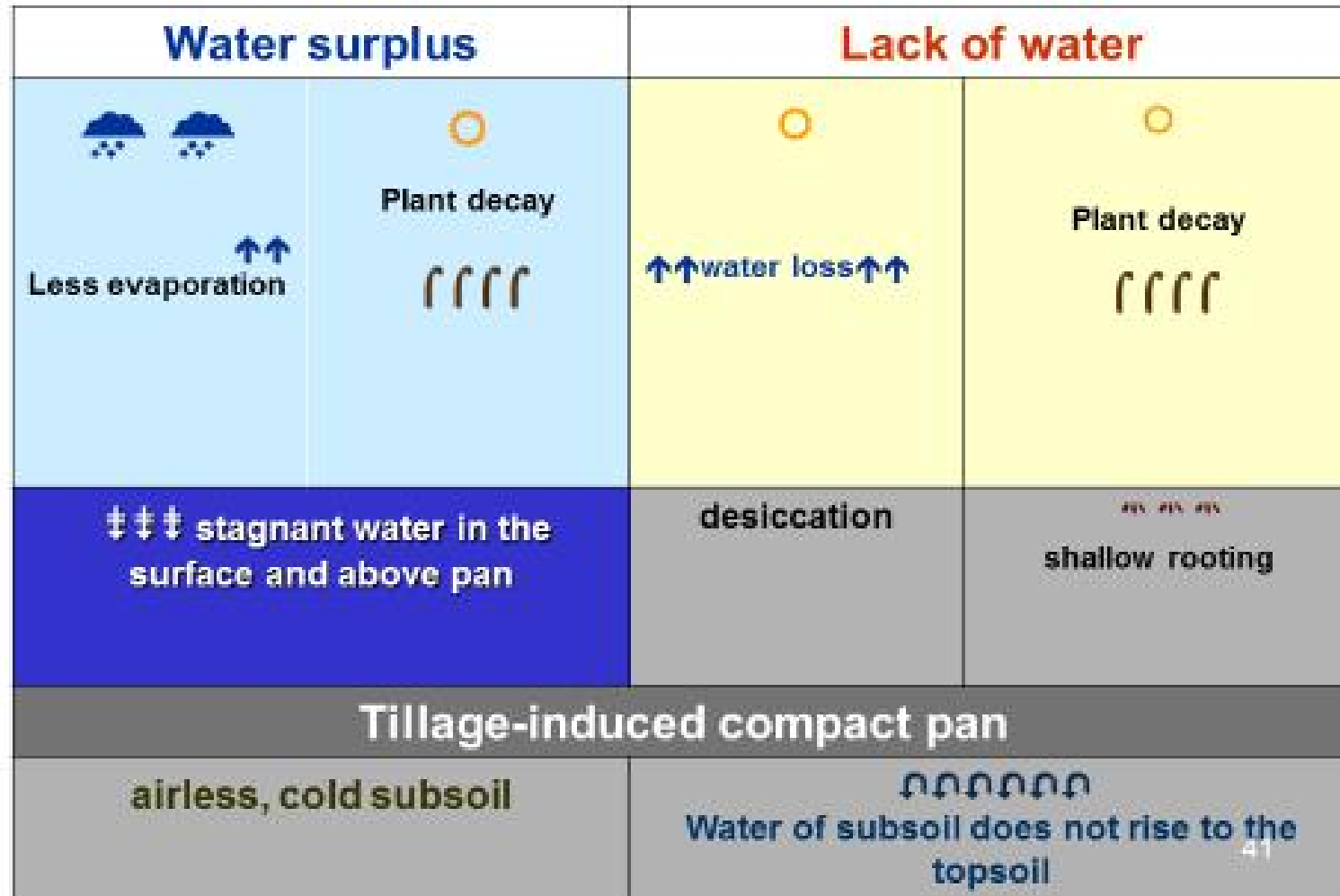
Effects of compaction

- Reduced root zone
- Increasing sensitivity of crops to drought
- Clod formation
- Dust formation
- Less yield

Effects of compaction

- Rainwater accumulating in larger quantities above the compact layer results in damage by water
- Water, air and heat transport are reduced
- Water that cannot seep into the soil will never be utilised by crops!
- Bad soil state = less stored water + greater loss
- Stress!

