Eects of land use changes on the dynamics of selected soil properties in the Northeast Wollega, Ethiopia

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General comments

This manuscript studies the effects of land use change on the variation of different soil properties (organic matter content, organic N, pH, available P, CEC and exchangeable cations) in the 0-15 cm layer of forest, grassland and cultivated soils from Northeast Wollega (Ethiopia). In my opinion, authors have carried out a well-designed experiment and made huge efforts to obtain a high number of data. But, in my opinion, the text needs a lot of work before it is ready for publication in SOIL.

These are some general comments about formal aspects:

Abbreviations in the abstract and the main text must be used only after defining. “SOM”, “CEC” or “AP” are used in the abstract without previous definition.

The use of abbreviations is not rational. There are many examples of this through the text that must be revised. Different expressions are used for the same object even in a short text. In page 1085, lines 4-7 (only four lines!), soil available phosphorus is named as “P” (element), “soil P”, “available P” or “AP” (available P).

Try to avoid 4-5 lines long sentences.

Describing and discussing results following the sequence [i] mean data and [ii] difference between mean data, with different tables is repetitive and makes the text too long. In some cases, even the order of tables is strange (table 2 describes differences between soil properties and table 3 describes soil properties). In some cases, also, discussion of actual data is avoided in favour of variations between data. I would like to seriously highlight this, because variations on sand, silt and clay contents, for example, are described and discussed (see Table 4), but dispersion of original data are not provided and discussion on them is not carried out. What is the relevant thing? Mean differences and standard deviation of differences or mean values and standard deviation of mean values? What is more important? ANOVAs of differences between data or ANOVAs of mean data? I suggest deleting tables 2, 4 and 5 and moving relevant information to Table 3.

I have serious concerns about the validity of most references. There is a huge number of references that do not support the statements they are supposed to. Some examples are discussed in the detailed comments below, but I strongly suggest authors to revise if all citations do actually support the statements in the text. Although there are many evidences, I was surprised when even my own work is cited in order to support a statement that is absolutely not suggested by me. Authors must carry out a serious revision of the text.

Detailed comments

Page	Line	Comment
1076	4-5	Substitute “adjacent land uses” with “adjacent soil plots under different land uses”.
	5-6	Delete “and tested in Natinal Soil Testing Center, Ministry of Agriculture of Ethiopia”.
	6-8	Were soil properties from cultivated land and grazing land not compared?
	6	Delete “Percentage”.
	7	Substitute “was” with “were”.
	8	“ANOVA” is an widely accepted abbreviation, so substitute “Analysis of variance (ANOVA)” with “ANOVA”.
	9-10	Substitute “The results indicate that sand, silt, SOM, N, pH, CEC and Ca were the highest in forestlands” with “Sand and silt proportions, SOM content, N content, pH, CEC and Ca content were higher in forestlands”.
	13	Substitute “relationship” with “relation”.
	15-16	I am not in agreement with this statement. See detailed comments below on page 1088, lines 26-27.
	24	Delete “For example”.
	25	Litter is not added in forest soils. Substitute “hinder addition of litter” with “reduce the input of organic residues”. Note: The word “litter” is not mentioned in the cited paper (Ozgoz et al., 2013). In addition, unless litter is transported from external sources, higher litter inputs cannot, in any way, increase the nutrient content in soils. Ozgoz et al. (2013) studied organic matter contents in terms of general soil quality and in relation with physical properties. The only time Ozgoz et al. (2013) relate the concepts of nutrients and organic matter together is: “Too much chemical fertilizers application, especially P, and decreased use of organic fertilizers have induced eutrophication at the surrounding drainage channels”. These authors may be cited later in the introduction, when the role of organic matter decline on soil physical degradation is reviewed.

