Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-2-AC2, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Infiltration-Friendly Land Uses for Climate Resilience on Volcanic Slopes in the Rejoso Watershed, East Java, Indonesia" *by* Didik Suprayogo et al.

Didik Suprayogo et al.

suprayogo09@yahoo.com

Received and published: 17 May 2020

1. General comment

Comment 1 The study by Suprayogo et al. addresses a relevant topic and will be of interest to the hydrologic community. However, the work lacks the quality that is expected from a HESS publication. Some of the major issues are: 1) Introduction section is quite weak and doesn't offer enough lit review to gauge the novelty of the work; 2) research questions are vague and need to be carefully thought through; 3) Several method related details are unclear, and the statistical aspect of the work requires more effort. 4) Discussion lacks critical thinking, and authors need to carefully think about

the key messages that they want to discuss and convey. Lastly, the work needs clarity and organization throughout the sections. I would recommend the authors to revise the manuscript substantially and resubmit.

Feedback comment 1 Thank you, we do hope also that this manuscript is addressing a relevant topic to the hydrologic community. Our feedback with your concern: The Introduction, we will revised and the novelty we clarify at specific comment no 2.4. The research question, we develop hypothesis as describe at specific comment no. 2.17. The unclear method, we revised as drafted at specific comment from no 2.11, to no 2.17. The discussion, we revised as drafted as describe at specific comment no. 2.23.

Thank you for all the input for the improvement of this manuscript. The results of this review are really our concern to revise the manuscript.

Comment 2 Abstract – Too much unnecessary detail and the relevant information is missing. Most of the abstract focuses on introduction and methods and relatively little text on interpretations and implications of the work.

Feedback comment 2 Our abstract, we revised as: Abstract. Forest conversion to agriculture or agroforestry may increase risks of loss of hydrologic functions in an era of climate change. Infiltration during high-intensity rainfall is important for avoiding erosion and feeding aquifers but depends on land use practices that maintain soil macroporosity. In the forest-to-open-field-agriculture continuum it is not clear where thresholds to functionality ('degradation') are crossed. Our assessment of 'infiltration-friendly' land uses in the Rejoso watershed on the slopes of the Bromo volcano in East Java (Indonesia) focused on two zones, upstream (above 800 m a.s.l.) and midstream (400-800 m a.s.l.) of the Rejoso river and feeding aquifers that support lowland rice areas as well as drinking water supplies to nearby cities. Upstream land uses included old and young pine plantations (production forest) and highland vegetable crops with variation of tree canopy cover on the landscape on in steep (30-60%) to very steep (> 60%) lands with imperfect ridge terraces. Midstream land uses included production forest, multistrata

coffee-based agroforestry, clove-based agroforestry, and several mixed agroforestry types with variation of tree canopy cover on the landscape on moderately steep (15-30% and steep (30-60%) with bench terrace sloping outward. We quantified infiltration and erosion in three replications per land use category over a period of nearly two months (one-fourth of mean annual rainfall), with 6-13% of rainfall with intensities (51-100 mm day-1). We related soil infiltration to plot-level characteristics across the land use systems and found statistically significant relations with tree canopy cover (likely based on combined effects of interception, soil moisture status and effects on soil) and amount of litter. The soil infiltration had statistically significant relations with surface micro-topographic variation under forest-agroforestry systems (midstream), but not under vegetable cultivation in steep to very steep lands. There was no significant relationship between soil erosion and understory biomass of land use systems. Results for the upstream watershed showed that a tree canopy cover >55% was associated with adequate infiltration and acceptable soil erosion levels. For vegetable cultivation with a tree canopy cover below 55%, surface runoff was between 24% and 46% of rainfall, with high rates of soil erosion. Midstream, a tree canopy cover of >80% was associated with 'infiltration-friendly' land use, given the higher rainfall total (and rainfall intensity) in this zone. For a tree canopy cover in the range 20-80%, erosion rates were relatively low, but surface runoff increased to 36 to 62% of rainfall. Differences in soil type influenced the thresholds, as the areas' Inceptisols have lower intrinsic porosity than Andisols. A high soil surface roughness and litter thickness assist in reducing surface runoff and soil erosion. Where more open forms of agroforestry, with tree canopy cover less than 80% are becoming more common this will affect water resources in the downstream area and increase vulnerability to climate change.

