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How organic compounds affect vegetation shifts in ecosystems

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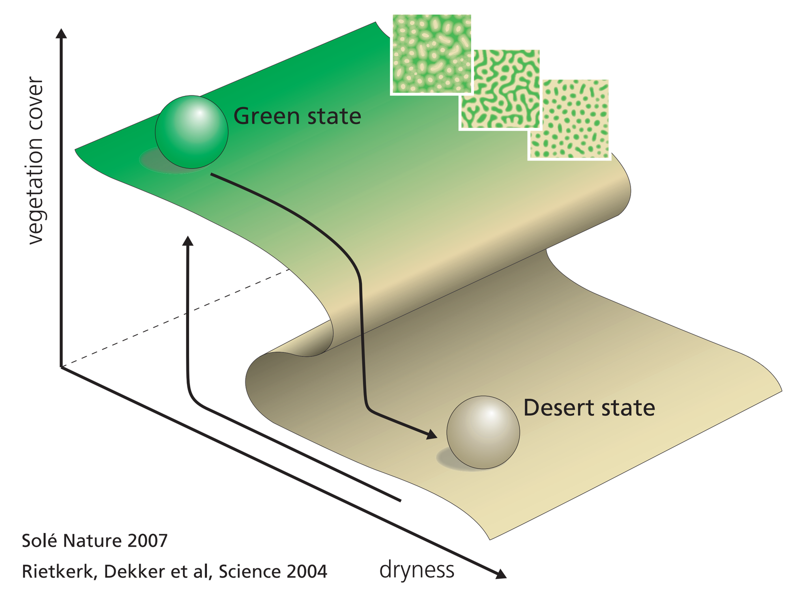
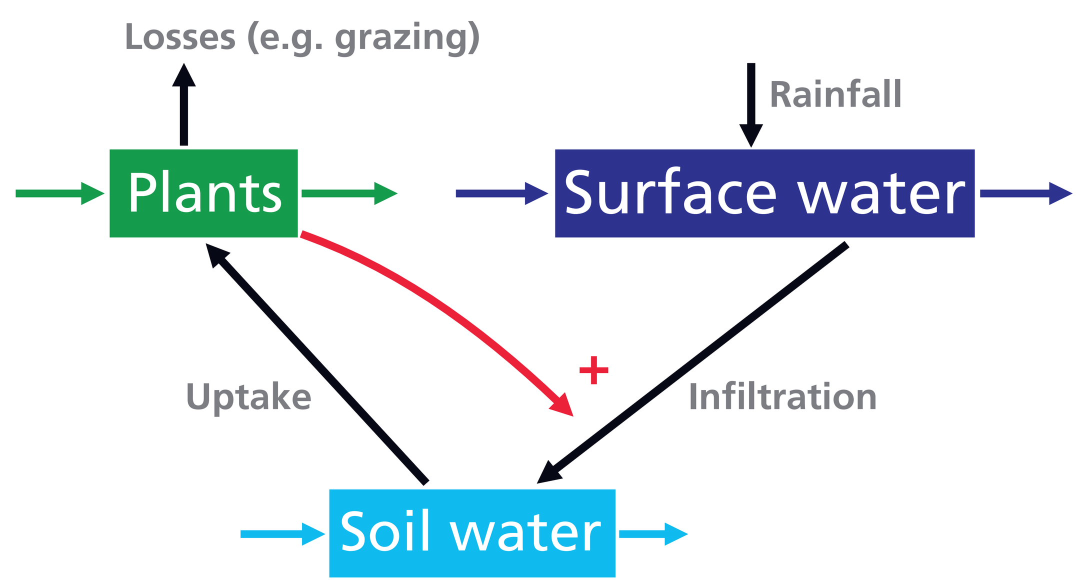
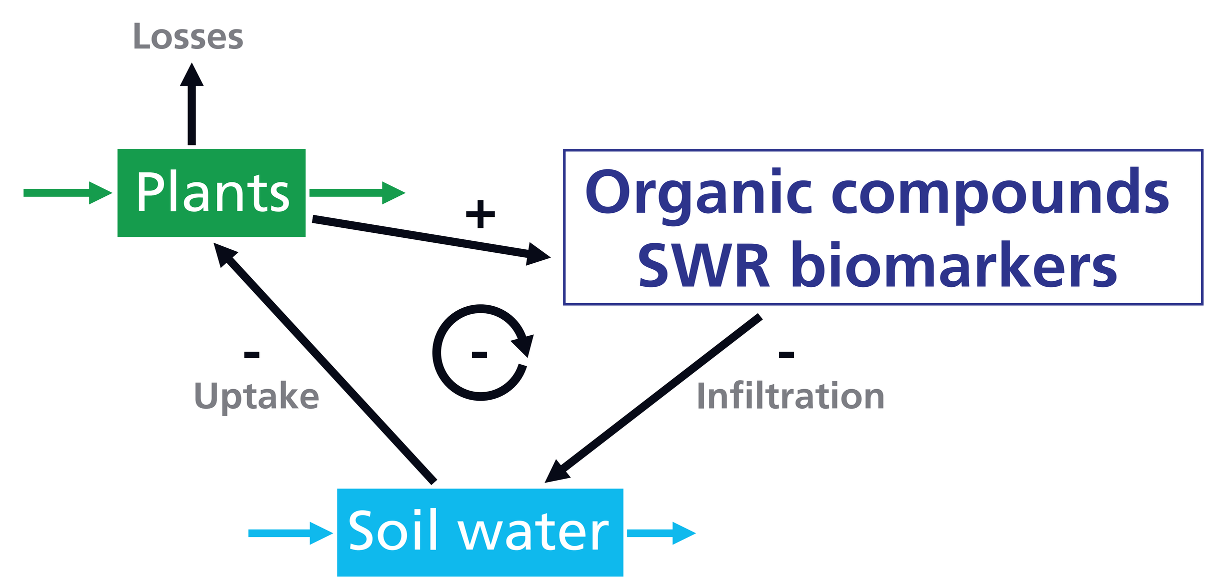