Drought damages in compacted soils following a wet growing season

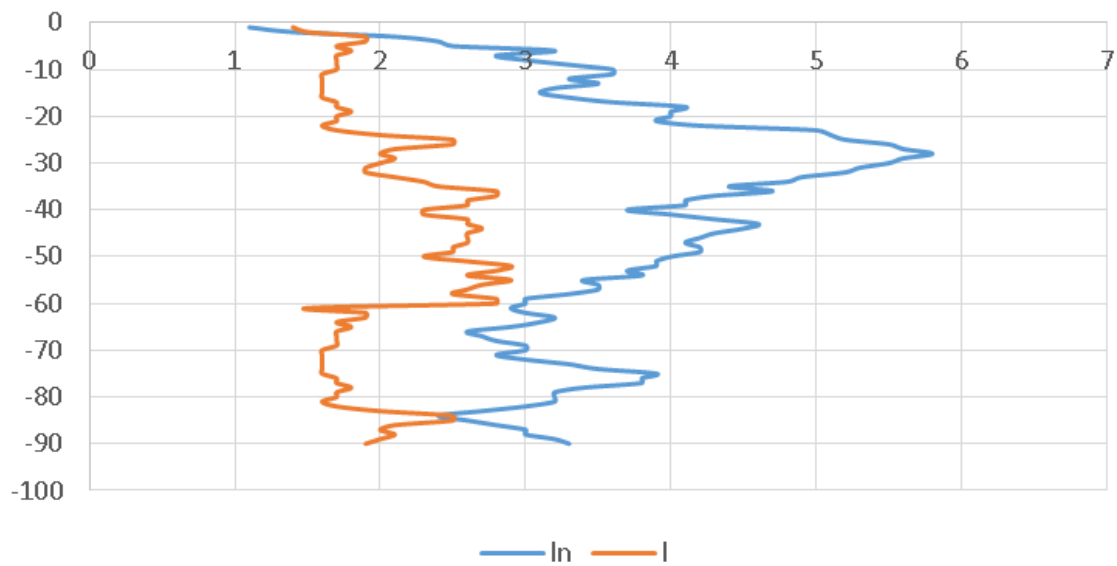


Field experiment

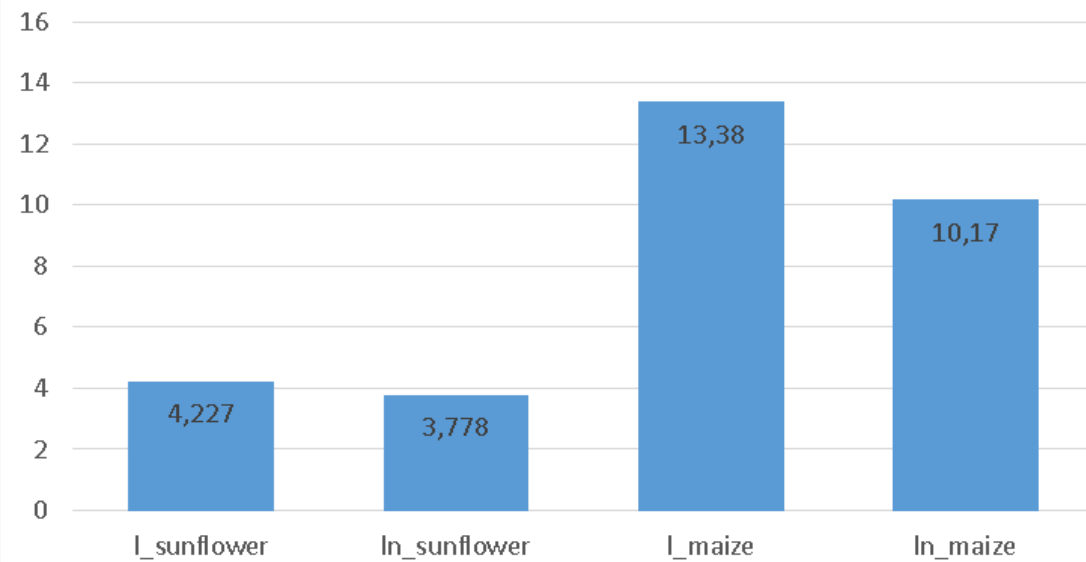
- Chernozem soil
- Planned depth of the loosening: 55-60 cm
- Maize and sunflower
- Tillage methods:
 - Stubble tillage
 - Loosening (half of the experimental area)
 - Autumn ploughing
 - Spring: secondary tillage – disc, roller, seedbed preparation