Comment 3 Introduction – The authors need to highlight the novelty and research gap in their work. What is the research gap that you want to address? Is it about the volcanic landscape, erosion in a forest to open-ïňĄeld-agriculture continuum or, both? How many studies have done similar work in a volcanic landscape? If any, what were their ïňĄndings?

Feedback comment 3 In the forest-to-open-field-agriculture continuum in the Rejoso watershed as examples, it is also happen in other place in Indonesia and also in the world, has the potential to alter water ïňĆuxes on different spatial scales. Despite some large-scale studies being developed, there are still few investigations in experimental sites in this region. In Indonesia, many large-scale studies on water balance were developed in some hydrographic regions in the country (Ridwansyah et a;., 2014, Pradiko et al. 2015, Azmeri at al., 2015, Kuntoro et al., 2018, Mahmud et al. 2018, Nugroho et al. 2019). Nevertheless, experiment-scale studies are still rare due to the local heterogeneities and uncertainties from hydrological measurements and estimates (Beven, 2006; Graham et al., 2010).

Basic ïňĄeld-hydrology studies are important for improving the sustainable land use management while promoting sustainable development. Therefore, these studies are important for promoting new solutions and techniques to maintain the water balance in spite of the rapid land use changes (Dotterweich, 2013; Nobrega et al., 2017). This research of this kind can be done using experimental plots, which are delimitated hillslopes (control volume) where the runoff is directed to one outlet of runoff colector (Sadeghi et al., 2013; Oliveira et al., 2016; Mwango et al., 2016; Strohmeier et al., 2016; Youlton et al., 2016b; Anache et al., 2017).

Comment 4 Research questions could use some clarity and can better. In question 1, ": : :limit inïňĄltration below the required rate" what do you mean by required rate? How do you deïňĄne it? Please be more quantitative about it. Similarly, "inïňĄltration friendly" is also a vague term.

Feedback comment 4 Regarding the research question, we describe in general feed comment 7. Required rate is refer to adequate infiltration when the forest hydrological function with runoff coefficient is not more than 0.14 for Andisol (soil type A and for Inceptisol 0.20 (soil type C) base on reference: Knox County Tennessee. Stormwater Management Manual, section on the Rational Method, Volume 2 Technical Guidance. Available online: (https://dec.alaska.gov/water/wastewater/stormwater/swppp-

dev-runoff-coefficient-values-rm (accessed on 26 April 2020).

We considered this suggestion related the term “inïňĄltration friendly”, but think that it will create more confusion that it solves. If the reader gets interested in what this term means, we invite them to read the abstract and paper in which it is explained.

Comment 5 Generally, the topical sentence of a paragraph introduces an idea and rest of the texts expand on it. In the manuscript, several ideas have been introduced in the same paragraph, resulting in an incoherent passage with no clear message. This is true for many paragraphs throughout the draft. Lastly, the entire section could use better organization.

Feedback comment 5 Thank you for your suggestion, we will consider during revision of this manuscript

Comment 6 Methods Several method related details are unclear, and assumptions made during measurements have not been clearly laid out. How many places did you measure rainfall/through fall underneath the canopy? How do we account for the spatial variability in rainfall due to heterogeneity in canopy cover? The method used for estimating canopy cover is unclear, and the citation is missing in the References section.

Feedback comment 6 We clarify in the specific comment from comment 12 to comment 18.

Comment 7 “A probability level of 0.05 was set for rejecting null-hypothesis of no difference in tests of statistical..” what were the hypotheses that you tested? No hypothesis has been shared in the manuscript. Are you referring to LSD tests? In the ïňĄeld conditions, most of the key drivers will “interact” in response to rainfall.