Ecosystem shifts

Self-organizing vegetation patterns can suddenly shift vegetation cover from green to desert state. A **positive feedback** between organic matter and water infiltration rate leads to increased plant productivity nearby the plants. Surface water will flow from bare soil patches with low infiltration to vegetation patches with high infiltration.



Soil Water Repellency (SWR)

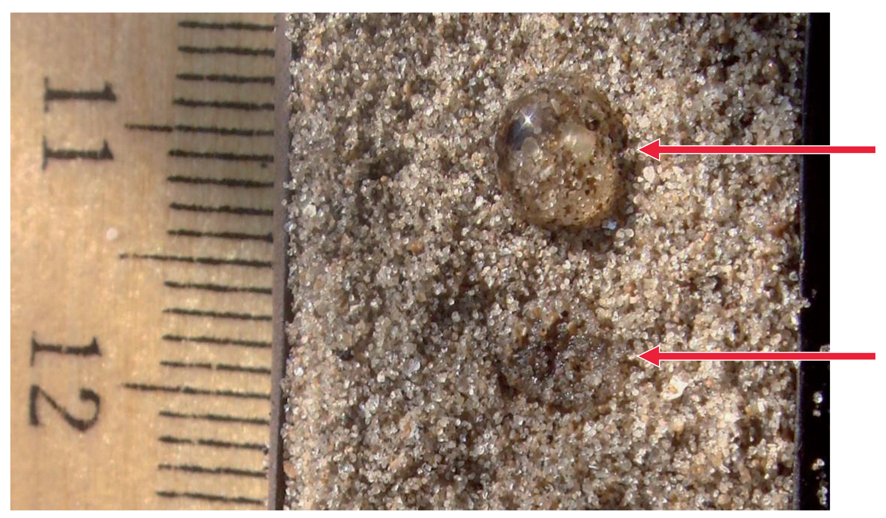
Plants produce organic compounds that may contain SWR biomarkers that can block water infiltration and forming a **negative feedback** between organic matter and water infiltration.