Penetration resistance (MPa)

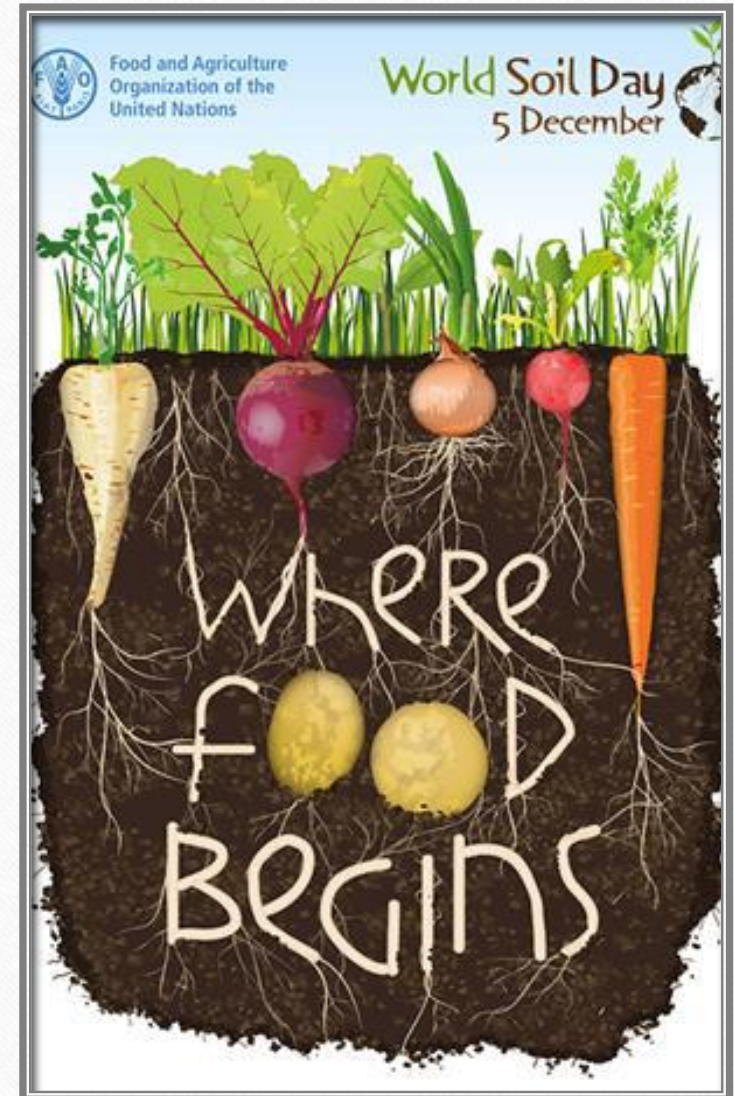


Yield t/ha



You are not just standing on
the soil, but you live from it...

P. Stefanovits



Thank you for your kind attention

