**REFEREE #3**

General comment I agree with the body of the article through the comparison of the Erodibility (K) factor in RUSLE with soil aggregate stability indexes, it could be a useful tool to analyse soil status regarding erosion, I agree with the developed methodology. Anyway, I would like to remark that soil erosion estimation through RUSLE involves soil external factors such rain characteristics that are most important in the A RUSLE factor. In that sense, underestimating or overestimating the soil erosion through this methodology are not completely trustable since no REAL data are produced. I also stress to discuss with OWN data on the discussion section. On the attached document I made some comments overwritten in yellow. Based on the scientific significance of the article I will accepted with major revision. Please also note the supplement to this comment:

**The paper was deeply revised thanks to the comments of all referees.**

**We therefore reformulated a large part of the work considering the general concerns of the three reviewers. In particular, we tried to better define the aim and therefore made substantial changes in abstract, introduction and conclusion sections. We also better discussed (see also comments of referees #1, 2) the residuals issue and introduced new figures and annex (as specifically requested by rev#2).**

**New abstract and conclusions are reported below, followed by the responses to specific comments.**

*Abstract*

*Erosion is a relevant soil degradation factor in mountain agrosilvopastoral ecosystems, and can be enhanced by the abandonment of agricultural land and pastures, then left to natural evolution. The on-site and off-site consequences of soil erosion at the catchment and landscape scale are particularly relevant and may affect settlements at the interface with mountain ecosystems. RUSLE (Revised Universal Soil Loss Equation) estimates of soil erosion consider, among others, the soil erodibility factor (K), which depends on properties involved in structure and aggregation. A relationship between soil erodibility and aggregation should therefore be expected. On the other handerosion may limit the development of soil structure, hence aggregates should not only be related to erodibility but also partially mirror soil erosion rates. The aim of the research was to evaluate the agreement between aggregate stability and erosion-related variables and to discuss the possible reasons for discrepancies in the two kinds of land use.*

*Topsoil horizons were sampled in a mountain catchment under two vegetation covers (pasture vs. forest) and analyzed for total organic carbon, total extractable carbon, pH, texture. Soil erodibilty was computed, RUSLE erosion rate was estimated, and aggregate stability was determined by wet sieving. Aggregation and RUSLE-related parameters for the two vegetation covers were investigated through statistical tests such as ANOVA, correlation, and regression.*

*Soil erodibility was in agreement with the aggregate stability parameters, i.e. the most erodible soils in terms of K values also displayed weaker aggregation. Despite this general observation, when estimating K from aggregate losses, the ANOVA conducted on the regression residuals showed land use dependent trends (negative average residuals for forest soils, positive for pastures). Therefore, soil aggregation seemed to mirror the actual topsoil conditions better than soil erodibility. Several hypotheses for this behavior were discussed. A relevant effect of the physical protection of the organic matter by the aggregates that cannot be considered in K computation was finally hypothesized in the case of pastures, while in forests soil erodibility seemed to keep trace of past erosion and depletion of finer particles. A good relationship between RUSLE soil erosion rates and aggregate stability occurred in pastures, while no relationship was visible in forests. Therefore, soil aggregation seemed to capture aspects of actual vulnerability that are not visible through the erodibility estimate. Considering the relevance and extension of agrosilvopastoral ecosystems partly left to natural colonization, further studies on litter and humus protective action might improve the understanding of the relationship among erosion, erodibility and structure.*

*5 Conclusions*

*The soil aggregate stability in a mountain catchment was assessed with a laboratory wet sieving test and the results were compared with the erodibility factor K and the estimated erosion rate (RUSLE model). The K factor was positively correlated with the aggregate loss (wet sieving test), i.e. the most erodible soils (higher K) also displayed higher aggregates losses and quicker breakdown. Land use dependent trends were however observed in the estimate of K from aggregates loss. In facts, the residuals for forest soils were lower in absolute value and with average negative value, while the opposite behavior was found in pastures. Therefore, soil aggregate stability seemed to reflect better the actual vulnerability of topsoils to physical degradation. Several reasons for this behavior were discussed, and a relevant effect of the physical protection of organic matter by aggregates that cannot be considered in the traditional K formulation was hypothesized for pastures. In forests, soil erodibility seemed to keep trace of past erosion and depletion of fine particles. Moreover, while the RUSLE erosion rate could be satisfactorily predicted from aggregates loss for pastures, this was not possible for forests. In forests, erosion estimate seemed particularly problematic also because of a high spatial variability of litter properties. The protecting role of the forest floor in terms of richness and diversity, and not only of cover, in the RUSLE C factor definition, would need further investigation in order to better understand the mechanisms that determine the relationship between soil erosion and structure for the different land uses.*

Comment 1 page 6: the number
Unbalanced N.

**As suggested also by reviewer 1, comment#5, we reformulated as follows the sampling strategy description:**

*"Out of the total area, around 199 ha were represented by soils while the rest was covered by rock outcrops. Considering a medium to high detail according to Deckers et al. (2002) we hypothesized a minimum sampling density of ca 1 profile/10 ha, then distributed the sampling frequency according to LUTs abundance and accessibility. Twenty-five topsoils (i.e. always within A horizons, discarding the organic layers) were sampled at 0-10 cm (n=25, of which 9 were represented by pasture, 16 by forest). The number of samples per LUT class was proportional to the LUT type abundance and considered the internal homogeneity of the LUT types. "*

Comment 2: replicates

**We referred to the replicates of lab analyses, i.e. all chemical analyses and physical analyses were determined twice and then averaged. We explained better in the text as follows** *"All chemical and physical analyses were made in double and then averaged."*

Comment 3: statistics

**We added a new paragraph in the methods (section 2.4) as requested by referee#1, too.**

Table 1: **in the table, now table 2, we added the carbonates column**

Comment 4**: we added the following sentence about the role of Carbonates in aggregation. We can however remark that, despite the topsoil contains carbonates, the carbonates found in the studied topsoils are primary carbonates and not pedogenic carbonates, therefore their role as binding agents in aggregates formation may be reasonably considered marginal.**

**We changed into** *"In facts, as reported by Tisdall and Oades (1982), in coarse sand-sized aggregates, organic matter acts as a relevant binding agent for aggregates. Moreover, CaCO3 in the studied environment is of primary origin and not pedogenic, thus is not expected to act as cementing agent because of scarce reactivity and large grain dimensions (Le Bissonais, 1996)."*

Figure 5: **we changed the figure as required adding in the text the $R^2$ value (0.18) and line. We remarked in the text that the forest regression is non-significant.**