

Speckert et al. Soil organic carbon stocks did not change after 130 years of afforestation on a former Swiss Alpine pasture

### Review notes

The study presented here covers a topic that is interesting and relevant since many pastures in alpine regions are abandoned and expected to become forests in the future – which could feed back to climate change. Knowing the impact of this land-use conversion is needed. The topic and proposed research questions however are not very novel and do not contribute much new knowledge.

There are two things I value in the current manuscript:

- The long gradient in time (if the chronosequence would have been replicated) adding more information on the long term impacts of afforestation
- The study is well executed (- the design) and the manuscript is well written

My major concern:

- The study is based on pseudoreplications so the conclusions in terms of time since afforestation are not supported by the data, they could be coincidence or site effects. In my opinion this is a major issue that is hard to resolve.

Specific comments:

Line	Comment
19-22	As roots ... -> unclear sentence
22-25	Is this novel enough?
37-38	Afforestation is a promising measure -> is this also true for alpine regions where albedo effects might have a negative impact on climate change
49-50	Be explicit and call it "context-dependency"
51	Initial carbon stock is a key factor -> yet you do not take this into account in your research
54-55	Transition line 54 to 55 not very fluent (10-20 cm is not that deep? Was that the point?)
58-59	Age is underexplored -> I think this is the main strength of your study that you have a large gradient in time going back 130 years
75-77	Clear hypothesis. Is (iii) really needed? It is accepted as common knowledge I would say
Introduction	Overall very well written introduction with nice literature review.
85	Afforested -> Encroached? Natural regeneration? Planted to avoid erosion? Not explicitly stated in the M&M. If planted, at what planting distances? What is was the basal area (the density) of the stands at the time of sampling. This is important information that is needed to interpret the results
M&M	There are no replications of the different ages. The replications are made within the same forest stands resulting in pseudoreplications. This means you cannot say anything about the effect of age / time since afforestation. It can just be differences in between individual stands that do not correspond with the age effect. This should be very explicitly discussed that you make assumptions and in the discussion (and in the end of the abstract) you should be very careful with generalizing your interpreted results.
98	Five individual plots ... -> not true, only for the pasture. This is misleading.

100	Your forests are quite small and your plots are taken as pseudoreplications within these small stands -> weakness of the study
100	Add also the area for the 40y old stand
110	Here it becomes clear that there are only 3 replications for the forest stands
111	I appreciate the effort to make soil profile pits to have a more detailed understanding of the belowground ecosystem (as well as a complete sampling of the roots)
113	Roots were counted on three profile walls -> per pit? Per replication? Unclear
115	In the end the results were pooled -> be already transparent about this in the M&M
130	Typo 45mm? So how many samples for the roots do you have per forest stand? 3 replications of pooled samples? In the figures it seems more? Unclear
130	Can you discuss the results of pooling these samples in the M&M section
163	I miss information about the density (do you have basal area)?
194	Not very clear "age gradient" in the results. This indicates that the differences between stands might just be random (site effects) that do not correspond with the age of the forest
203	between
224	You have a very high initial carbon stock -> could you explain more how come?
228	Careful with phrasing -> here you cannot say it is the effect of 40 years of afforestation for sure
232	Again very case specific
247-248	Can you really say it is forest age?
305	Here you speak of forest encroachment but you did not make this clear in the M&M. In that case how did the stand evolve?
515	Many outliers. Which ones are from the sides and which ones from the levels? Or are they pooled in that way as well. Be clear about the experimental design