Page	Line	Comment
1077	6	Delete “Bochet, 2015” and “Tejada and Benitez, 2014”. These references do not exactly support the statement, as they refer to influence of overland flow on seed removal and effects of mulch, respectively. Substitute “Cedar” with “Cerdà”.
	8-11	Check: • It is not clear what authors mean with “overcultivation”, which is not mentioned in the cited source. Biro et al. (2013). These authors make reference, in some cases, to land use/land cover changes or expansion of cultivated areas. • “Grazing intensity and frequency” or relations between grazing and nutrient status are not mentioned by Biro et al. (2013). If these statements are confirmed, please, re-write: “Biro et al. (2013) observed that grazing intensity and frequency, and over cultivation can substantially affect soil nutrient content by reducing composition of plant species, net primary productivity, above and belowground allocation in plants, and nutrient cycling.”
	21	Delete “human-induced” (all land use changes are human-induced).
	22-23	Delete “and make the ecosystem more delicate and susceptible to land degradation”.
	24-25	Check: “The country’s inherently fragile soils […] make soil highly vulnerable …”. This only means that “vulnerable soils are vulnerable”. Instead, cite the main characteristics that make soils “fragile”. Re-write: “and inappropriate farming practices”
	26-27	Add references to support these soil erosion rates.
	27-…	Re-write: “Soil degradation causes …”, revise the full sentence and add a reference. Is economic loss an on-site or an off-site change?
1078	3	Substitute “And this is why is necessary to apply restoration strategies” with “Soil degradation in the area makes necessary to apply…”.
	4-5	Re-write: “Soil protection is…”.
	3-6	This lines should be moved before mentioning the general objectives to support the necessity of this study.

Page	Line	Comment
	15	Delete “on their part”.
	25	Delete “have” and “appreciable”.
	26-27	Re-write: “of natural forest into grazing land”.
	27	Delete “the hypothesis that”.
1079	3	Delete: “at dierent geographical area”.
	3-5	This is true, but try to substitute “the study area” and focus on the degraded soils in this region of Africa (and probably others) to attract a wider audience.
	5	Can you describe briefly the type of forest, dominant species…? Just some words.
	7	What soil parameters?
	14-15	I have a suggestion about the use of “woreda”. This is a local (Amharic?) term, and I am asking authors to think about substituting it with the most common English form “district”. Nevertheless, I suggest using a simpler description, re-writing (please, check if wrong): “The study area is located in Northeast Wollega (Horo-Guduru Wolega zone, Oromia Region, Ethiopia), approximately on the coordinates 9^{o} 45’-10^{o} 00’ N and 37^{o} 00’-37^{o} 15’ E.”
		Delete “Geologically”.
	20-…	If possible, add a reference to support soil classification and another one for the classification system (WRB?).
	23-24	Soils on steep slopes do not downgrade, they come not from a higher evolutional status. Re-write: “Dominant soils on steep slopes are Regosols and Cambisols”.
	24-…	Substitute “altitude” with “elevation”.
		Are these characteristics (elevation, temperature and rainfall) for the study area? If yes, move these lines (page 1079, line 14 to page 1080, line 5) to line 15.
1080	11-13	Re-write: “at least during the last 40 years”.
		Please, revise. It is not clear to the reader if only forestland was present 40 years ago and only land use in “some portions” has changed or different land uses (forestland, grazing land and cultivated land) were present in most of the

