We thank both reviewers and Yan Li for their time and effort and their helpful and constructive comments. The original comments of the reviewers and Yan Li are in color. Our reply is in black.

Comments Yan Li

I just happened to read this paper and I would like to pose my comments. It is a interesting paper that calculate RF at very fine scale. Here are my comments.
P10127 L5: RF affects global mean temperature. Technically, estimating RF can be done at very fine scale. But I am thinking RF at very fine scale, even it is positive, may have negligible impact on regional/global climate. However, the local impact of forest expansion is much larger than RF change. This is not for your paper, it is just my consideration on this question.

L6: Why forest cover increased in temperate mountains region? Is that because tree line moves up to higher altitude due to global warming?

In our discussion paper we write: "Forest cover has increased in many temperate mountainous regions". We do not suggest that it increased in all temperate mountainous regions. E.g. Ramankutty et al. 2010 show regional differences in the United States. The references we listed in line 6-8 (P 10127) discuss both aspects, forest cover increase due to land-use change and due to climatic changes (Alewell and Bebi, 2011; MacDonald et al., 2000; Ramankutty et al., 2010; Kozak, 2003; Hagedorn et al., 2014).

L20: What drives forest expansion in Switzerland? Natural causes or forestry? Or due to reasons listed in P10128 L16-17?

Forest expansion in Switzerland is mainly related to the reasons listed in P10128 L16-17 (the widespread abandonment of marginal agricultural land and the subsequent expansion of forest cover). However, a small amount of forest cover increase is related to climatic changes.

We added the following sentence to the revised discussion paper: "Land abandonment was the most dominant driver for the establishment of new forest areas, however, a small fraction of forest expansion at the tree line can be attributed to the recent climate warming (Gehrig-Fasel et al., 2007)."

For methodology part: How reliable are the climate data (global radiation) and carbon stock (soil carbon…) at such high spatial scale? It seems to me that spatial data of carbon stock are derived from assigning averaged values of each land class to an existing land cover map? Accurately mapping carbon stock is still a challenge.

We think that the global radiation data is of high quality (P 10133 L15-L19): "The spatial resolution of the global radiation datasets is 2.2km. The derivation of the global radiation data was based on the Heliosat method (Cano et al., 1986; Beyer et al., 1996; Hammer et al., 2003), applied to Meteosat SEVIRI data. It was verified using high-quality surface measurements and sensitivity runs for key input parameters (Durr et al., 2010)."

Yes, to derive carbon stocks at high spatial resolution is indeed a challenge and we thus assigned average values to the land-cover classes based on a biogeographical and altitudinal stratification. We mainly follow the methods in Switzerland's Greenhouse Gas Inventory. Please refer to the methods section P 10129 L 26 – P10130 L 3 (P 10129 L 24 – P10131 L 4).

Please check the label of each sub-figure and its captions of figure 3.

We changed the labels.

Figure 3: Does Albedo difference have seasonal variations due to phonology during snow free season?

Please refer to the reply to the comments of referee 1 for a more detailed discussion on this point.

P10131 L10: How do you estimate delta mc (carbon sequestrated)? Do you mean carbon stock here?

We changed the description of delta mc. It is now: "... where ΔCA is the change in atmospheric CO2 concentration, ΔmC the difference between carbon stocks of two LULC classes, …"

P10139 L28-29 You said "The carbon sequestration potential of forests decreased with altitude". But why CO2 - forcing in figure 5 becomes more negative as altitude increases in the three region on the righthand?

Figure 5 shows the CO2-forcing of forest expansion between 1985 and 1997. The CO2 forcing becomes more negative as altitude increases because most transitions from open land to forest occurred above 1000 m. Forests in high altitude will have lower carbon stocks than forests in low altitudes. However, there are much more transitions from open land to forest in high altitude and thus the CO2 forcing becomes more negative.

It seems to be a general issue, that our discussion paper does not yet clearly show, where we included real forest transitions between 1985 and 1997 and where we just showed spatial differences in RF of "potential" forest expansion. Please refer to the reply to the review of referee 2 and the revised version of the discussion paper, where we dealt with this issue in more detail.

P10140 L5: The word “carbon sequestration” sounds to me is a time dependent rate that forest remove carbon from atmosphere, e.g., NEP/NEE, kgc/year. Carbon stock refers to the current state about the existing mass of carbon in forest biomass.

We estimated carbon sequestration as the difference in carbon stocks between two LULC classes. For a better understanding we replaced: “Transitions from Open Forest to Closed Forest were generally associated with relatively high amounts of carbon sequestration…” by “Transitions from Open Forest to Closed Forest were generally associated with relatively high change in carbon stocks…”.

I think some contents in discussion are more suitable to appear in Results (e.g., second paragraph of discussion). There are too many things in current discussion which is a bit too long and lacks of focus that I get lost. It can be improved by better organize key points and condensation in language.

We tried to shorten the discussion. However, we did not include many changes, because we considered most of the points very important. Please refer to the revised version of the manuscript.

RFs of albedo change and CO_2 have different climate sensitivities, if you want to use RF to consider their contribution to temperature change, you should keep in mind about this. (see Zhao, KG, 2014, Biophysical forcings of land-use changes from potential forestry activities in North America; Hansen, J., et al. 2005. Efficacy of climate forcings. Journal of Geophysical Research Atmospheres 110:D18104.)

We agree that climate sensitivities are a very important point. Please refer to the discussion paper P 10144 L 24 – P 10145 L 2: “However, the interpretation of RF values has to be done carefully. First, the concept of Radiative Forcing has been developed to compare the impact of different forcing agents on the global mean temperature (Hansen et al., 2005). When applied at the regional and local scales one should keep in mind that the comparison of different forcing agents is far from being straightforward. For instance, the impact of albedo will remain mostly local while those from CO_2 will be globally distributed and therefore diluted. Furthermore, the Climate sensitivities of CO_2 RF and Albedo RF may differ (Davin et al., 2007).”

Since Zhao and Jackson (2014) refer to Davin et al. (2007) when discussing the differences in climate sensitivities of CO_2 and albedo, we chose to directly refer to this reference.

DAVIN, E. L., DE NOBLET-DUCOUDRE, N. & FRIEDLINGSTEIN, P. 2007. Impact of land cover change on surface climate: Relevance of the radiative forcing concept. *Geophysical Research Letters,* 34.
GEHRIG-FASEL, J., GUISAN, A. & ZIMMERMANN, N. E. 2007. Tree line shifts in the Swiss Alps: Climate change or land abandonment? *Journal of Vegetation Science,* 18**,** 571-582.
ZHAO, K. G. & JACKSON, R. B. 2014. Biophysical forcings of land-use changes from potential forestry activities in North America. *Ecological Monographs,* 84**,** 329-353.