Feedback comment 7 To answer the first research question with the hypothesis that forest-to-open-field-agriculture continuum significantly decreases the soil hydrological function of forests, we examine differences in soil infiltration, runoff coefficient

and soil erosion between dominant land uses in each upstream and midstream with The Fisher’s LSD test. The Fisher’s LSD test, which establishes differences between groups deïňĄned for independent samples, was used for hypothesis testing, given that the data met the requirements for normality and homogeneity of variances. A probability level of 0.05 was set for rejecting null-hypotheses of no difference in tests of statistical signiïňĄcance. We used software GenStat 15th edition to have Fisher’s LSD test. The soil infiltration, runoff coefficient and soil erosion then we compare with soil infiltration category (Landon, 1984), the adequate infiltration (Knox County Tennessee criteria) and acceptable soil erosion (calculated by using the formula Hammer, 1981). The second research question come out with hypothesis that dominant factors that determine “infiltration friendly” on plot scale are tree canopy cover, understorey vegetation, litter necromass, and land surface roughness. Linear regression relationships between the surface runoff / rainfall ratio or soil erosion and the amount of rainfall, tree canopy cover, understory, litter, and land surface roughness were determined using SigmaPlot version10.0.

The third research question is as an analysis the answers of the previous two research questions with the hypothesis that it is not always that the upstream watershed area is more sensitive to hydrological disturbance due to changes in land use than midstream, but the factor of soil properties also determines considerations in watershed hydrological management.

Comment 8 The regression model with a single explanatory variable may not be an ideal approach here. Would it be possible to use models that incorporate some interaction effect between the explanatory variables? Also, did you explore the correlation among explanatory variables? If you are really interested in exploring the inïňĆuence of an individual exploratory variable on erosion, please use partial correlations that allows to control the effect of other related variables on responses.

Feedback comment 8 Thank you for your suggestion, We will looking again the data and we try to reanalysis by using the linier multiple regression with Genstat statistical

tool analysis. However, we will still consider with 12 observations whether it is sufficient for this analysis.

Comment 9 Results and Discussion: The discussion section could use some critical thinking, especially about the key messages that you want to convey. Most of the discussion revolves around the major drivers of responses. The section barely discusses questions 1 and 3. Lastly, you want to show how the work advances our current understanding of runoff and erosion processes in the volcanic region.

Feedback comment 9 The result and discussion, we will revised to answers the determined tree research question in this manuscript. For the first research question, we added the additional data that not yet presented in the first draft of manuscript. The additional data as presented in supplement note no 1. as revised Table 2. We revised soil texture data that presented on each layering soil of 0-10 cm, 10-20 cm and 20-30 cm, 30-40 and 40-50 cm. We added our data measurement on soil bulk density, particle density, total soil porosity, soil macro-poroity and soil organic matter content in each layering soil of 0-10 cm, 10-20 cm and 20-30 cm. We also will added the infiltration measurement data by using Double ring infiltrometer as presented in note 1.2. We use this data to answer the first research question.

2. SpeciïňĄc comments

Comment 1 Line 11 Too much detail and the key massages are hard to follow

Feedback comment 1 We clarify in the general comment 2 above.

Comment 2 Line 24.What was the landscape type steep, very steep? Why mention at one place not at others?

Feedback comment 2 We classified based on FAO, 2006. Guidelines for soil description. Food and Agriculture Organization of the United Nations, Rome, 2006.

We revised: Upstream land uses included old and young pine plantations (production forest) and highland vegetable crops with variation of tree canopy cover on the land-

scape on in steep (30-60%) to very steep (> 60%) lands with imperfect ridge terraces. Midstream land uses included production forest, multistrata coffee-based agroforestry, clove-based agroforestry, and several mixed agroforestry types with variation of tree canopy cover on the landscape on moderately steep (15-30% and steep (30-60%) with bench terrace sloping outward.

Comment 3 Line 24. How do you define adequate infiltration or acceptable soil erosion? Please be more quantitative

Feedback comment 3 Adequate infiltration when the forest hydrological function with runoff coefficient is not more than 0.14 for Andisol (soil type A and for Inceptisol 0.20 (soil type C) base on reference: Knox County Tennessee. Stormwater Management Manual, section on the Rational Method, Volume 2 Technical Guidance. Available online: (https://dec.alaska.gov/water/wastewater/stormwater/swppp-dev-runoff-coefficient-values-rm (accessed on 26 April 2020).