Page	Line	Comment
		study area and only small areas have changed to cultivation or grassland (coming from what land use?)-
	15	Some details are missing about sampling: what was the sampling period?, how were sites and tiles selected (randomly?), how much distance between sites, tiles and subplots? How much distance between the border of the tile and the subplots? Are subplots squared? Description of sampling is some different from the cited sources, which can help as a guide: • Vågen et al. (2013): "A cluster sampling design (Thompson, 1991) was used by first dividing each site into 16 tiles (2.5 × 2.5 km in size), then generating one random centroid location per tile, and finally generating 15 random sampling plots, each 1000 m^2, within a 564 m radius of each cluster centroid. Five of these plots were used as alternate plots and hence 10 were characterized and sampled in each cluster. Thus, the data for each site consisted of 160 stratified-random sampling plots with an area of 1000 m^2 each. Within each individual plot, four sub-plots were established, each with an area of 100 m^2, one in the center and three on a radial arm with 120° angles between them." • Vågen and Winowiecki (2013): "In short, within each 10 × 10 km site, 16 cluster centroids were stratified into 2.5 × 2.5 km tiles and their locations within the tiles were randomized, but buffered to avoid overlapping with neighboring tiles. Around each cluster centroid 10 sampling plots, each a 1000 m2 circle, were randomly located to fall within a circular area of 1 km^2 using a 564 m radius from the cluster center-point. Each plot consisted of four 100 m^2 subplots."
	15-16	Re-write: "Three adjacent sites under different land use types (forestland, cultivated land and grazing land) were selected for this study, with similar slope, elevation and aspect". Please, provide information on slope, elevation and aspect.
	18	Re-write: "100 m × 100 m".
	23	Delete "from each of the three land use types".
	24	Substitute "For each tile, soil samples were collected from each sub-plot and composite samples were prepared by hand mixing for 0–15 cm soil depth" with "For each tile, soil samples (0-15 cm depth, the average plough layer in the area) were collected from each sub-plot and composite samples were prepared by hand mixing". Where were soil samples collected? At the center of each 100 m^2 subplot?

Page	Line	Comment
	26	Substitute “had” with “prepared”.
1081	1-2	Delete “at a depth of 0-15 cm, because the 0–15 cm represents the average plough layer in the area”.
	4-6	Delete the first sentence of the paragraph, it is not relevant for the paper.
	6	Substitute “Disturbed soil samples” with “Composite soil samples”.
	7-14	Re-write: “Soil analyses included soil texture (determined by the Bouyoucos Hydrometer method; Black et al., 1965), soil pH (determined in a 1:2.5 soil:water ratio), total N content, cation exchange capacity (CEC) and exchangeable cations (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}) by atomic absorption spectrophotometry, P content (Olsen et al., 1954) and organic carbon (OC) content (Walkley and Black, 1934)”. Refferences for N-Kjeldahl and CEC are not provided. I suggest the following: • For N-Kjeldahl: Bremner (1996), http://dx.doi.org/10.2136/sssabookser5.3.c37. • For CEC and exchangeable cations: Summer and Miller (1996), http://dx.doi.org/10.2136/sssabookser5.3.c40.
	12-13	Re-write: “Soil organic matter (SOM) content (%) was determined by multiplying OC% by…”. A suggestion: The 1.724 factor is disused. The 2.0 factor is much more exact, according to Pribyl (2010; http://dx.doi.org/10.1016/j.geoderma.2010.02.003). However, it is not necessary to transform SOC to SOM if we can freely work with SOC data. I suggest not transforming.
	16	The normal distribution of data must be checked before using parametric tests (ie ANOVA) and correlation analyses. Results and statistical analyses are not acceptable unless this is checked (in SPSS, Analyze > Descriptive Statistics > Explore and mark the “normality plots with tests” cell). If data are not normally distributed, non-parametric tests must be used or data transformations are required.
	17-24	Substitute “One-way ANOVA was under taken to test the significance of the effects of land use changes on the variation…” with “When the normal distribution of data was confirmed, one-way ANOVA was used to analyze the differences among groups of samples for soil texture, pH, P, SOM, N-Kjeldahl, CEC and exchangeable cases at the 0.05 level. When significant differences among groups were found, homogeneous groups were analyzed using the LSD post hoc test at the 0.05 level.”

