

2022-08-23

Dear Marym, dear Jacob, der All,

Thanks a lot, Maryam, I wasn't aware of the Working Group – developing a strategy paper on the issue of trees in rangelands.

**One of the most powerful narratives** for the dominating preference of trees/forests regarding climate mitigation **is the conviction, that the QUANTITY of plant root biomass is determinating for the QUANTITY of carbon storage / soil building** (what is wrong – see below).

Unfortunately too for the further perception of grazing and the IYRP: The dominating question in the grassland-ecosystems research is still „**Why trees are not growing here?**“ – still and again focussing on trees. Instead of „**Why grass societies are so successfully growing here?**“ – bringing the **coevolution** of grazers and grasses in the focus of perception.

In my view too the current SCIENCE special is an important support for our work. A lot of basic aspects have been mentioned – first of all the general „**The unrecognized value of grass**“ – and criticizing the dominant „tree narratives“ (sure not achieving the data based quality of Susann Vetter's „**The long shadow of colonial forestry is a threat to savannas and grasslands**“).

But furthermore **the intrinsic role of the grazing animals** is lacking in the perception – regarding research and communication.

Even where grazers are object of research, **grazing is generally still seen as disturbance**. (Unfortunately but understandable: That perception becomes enhanced where overgrazing is increasing).

Yes it has been a disturbance millions of years ago. But because of grazing and not despite grazing: Later grassland ecosystems became the most successful plant societies worldwide:

- the biggest biom
- the biggest permaculture and mixed culture (a criterion for success) too.

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Regarding the land area grassland ecosystems are the most successful worldwide. The only plant society which is losing periodically a lot of its above ground biomass is covering more land surface than any other plant society – already during the last glacial and until now.

### **Grasslands – criteria for success?**

While grazing is – generally – still seen as disturbance perennial grasses developed completely different growth dynamics as the result of millions of years of **coevolution from grasses with grazers**:

- **If not overgrazed:** Grasses don't try to prevent to be beaten.
- **Sustainable grazing preconditioned:** Grasses profit from the (cow's) bite. The loss of biomass is inducing a growth impulse leading to an increased photosynthesis rate – leading to increased plant biomass building above (leaves) and below (roots) ground.

**Other plants are expending a relevant part of their energy, to prevent to be beaten:** They are building e.g. spikes (what we easily can see/perceive) and in an enormous amount bittering agents (what can't be seen/perceived easily) etc.

### **Grasslands – criteria for success?**

**Trees** are storing their carbon yield from photosynthesis mostly above ground as wood.

Plant biomass root-shot-ratio 1 : 2. **Trees primarily invest in their own plant biomass** – and that more above than below ground, (what is easier to perceive for us).

**Grasses** grow more below than above ground (Plant biomass root-shot-ratio 2 : 1 until 20 :

1). **Grasses don't primarily invest in their own plant biomass, but in soil building!**

Soil originates by over 80 % from root biomass. Of course: Much more root biomass from trees is located below a hectare of forest than root biomass from grasses is located under a hectare of permanent grassland.

But despite the dominating narrative (see below Terrer et al. 2021): **Soil building is not depending on root QUANTITY!**

As soil building is taking place at the ends of the roots **the QUALITY of roots is key!**

**Grasses are FINE rooters.** It's the mass of FINE roots which is crucial: It's there where exudates are leaving the roots and where rotting is taking place.

**Still the dominating question in the grassland-ecosystems research reads as „Why trees are not growing here?“ Instead of „Why grass societies are so successful here?“**

### **Grasslands – criteria for success?**

They all have a **common genesis** – thousands of years of steppe grazing.

- So not „only“ the vast less fertile grassland ecosystems of the world,
- but too the most fertile plains worldwide (prairies, pampas, tschernosem in Ukraine, Mandschurei, Rumania, Germany etc.)

All research predicting soil building / carbon sequestration will be leading to a saturation in the soils can't explain the existence of this most fertile soils – the granaries / the breadbaskets of the world.

As method of success grassland ecosystems invest in – their own – fertile soil biomass.

So its remarkable but not astonishing that

- forest ecosystems store less C worldwide than grassland ecosystems (similar area)
- grassland ecosystems store in their soils 50% more C than forest soils (similar area) (don't use average data!).

But most of the **climate modelizing** is still holding on the narrative, the more photosynthesis >> the more building of plant biomass (what is true) and **the more soil building (what is wrong)**.

See the meta study from Terrer et al. (2021)! (mentioned in the SCIENCE special literature :-)

#### **A trade-off between plant and soil carbon storage under elevated CO<sub>2</sub>**

<https://doi.org/10.1038/s41586-021-03306-8>

>>We found that overall, SOC stocks increase with eCO<sub>2</sub> in grasslands (8 ± 2 per cent) but not in forests (0 ± 2 per cent), even though plant biomass in grasslands increase less (9 ± 3 per cent) than in forests (23 ± 2 per cent). (...) Ecosystem models do not reproduce this trade-off, which implies **that projections of SOC may need to be revised.<<**

All the best Anita