Acceptable soil erosion where the soil erosion equal or less than Agriculture permissible rate of soil erosion (Eapr, ton ha-1 year-1) for tropical soil analyzed according to the formula Hammer [1981], calculated as::

E_apr=((Depth of soil*Factor of soil depth)/(The useful of soil))*Soil bulk density

Both Andisol and Inceptisol is has deep soil, then we consider that the regolith soil has 120 cm soil depth, and factor of soil depth = 1 (see also supplement note no 2), The useful of soil we determine 400 year. With average soil bulk density of Andisol = 0.83 g cm-3, and Inceptisol = 0.99 g cm-3, then the Eapr Andisol = 24.9 ton ha-1 year-1 and Eapr Inceptisol 29.7 ton ha-1 year-1

Hammer W. I. 1981 Soil Conservation Consultant Report AGOF INS/78/006 Technical Note No 7CSR Bogor

Comment 4 Line 29 Threshold for what?

Feedback comment 4 We mean that threshold for “infiltration friendly”

Comment 5 Line 33 Research gap and novelty are difficult to see here

Feedback comment 5 In the forest-to-open-field-agriculture continuum in the Rejoso watershed as examples, it is also happen in other place in Indonesia and also in the world, has the potential to alter water ïňĆuxes on different spatial scales. Despite some large-scale studies being developed, there are still few investigations in experimental sites in this region. In Indonesia, many large-scale studies on water balance were developed in some hydrographic regions in the country (Ridwansyah et a;., 2014, Pradiko et al. 2015, Azmeri at al., 2015, Kuntoro et al., 2018, Mahmud et al. 2018, Nugroho et al. 2019). Nevertheless, experiment-scale studies are still rare due to the local heterogeneities and uncertainties from hydrological measurements and estimates (Beven, 2006; Graham et al., 2010). Basic ïňĄeld-hydrology studies are important for improving the sustainable land use management while promoting sustainable development. Therefore, these studies are important for promoting new solutions and techniques to maintain the water balance in spite of the rapid land use changes (Dotterweich, 2013; Nobrega et al., 2017). This research of this kind can be done using experimental plots, which are delimitated hillslopes (control volume) where the runoff is directed to one outlet of runoff colector (Sadeghi et al., 2013; Oliveira et al., 2016; Mwango et al., 2016; Strohmeier et al., 2016; Youlton et al., 2016b; Anache et al., 2017). References listed at supplement note no 3.

Comment 6 Line 37 Almost every line in the paragraph introduction a new idea and moves on to other in the next line. What is the massage that you want to convey here?

Feedback comment 6 Thank you for your suggestion, we will consider during revision of this manuscript

Comment 7 Line 71 How do we know this? Any citation / data?

Feedback comment 7 This is based on the video document made by Danon and we will share this video

Comment 8 Line 79 What do you mean by required rate?

Feedback comment 8 Required rate is refer to adequate infiltration when the forest hydrological function with runoff coefficient is not more than 0.14 for Andisol (soil type A and for Inceptisol 0.20 (soil type C) base on reference: Knox County Tennessee. Storm-water Management Manual, section on the Rational Method, Volume 2 Technical Guidance. Available online: (https://dec.alaska.gov/water/wastewater/stormwater/swppp-dev-runoff-coefficient-values-rm (accessed on 26 April 2020).

Comment 9 Line 80 Discussion sector mostly focuses on the second question, rest of questions are rarely discussed

Feedback comment 9 Thank you for your suggestion, we will revised the balance discussion for three research question in this manuscript

Comment 10 Line 85 Please use SI units throughout

Feedback comment 10 63,359 hectares. We revised using SI unit become 634 km2

Comment 11 Line 100 This is also known as runoff coefficient

Feedback comment 11 We will change in the manuscript instead of the Runoff / Rainfall ratio to become runoff coefficient.