Page	Line	Comment
		What soil texture classes were determined? What system was used for texture classification (which is used in the results section, page 1082, line 17)?
	20	Na^{+}?
		Cmol (+) kg^{-1}?
1082	4-5	Re-write: "Where $Ch_{CI, GI}$ is the percentage of change in soil properties of … and Lu_{CI}, Lu_{GI} and Lu_{FI} are mean values of…".
	7	Join this sentence to the previous paragraph.
	11-14	This is not part of results or discussion. Move to the proper part of the text or remove.
	21-22	If difference is not statistically significant, you cannot state that silt fraction is higher or lower than anything. Please, delete.
1083	2-4	Please, explain how plowing, clearing, "disposing" and leveling can transform sand and silt into clay or enhance weathering.
		Vertical clay migration is not "leaching", which involves different processes.
	9	The reference for "Ozgoz, 2013" is not provided. I have tried to find a similar statement in Ozgoz et al. (2013), but these authors do not mention anything related to clay leaching.
	10-13	Please, check. I have carefully read the cited fourth edition of FAO's guidelines for soil description and have not found anything similar to this statement.
	15	Most compact soils compared to what? Soil compaction has not been studied in this manuscript. So, add a reference.
	15-…	Check concordance: "These soils … is manifested…".
	18	Check spelling: "lagging".
	19	What do you mean with workability?
	20	Try to avoid abbreviations in section titles.
		For discussing the impact of agriculture on soil available P, I suggest reading and citing Manning (2008; http://dx.doi.org/10.2113/GSELEMENTS.4.2.105).

Page	Line	Comment
	21-22	ANOVA and post-hoc results are necessary to state this.
	22	Check: “is in between (Table 3)”?
	24	ANOVA p-value is not shown in table 3.
	26-28	Add a reference for this.
		I do not think that the contribution of soil macro and microfauna to soil organic matter content in forest soils is comparable to that by plants. Please, try to re-write this statement.
		Why do you think bacteria and fungi, for example are not microbial biomass?
1084	1-3	Delete the first three lines. Are roots not important in forest soils?
	4-5	Substitute “and adding organic matter” with “increasing organic matter inputs”.
		Re-write: “lower SOM contents”.
	6-7	You have not studied erosion rates or risk, so this is speculation. You can speculate, but state it clearly. Explain why erosion and decomposition rates are higher in croplands.
	8	Re-write: “SOM”.
	8-12	I find the first part of this statement is strange. It is true that organic matter (not only soil organic matter) is composed of C, H, O, N, S and other elements, but this is not why it is considered a good indicator of soil quality.
	9	USDA (2014) is not a valid source for citing here. Please, delete. See comments on references below for “Gebreyesus”.
	12-15	I do not understand this. What are N, P and S other reservoirs in grasslands and croplands?
	15-16	Not in soils under grass or crops? You mean that soil water holding capacity and CEC are higher in forest soils than in soils under other land use types because of higher SOM content. At this point, it is necessary to know if statistical differences exist between forest and other studied soils. ANOVA and post-hoc results should be shown in table 3.

Page	Line	Comment
	17-18	Significantly higher? Readers do not know. Two lines below, you write that the different between N contents from forest and grazed soils is not significant. So what?
	22-25	Check: “Wider” C:N ratio? I am not in agreement with this statement. Even if significant differences exist, do you think that differences in C:N ratio have any practical relevance? The highest and lower mean values are different only in 1.3.
	25	Again: what is the practical relevance of this? Do you think that nutritional status is different between soils with 2.1 or 3.7 ppm of P?
	26	Check: “it is in between”?
	27	Re-write: “soil AP”. Hyphen may be used to join two or more adjectives before a noun, not an adjective to a noun.
1085	3	I suggest substituting “weathered soil minerals” with “secondary minerals”, according to Shen et al (2011, http://dx.doi.org/10.1104/pp.111.175232). Re-write: “organic and inorganic fertilizers”.
	4	Substitute “has” with “have”.
	15	I find that higher weathering of minerals in cultivated land than in grazing land should be better explained.
	22-25	This text is too general and describes stablished science. It should be strongly reduced. I suggest removing “Dynamics … (Barua and Haque, 2013)”.
1086	1-4	Write shorter. Substitute “The mean differences between forestland and cultivated land, and forest land and grazing land are statistically significant ($P < 0.05$, Table 5), but the mean difference between cultivated and grazing lands is not significant (Table 5)” with “Mean pH from forest soils was statistically different from cultivated and grazing land ($P < 0.05$, Table 5)”.
	8-9	“Benítez” is not correctly spelled. Tejada and Benítez (2014) do not mention this in their paper. Please, remove this reference. I have not access to the paper by Yao et al. (2010) and cannot check it.