Soil water repellency and Ecosystem Shifts

Research Questions

1. What is the relation between vegetation succession, infiltration and SWR?
2. Can we identify SWR biomarkers from soil organic matter?
3. Can we link SWR biomarkers to the above/below ground vegetation or algae/fungi?
4. Can we understand ecosystems shifts within the concept of SWR?

Methodology

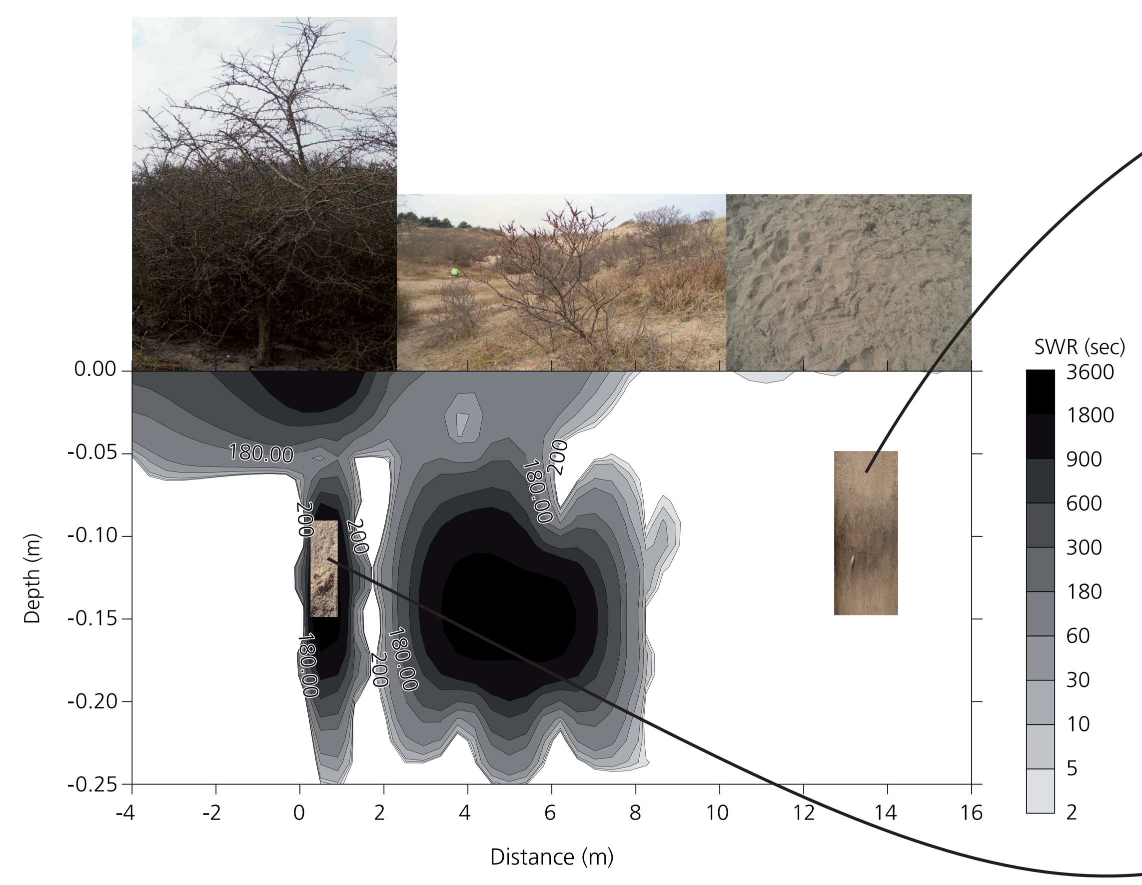


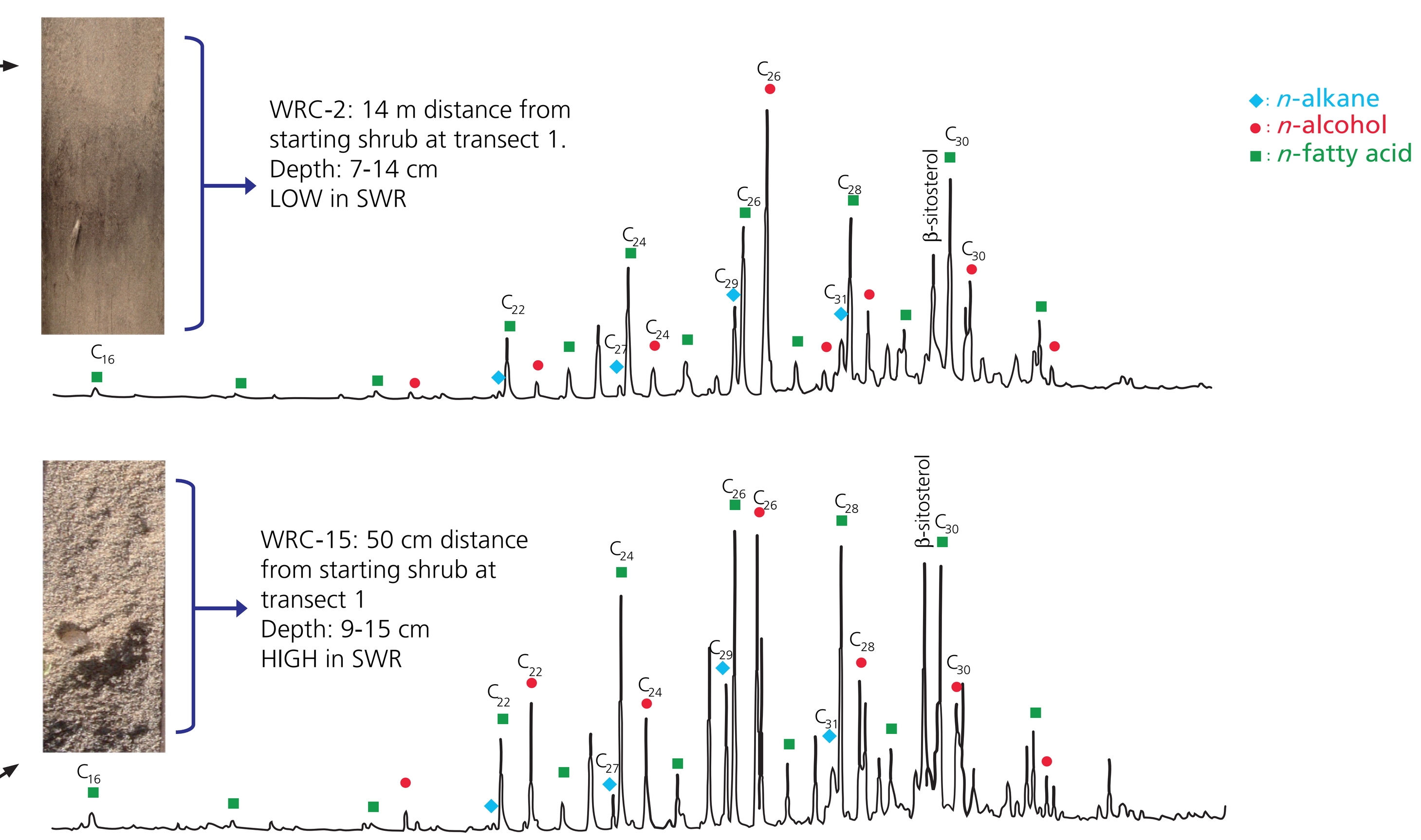
Measuring the WDPT. The lower drop has infiltrated, but the upper drop is still at the surface of the soil core. Scale is in cm.