Comment 12 Line 101 Did you measure rainfall at multiple places under the canopy or at ‘one’ places? Generally, there is large variability an interception, depending upon the vegetation / forest type

Feedback comment 12 We revised as: “Rain gauges were installed in four observation locations (with adjacent erosion plots) upstream and four observation locations midstream of the Rejoso watershed. Each plot, the rainfall was measured with 5 replications. The rain gauges consisted of 30 cm diameter of funnel and bottle with a volume of 1.5 dm3 placed 120 cm above the soil surface and below the tree canopy

with bamboo as a support. Rainfall was observed every day during two months of the rainy season, from March to May 2017".

The measurement of rainfall at 5 places randomly in the inner-plot. It is right there is large variability an interception, depending upon the vegetation / forest type. The Through-fall /Rainfall ratio variability is presented in supplement note no 4.

Comment 13 Line 112 What do you mean by "newsprint"? Is that standard approached? Please provided citation.

Feedback comment 13 "Newsprint" mean old newspapers (see picture in Supplement Note 5). We filtering the sediment sample using 'newsprint'. The water through a filter 'newsprint' was relatively clear. Therefore, we consider that 'newsprint' filter is considered effective to trap the sediment. We do not calibrate between 'newsprint' filter with standard filter. However, we can calibrate this filter 'newsprint' with standard filter.

Comment 14 Line 131. I was expecting remote sensing based method here. I can't find citation so don't really know about this method.

Feedback comment 14 The canopy cover can be defined as the percent tree canopy area occupied by the vertical projection of tree crowns (Jennings, 1999). The percentage of canopy cover is measured by scathing the shadow of sunshine at ground level using 10 m x 10 m of white paper. The canopy projection when the sun was overhead was drawn to scale on white paper in each of four quadrants of the 20 m x 20 m plots, after which the areas shaded were cut out and weighed separately. Canopy cover was calculated according to eq. (5):

%Canopy Cover=(W Canopy)/(W Total) X 100 [5]

Where: % Canopy cover is the percentage of tree canopy cover, W_Canopy is the paper weight representing canopy cover and W_Total the paper weight representing the total area of observation, respectively. *Jennings, S.B., N.D. Brown, and D. Sheil..

Assessing forest canopies and understorey illumination: Canopy closure, canopy cover and other measures. Forestry72(1):59-73. 1999.

Comment 15 Line 133 Citation not provided

Feedback comment 15 Cited Arumsari, 2003 is in Bahasa Indonesia and hence less accessible for most readers therefore, we replace with *Jennings, S.B., N.D. Brown, and D. Sheil.. Assessing forest canopies and understorey illumination: Canopy closure, canopy cover and other measures. Forestry72(1):59-73. 1999.

Comment 16 Line 137. CV also refer to coefficient of variation so may bay pick a different acronym

Feedback comment 16 We change without acronym as below:

Canopy cover was calculated according to eq. (5): %Canopy Cover=(W Canopy)/(W Total) X 100 [5]

Where: % Canopy cover is the percentage of tree canopy cover, W_Canopy is the paper weight representing canopy cover and W_Total the paper weight representing the total area of observation, respectively

Comment 17 Line 144 Again citation missing in reference.

Feedback comment 17 Hoechsteetter, S., Walz, U., Dang, L. H., Thinh, N. X.. Effect of Topography and Surface Roughness in Analyses of Landscape Structure- A Proposal Modify The Existing Set of Landscape Metrics. Landscape Online 3: 1-14 (8). https://gfzpublic.gfz-potsdam.de/pubman/item/item_32854. 2008

Comment 18 Line 145. Provide more detail. What are the groups that you are looking at. What hypotheses are being tested? Are you planning to build linier regression model to stimulate runoff or sediment? Line 147 I haven't seen any hypothesis yet?