Page	Line	Comment
	10-11	Again, Tejada and Benítez (2014) do not mention this in their paper. Probably this is just a copy/past error, but check your references.
	11-12	The statement “soils in the cultivated land appeared more acidic than those of the forest and grazing lands” is true only on the basis of mean values (no dispersion or ANOVA results are provided). But differences are small: only 0.4 pH units between forest and grazing soils (pH 5.7-6.1) and 0.7 pH units between forest and cultivated soils (pH 5.4-6.1). This must be clearly stated in the text. Do small differences between pH from soils below forest (pH = 6.1) and pastures (pH = 5.7) validate the statement “Different nutrients are available at different pH levels” (line 6)?
	14	Substitute “This variation may be happened because” with “This is because”.
	15-17	Delete.
	18	Check spelling: “Parras-Alcántara”.
	17-18	I have carefully read the paper by Parras-Alcántara et al. (2013). They studied the impacts of land use change in soil organic C and N (paying special attention to soil organic C content and vertical distribution, the stratification ratio of soil organic C and total N) in a Mediterranean agricultural area. BUT I have not found any reference to the role of Al and Mn as toxic elements in acid soils (which is true, but not mentioned by them) or the study area.
	19-21	Why pH 5.5 is suggested as a threshold for Al and Mn toxicity? Any evidence or reference to support this? McKie (2014) is not a peer-reviewed source, so delete.
	23	Re-write: “pH”, minuscule even at the beginning of a sentence, or substitute it with “Soil acidity”.
	28	The cited reference (Parras-Alcántara et al., 2013) does not support this statement.
	29	“Nitrate” or “NO_3^-”, not both. Re-write: “crops with NO_3^- as the only source of N may”. Consider that these are all crops except leguminosae.
1087	1-2	The cited reference (Gelaw et al., 2013) does not support this statement.

Page	Line	Comment
	5-8	Delete “CEC, which is a good measure of the ability of a soil to retain and supply nutrient to a crop is naturally reliant on soil organic matter, pH, amount and type of clay mineralogy, land management (Tahir et al., 2009; Gol et al., 2010)”.
	10-12	This statement can be combined with the previous one in order to reduce the length of text.
	12	Re-write: Mean exchangeable Ca^{2+} content”.
	20-22	If data are not significantly different, you cannot say they are. Please, revise this statement.
1088	2	Delete the first sentence and move a reference to Table 6 to the next one, between parentheses.
	3	Re-write: “exchangeable Ca^{2+} and Mg^{2+} and …”.
	8	Re-write: “pH”.
	8-…	Delete the “+” sign for r coefficients through the text, it is not necessary.
	8-9	This is OK, but try to avoid repeating results from tables. Otherwise, if all coeffcients and p-values are in the text, the table should be deleted.
	15-17	Check spelling: “Muñoz-Rojas”. In their paper, Muñoz-Rojas et al. (2015) talk about certain land use changes, but not about specific practices as compost, cover crops, manures, minimum tillage or crop rotation.
	18-21	Delete “Nevertheless”. Not only the low available P contents, also the limited range of pH is involved.
	21	Re-write: “exchangeable Ca^{2+}”.
	21-23	Any explanation for this?
	26-27	This statement is absurd. Revise. The only time that Emiru and Gebrekidan (2013) [not “Nega and Heluf”, see comments below on references] mention the word “clay” in their paper is very far from your statement: “Additionally, increasing clay percentage with

Page	Line	Comment
		depth also has the tendency to furnish hydrogen ions from clay colloidal surfaces to the soil solution again reducing which finally reduce soil pH. ”.
1089	1	Kaolinite has a low CEC, of course. But more explanations are needed. pH can contribute to explain high or low soil OM contents, but pH only cannot explain why OM content decreases when clay content increases.

References

I have not checked all references, but have found some mistakes and repeated errors (as changing family names for given names). Some of these are commented below, but a deep revision of the reference list is necessary. Some changes in the reference list may imply changes of citations in the main text.