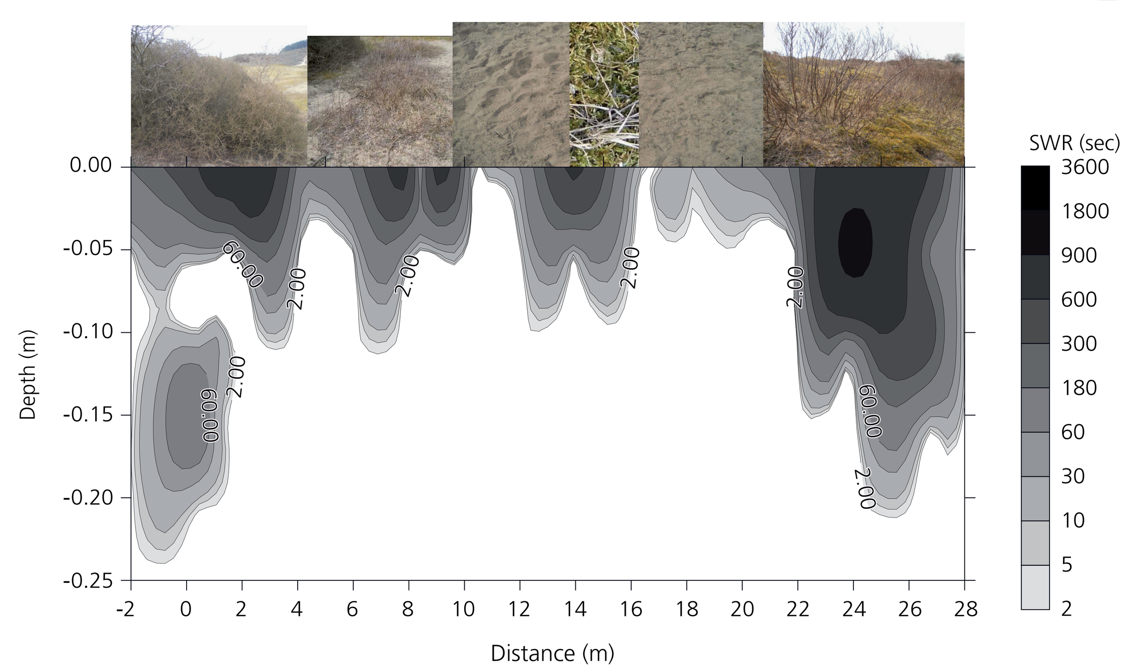
First results of vegetation succession and SWR

SWR is measured in a sandy dune area (Kennemer-duinen) along two transects with different plant species (x-axis in m). At different depths (0, 0.05, 0.10, 0.15, 0.20 and 0.25 cm), the SWR was measured using Water Drop Penetration Time (WDPT). The time needed for one drop to infiltrate was recorded (grey bar in seconds).

Different vegetation clearly shows different SWR.







Methodology

Soil samples were oven-dried at 30° and passed through a 1.40 mm sieve. Subsequently they were extracted using a Soxhiet apparatus with DCM/MeOH (9:1, v:v) for 24 hours, derivatized using diazomethane and BSTFA, and analysed by GC-MS.

First results on Organic Compound analyses and SWR

The extracts contained mainly *n*-alkanes (ca. 10%), *n*-alcohols (ca. 30%), and *n*-fatty acids (ca. 60%). Surprisingly, the composition was rather similar for the two soils that exhibited different degrees of SWR. However, the average chain length of the alcohols was lower, while that of the fatty acids was higher (in particular >C_{30}) in the soil with high SWR. Possibly these long fatty acids play a key role in the extent of SWR for a given soil.