Feedback comment 18 To answer the first research question with the hypothesis that forest-to-open-field-agriculture continuum significantly decreases the soil hydrological

function of forests, we examine differences in soil infiltration, runoff coefficient and soil erosion between dominant land uses in each upstream and midstream with The Fisher's LSD test. The Fisher's LSD test, which establishes differences between groups deïňĄned for independent samples, was used for hypothesis testing, given that the data met the requirements for normality and homogeneity of variances. A probability level of 0.05 was set for rejecting null-hypotheses of no difference in tests of statistical signiïňĄcance. We used software GenStat 15th edition to have Fisher's LSD test. The soil infiltration, runoff coefficient and soil erosion then we compare with soil infiltration category (Landon, 1984), the adequate infiltration (Knox County Tennessee criteria) and acceptable soil erosion (calculated by using the formula Hammer, 1981). The second research question come out with hypothesis that dominant factors that determine "infiltration friendly" on plot scale are tree canopy cover, understorey vegetation, litter necromass, and land surface roughness. Linear regression relationships between the surface runoff / rainfall ratio or soil erosion and the amount of rainfall, tree canopy cover, understory, litter, and land surface roughness were determined using SigmaPlot version10.0.

The third research question is as an analysis the answers of the previous two research questions with the hypothesis that it is not always that the upstream watershed area is more sensitive to hydrological disturbance due to changes in land use than midstream, but the factor of soil properties also determines considerations in watershed hydrological management.

Comment 19 Line 155. What do mean by average rainfall here? This is the rainfall total for 3 months correct? How did you get range, explain!; rewrite the entire sentence for clarity

Feedback comment 19 Yes, it is right that the rainfall total of 2 months (not 3 months). The average rainfall mean that in upstream we have 4 condition of canopy cover and each canopy cover has 3 replication, then there is 12 plot measurements. Each plot of measurement was installed a rain gouge on open surface. We also installed five rain

gouges to measure through-fall rain. This rainfall is the average of 12 rain gouge on open surface, then we have a range. The same thing also done for midstream.

Revision: Within the measurement period 31 rainy days were recorded (Figure 3). Rainfall variation between upstream and midstream observation plots was relatively high with an average of 520 mm (range 476 - 556 mm among 12 rain gauge measurements), and an average 666 mm (range 541 – 840 mm among 12 rain gauge measurements), respectively. In the upstream and midstream areas 71% and 57% of the rainy days had <20 mm day-1 ('light rain'), 24% and 31% had 'moderate' rainfall (21-50 mm day-1) and 6% and 13% 'heavy' rain (51-100 mm day-1), respectively; none had 'very heavy rain' (> 100 mm day-1). Such rain conditions indicate that the rain-erosivity in midstream is higher than that upstream.

Comment 20 Line 163 what is C-org? never been explained in the paper. Organic carbon content?

Feedback comment 20 We revised become: The soil organic carbon content varied from 0.65 to 2.12 %.

Comment 21 Line 197 It is correct interception? Figure 6 and Figure 7 do not show no significant relationships with understory, no?

Feedback comment 21 Thank you for your correction. We revised as: "Understory vegetation theoretically can reduces splash impacts on the soil and supports infiltration, as does the litter necromass present. However, the result of this study indicated that understory show no significant relationships with runoff coefficient and soil erosion".

Comment 22 Line 203 Is this the summary of all the findings?

Feedback comment 22 Referring the comment 2.17 this is the summary of the finding for research question 2. We will add the summary research question 1 and 3.

Comment 23 Line 207 Itn't this broad statement? Won't also depend upon the type of forest, no?

Feedback comment 23 We revised as drafted in Supplement Note 6.

Comment 24 Line 207 para 2 on canopy cover, para 3-roughness and porosity

Feedback comment 24 We revised as drafted in Supplement Note 6.

Comment 25 Line 219 Bit vague statement, compared to?

Feedback comment 25 We revised as "Both the production forest and agroforestry systems with high canopy maintained a relatively high land surface roughness compared with rare canopies in midstream area."

Comment 26 Line 220 Refer to?

Feedback comment 26 We revised as "Without a high canopy cover (Table 3.a). this roughness was not able to control surface runoff and erosion in. . .."

Comment 27 Line 221 Significant correlation with what?

Feedback comment 27 We revised as ". . .. . .this roughness was not able to control surface runoff and erosion in the upstream area, but midstream there were significant correlations with runoff coefficient and soil erosion".

Comment 28 Line 221 I understand but it would be better to elaborate and explain clearly

Feedback comment 28 We revised as "The role of surface roughness as sediment filter may depend on frequent regeneration to counter homogenisation (Rodenburg et al. 2003). Surface roughness in the landscape includes a cavity, meandering of streams due to the present of litter, necromass, tree trunk and rocks, providing opportunities for water flow to stop for longer periods and experience infiltration. This condition also functions as a sediment filter. This function needs to be managed through land management, so that surface roughness is maintained on the ground".

