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Crown space and inherent resource investments and gains – a way to quantitatively express competitiveness
Ilja Reiter

Plants need source of energy, e.g. light and heat, and matter like CO_2, H_2O and nutrients. They are interacting directly with neighbour plants and indirectly over effects and responses related to resources. To get all resources a plant needs for growing it especially requires space in soil and atmosphere. Plants occupy space for example by increasing their crown volume, for that they have to invest carbon in branches and leafs. Also there are running costs of a large crown volume, like respiratory, transpiratory and nutritional demands. In return space exploitation results in a carbon gain for the plant.
Research from the “Kranzberger Forst”, near Munich, a mixed forest of Norway spruce with groups of European beech showed that these trees exploit space differently. Spruce and beech have different foliage distribution, e.g. more light reaches the lower branches of spruce compared to beech, but the photosynthetic use of the canopy is more or less equal. The volume increment of the sun crown is higher for beech as for spruce, what can be explained by different strategies. As for spruce it is the “sit-and-wait”-strategy and for beech the “foraging”-strategy in terms of branches. Also the investment for branches is less for spruce, because it has evergreen needles which live very long. Space occupation is higher for spruce, also the carbon balance for branches is higher than for beech, because beech has to import more C to shade branches as they return. Spruce has C export on both, sun and shade branches. In contrast to that the carbon balance of the whole profile shows that the spruce has more unproductive branches.
An example for interference competition is crown shyness as a form of direct interaction between plants. Gaps between the beech crowns can be lead back to branches breaking each other. Spruce show less signs of crown shyness because their branches are softer and don’t break of so easy.
The main plant growth in spruce affects the trunk, whereas beeches grow mainly by enlargening their branches. Below ground the available resources can not be observed, neither how they are accessed, it’s only possible to measure the root system or to have a look at above ground growth.

Soil degradation
Endla Reintam

The distribution of the land shows that there is not enough land for everything. Land is splitted into 51% of ice, snow, desert and mountains which is not suitable for agriculture and construction. 11% of land is arable land and 10% is used as pasture. Remaining 28% are tropical forest, dry land and forests. The land is needed for human food and animal feeding.
Soil degradation is defined as the loss of quality and productivity, through the loss of nutrients, the breaking down of soil structure, toxicity, pollution or covering by constructions. In the last fifty years 13 % of cropland and 4% of pasture land were lost, also it’s predicted that in Europe until the year 2030 20 Mha of agricultural land will be lost, because there is no protective directive.
The main threats to soil are erosion, decline in organic matter, pollution, compaction, acidification, desertification, salinisation, soil sealing, decline in soil biodiversity and floods and landslides. Soil erosion is the process by which material is removed from the earth’s

surface by water, wind, ice, snow or other. The natural loss of soil amounts 1 t/ha/year, in fact the loss of soil in Europe today is 6 t/ha/year and worldwide even 20 t/ha/year.
Water erosion can be classified into raindrop, sheet, rill, gully and channel erosion. Two examples of water erosion are maize fields and bank erosion from boats. Wind erosion appears mainly at sandy soils whose particles can be easily blown away. Yearly economic losses for erosion in Europe amounts to 53 €/ha. Causes for erosion can be inappropriate agricultural practices, deforestation, overgrazing, forest fires, construction activities, tourism and extreme sport. Erosion can be prevented by leaving the ground cover untouched. Another part of soil degradation mainly in alpine and Mediterranean regions are landslides of highly erodible soil or clay based-sub-soil because of intense and abundant precipitation.
The covering of the soil surface with an impervious material or the changing of its nature is called soil sealing. For example the covering by roofs, buildings, mining, waste and ash deposits make the soil impermeable.
Soil contamination is most frequently composed out of heavy metals in different shape and mineral oil. Also diffuse sources pollute soil through the atmospheric deposition of acidifying and eutrophying compounds or potentially harmful chemicals. Contaminants as well can be deposed from flowing water or eroded soil itself or the direct application of substances like pesticides, sewage, sludge, fertilizers and heavy metal containing manure. These sources are brought in by industrial plants, no longer in operation, past industrial accidents and improper municipal and industrial waste disposal, e.g. wastewater.
Salinisation is the accumulation of salts on or near the surface of the soil, which makes it an completely unproductive soil. Factors for it are inappropriate irrigation, increase of water table and drought events.
The 27 member states of the EU store about 79 t of carbon. 45% of European soils contain only 0 – 2 % organic carbon. Again 45% have medium content of organic matter. The decline of organic matter can be caused by cultivation, deep ploughing, overgrazing, soil erosion and forest fires.

Experimental climate change
Ilja Reiter

Definitions around climate change:

1. Steady state is a stable concentration that is never changing and is independent of time (coin game “head – you win, tails – I lose”)
2. We speak of a dynamic equilibrium when forward and reverse reaction occurs at equal rates
3. Pseudo-steady-state or quasi-steady-state is a state that changes so slowly, that it can be considered stable

To simulate global change there are different methods for temperature studies. Electronical heat-resistance ground cables, as well as greenhouses, vented and unvented field chambers and overhead infrared lambs are possibilities to raise temperature and study the consequences. The increase of global temperature can be observed by measuring the leafing date, which tend to be earlier each year. A warming of 0.3 – 6.0°C increases significantly the rate of soil respiration, the net N mineralization and the aboveground plant productivity. In future there should be more research, especially long term experiments, whole ecosystem warming and gradient studies for the southern hemisphere.
Observations regarding climate change are worse than expectations, so experiments are underestimating the extend of change.
Experiments can be arranged in laboratory or in the field in different set ups. In comparison to chamber-experiments the temperature in field changes and also the light is influenced by

clouds, reflection, etc. Therefore the conditions in field are never stable, but full of changes. The three main set ups in field are phytotrosses, open tops and FACE (free artificial carbon experiments), of which FACE is the best method for establishing natural conditions. A problem of FACE is for example that the ozone distribution is not constant.
There are several systems for precipitation manipulation experiments. All of which are influenced by abiotic factors like water diffusion, greenhouse effect and light.
Climate change is multifactorial.

Seminar Talks:

Soil organic matter from pioneer species and its implications to phytostabilization of mined sites in the Sierra de Cartagena (Spain)
C.J.M. Ottenhof , A´ . Faz Cano , J.M. Arocena , K.G.J. Nierop , J.M. Verstraten , J.M. van Mourik (Chemosphere 69 (2007) 1341–1350)
Seminar talk presented by: Alma Heckenroth, Julie Nehmtow

Water-table management in lowland UK peat soils and its potential impact on CO2 emission
C. Kechavarzi , Q. Dawson, P. B. Leeds-Harrison , J. SzatyŁowicz & T. Gnatowski (Soil Use and Management, December 2007, 23, 359–367)
Seminar talk presented by: Regina Minazhetdinova, Beatrice Weiss

Responses of soil microbial communities to water stress: results from a meta-analysis
Stefano Manzoni, Joshua P. Schimel and Amilcare Porporato (Ecology, 93(4), 2012, pp. 930–938)
Seminar talk prepared by: Valentina Zolotarjova, Šárka Otáhalová

Decomposition of ^{13}C-labelled plant material in a European 65±
40° latitudinal transect of coniferous forest soils: simulation of climate change by translocation of soils
Pierre Bottnera, Marie-Madeleine Couteauxa, Jonathan M. Anderson, Björn Berg,
Georges Billès , Tom Bolger, Hervé Casabianca, Joan Romanyá, Pere Rovira (Soil Biology & Biochemistry 32 (2000) 527±543)
Seminar talk presented by: Franck Coudray