- Biro et al., 2013: One author is missing.
- Braimoh and Vlak (2014): Check spelling of authors (Vlek) and title (land-cover).
- Food and Agricultural Organization (2006): Change to: FAO: Guidelines for soil descriptions, 4th ed, Food and Agricultural Organization of the United Nations, Rome, 2006.
- Gebreyesus (2013): Substitute “Gebreyesus, B.T.” with “Tesfahunegn, G. B.”.
- Gelaw et al. (2013): The paper is now published as Gelaw et al. (2015). Check for date, volume and pages.
- Gol et al. (2010): Check author names: Göl, C. Çakir, M., Ediş, S., Yilmaz, H. Check spelling in the title: Gökçay. McKie (2014): This is not a peer-reviewed publication. It is only a leaflet in the internet and cannot be used as a reference.
- Mekonnen et al. (2014): The paper has been assigned volume and pages. Please, check: Mekonnen, M., Keesstra, S. D., Stroosnijder, L., Baartman, J. E. M., and Maroulis, J.: Soil Conservation Through Sediment Trapping: A Review. Land Degrad. Develop., 26: 544–556, 2015.
- Nega and Heluf (2013): Check author names: Emiru, N., Gebrekidan, H. Use capitals for “Senbat” in the title.
- Tadele et al. (2013): Check author names: Amare, T., Terefe, A., Selassie, Y.G., Yitaferu, B., Wolfgramm, B., Hurni, H. Check spelling: “toposequence”.
- USAD (2014): USDA, not USAD. Nevertheless, this is not a scientific article and should not be cited here.
- Vågen et al. (2013): Check author names: Vågen, Tor-G., Winowiecki, L.A., Abegaz, A., and Hadgu, K.M.

Tables and figures

In general, tables and figures must be completely understood by the audience when read separately from the main text. I think ANOVA and post-hoc results are missing in some tables (Table 2?).

Table 2. Add units (percentage?) to the caption. Define abbreviations in the caption. Some abbreviations have not been explained neither in the main text (LU, EK^{+}, Eca^{2+}, EMg^{2+} ???).

Table 3. Use the same number of decimal places for available P (3.60, 2.09, 3.70?). Avoid unnecessary capitals ("Organic Matter"). Probably full forms may be used for cases (Forestland, Cultivated land and Grazing land). It is not necessary to define "P" for phosphorus, "C:N", "K^{+}" for potassium, "Ca^{2+}" for calcium or "Mg^{2+}" for magnesium. Standard deviation (SD) or other dispersion (standard error, SE) measure should be added to means (mean ± SD).

Table 4. Define "I" and "J". F statistics is not necessary, you can provide only the p-value in a row below the data columns as "ANOVA, p-value". Doing this and adding standard error as mean ± SE, this will simplify the table. Avoid unnecessary capitals ("Organic Matter").

Table 5. See previous comments on tables 3 and 4. Check spelling: "CECC".

Table 6. Use cation names, not element names when necessary (eg, Mg^{2+}, not Mg). Remove the "OM" row and the "Clay" column. Remove all "1" cells. Remove non-significant correlations: "AP" and "Silt" rows, and "AP" column. Then, all correlations are significant ($p \leq 0.01$) except Clay/TN and Mg^{2+}/Ca^{2+} (these will be the only ones that need to be marked as $p \leq 0.05$.

Figure 1. I think this figure is not necessary and suggest removing it. It would be more useful if land use types were shown in detail, not political borders of woredas. But if authors want to keep it, some changes are required. Remove "Map of the study area" from the figure. Add "Ethiopia" to the general view. Check if the figure is easily read when printed in the journal. Some patterns (Airo or Sobokumi, for example) are too similar to "Other Woreda Kebeles" (may you provide a color figure?). Is it necessary to differentiate woredas and regions (with a pattern for Oromia) in the detailed and general views instead of land use types? A zero to sixteen km scale is strange, can you provide a zero to twenty with ten or five km subdivisions? Remove the underscore ("_") from the legend.