Comment 29 Line 222 Quite odd! Why sudden switch from surface roughness to poros-

ity in the same paragraph? Shouldn't porosity be the part of soil related discussion?

Feedback comment 29 We revised as drafted in Supplement Note 6.

Comment 30 Line 225 broad, please be spesific

Feedback comment 30 We revised as "The formation of old tree root channels can cause long time-lags between land cover change and soil macroporosity (van Noordwijk et al. 2011), obscuring relations between current tree cover and soil hydrologic functions"

Comment 31 Line 247 How do we define acceptable? Any value /range of infiltration rate?

Feedback comment 31 Required rate is refer to adequate infiltration when the forest hydrological function with runoff coefficient is not more than 0.14 for Andisol (soil type A and for Inceptisol 0.20 (soil type C) base on reference: Knox County Tennessee. Storm-water Management Manual, section on the Rational Method, Volume 2 Technical Guidance. Available online: (https://dec.alaska.gov/water/wastewater/stormwater/swppp-dev-runoff-coefficient-values-rm (accessed on 26 April 2020).

Comment 32 Line 379 you may want to say this is a "plan view"

Feedback comment 32 We revised "Figure 2. Runoff and soil erosion plot"

Comment 33 Line 385 Please briefly remind readers about what "1-4" refers to

Feedback comment 33 We rivesed as "Figure 5: Soil erosion in relation to daily rainfall rates in production forest and agroforestry (a) Upstream Rejoso Watershed, under (a.1) 55% canopy cover of Pine based of old production forest, (a.2) 40% canopy cover of Pine based of young production forest, (a.3) 5% canopy cover of Cemara based of Agroforestry with Cabbage crop, (a.4) 0% tree canopy cover of Arable land (maize crop) ; (b) Midstream Rejoso Watershed under (b.1) 87 % canopy cover of Pine/ mahogany

based of old production forest, (b.2) 75% canopy cover of Coffee-based agroforestry, (b.3) 52 % canopy cover of Clove based agroforestry, (b.4) 26% canopy cover of mix tees-crop based agroforestry".

Comment 34 Figure 6. Ideally, these dirvers / variables interact which these linear regression models are not capturing. I am not sure if you have enough sample size to build a bit more sophisticated model that came in corporates interaction effect

Feedback comment 34 We have tried multiple linear regression analysis but the relationship is not good. This is indeed true that with n = 12 there is insufficient data to get an acceptable statistical analysis. For this reason, we believe that it should still be presented as presented in the manuscript.

Comment 35 Why not lenear relationship in upstream and liner in mid-stream- any hypothesis?

Feedback comment 35 Figure 6 we present following the distribution of data trends, then we determine the relationships that best fit with existing data trends. The hypothesis is the same that is "dominant factors that determine "infiltration friendly" on plot scale are tree canopy cover, understorey vegetation, litter necromass, and land surface roughness"

Comment 36 No relation with understory?

Feedback comment 36 This is possible because surface runoff and erosion have been largely controlled by land cover. Growth and development of understory determined by canopy cover. Likewise, the tree plantations in each plot are also diverse, so this also affects the diversity of understorey vegetation underneath.

Comment 37 Figure 7. Add n sample size to the plot or caption

Feedback comment 37 Figure 7. Soil erosion in relation to tree canopy cover, understorey vegetation, litter necromass, and land surface roughness (n=12) in a: Upstream Rejoso Watershed; and b: Midstream Rejoso Watershed.

Comment 38 Table 2 Usage of "a and b" is confusing because above they refer to watersheds (upstream / downstream) Briefly expand abbreviations in the methods section, so they are within the manuscript text to.

Feedback comment 38 Table 2, we revised as Supplement Note 1.. Table 3. We revised as Supplement Note 6. We revised as presented in specific comment 18.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2020-2/hess-2020-2-AC2-supplement.pdf

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-2, 2020.