hess-2015-538
March 2 2017

Response to reviewers
Dear Editor
We have addressed the remaining concern in the current version of the manuscript.

Comments	Response
The text is reading well, and the authors have addressed all of my comments. The authors have clearly undertaken a very challenging task of parsing their original manuscript into two separate companion papers, and have done this admirably. I commend them for taking a step back at this late stage and synthesizing the text and redirecting their storyline.	Thank you for the positive evaluation of the most recent version of the manuscript
My remaining concerns are:	
(1) the phrasing of section 3.2, Numerical Examples (lines 372 – 380) In section 3.2, the phrasing is a little confusing – leading with the method instead of why it was done. Monte Carlo simulations are tools used for different purposes – it would be helpful to know the purpose upfront in this paragraph.	The section now reads: "For visualizing the effects of stochastic rainfall on river flow according to equation [1] a spreadsheet model that is available from the authors on request was used in 'Monte Carlo' simulations. Fixed values for F_p were used in combination with a stochastic $Q_{a,t}$ value. The latter was obtained from a random generator (rand) with two settings for a (truncated) sinus-based daily rainfall probability: A) one for situations that have approximately 120 rainy days, and an annual Q of around 1600 mm, and B) one that leads to around 45 rainy days and an annual total around 600 mm. Maximum daily $Q_{a,t}$ was chosen as 60 mm in both cases. For the figures, realizations for various F_p values were retained that were within 10% of this number of rainy days and annual flow total, to focus on the effects of F_p as such. "
(2) Figures // Part I:	
-Minor, but Figure 1 part B could be cleaned up, e.g., lines in alignment (if desired), etc	Thanks, we have simplified it
-Figure 3: Correct subscript on all Fp's, use Qa instead of Qadd (or make consistent between figures and captions), words instead of abbreviations (e.g., StDev), Day of year starting from when (if Jan 1 – use Julian Day instead)	Thanks, we have checked figures and text for consistency on Q_a vs Q_{add} and hope all F_p's now have the p as subscript; we shifted to Julian day and spelled out the abbreviations.
-Figure 3 and 4 refer to discharge using different words – keep consistency	We adopted discharge as the standard term
-Figures 6 and 7: Correct subscript with the p in Fp	thanks
Part II:	
-Figure 2: Axis title and axis are overlapping, clarify time step of values shown	Adjusted

-Figure 4b: impossible to distinguish the six points as shown – could you jitter them, or show them next to each other? If this is the point, that's fine too.	We made the points larger, so they can be distinguished
-Figures 5 & 6: define abbreviations in legend or spell out – I couldn't find if they were used elsewhere in a Table or the paper	Done
-Figure 8: consider coloring the text for the line fits by the colors corresponding to catchments	Thanks, done

We have combined figures 8 and 9 of part 1 to ensure they are presented at the same size.

The final set of figures is:

Figures Part I:

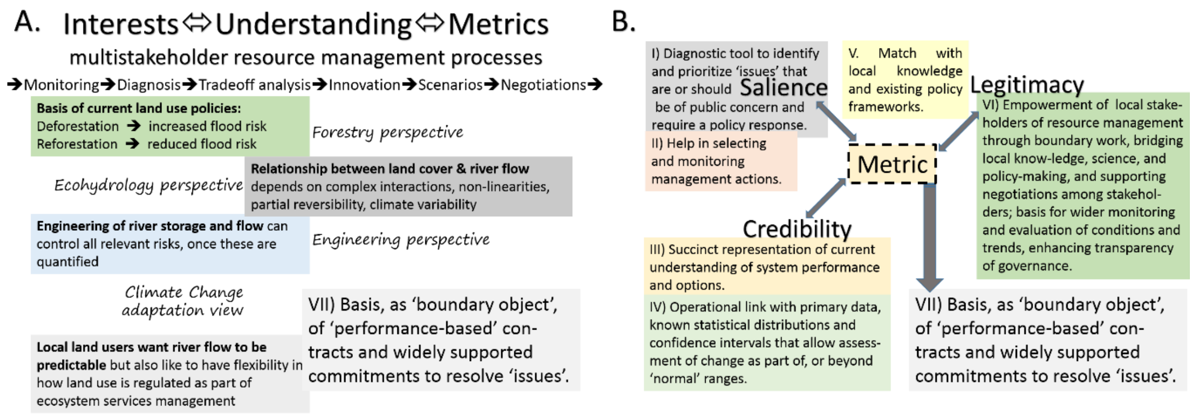

Figure 1. A. Multiple perspectives on the way flood risk is to be understood, monitored and handled according to different knowledge systems; B. Basic requirements for a 'metric' to be used in public discussions of natural resource management issues that deserve to be resolved and acted upon (modified from van Noordwijk et al., 2016)

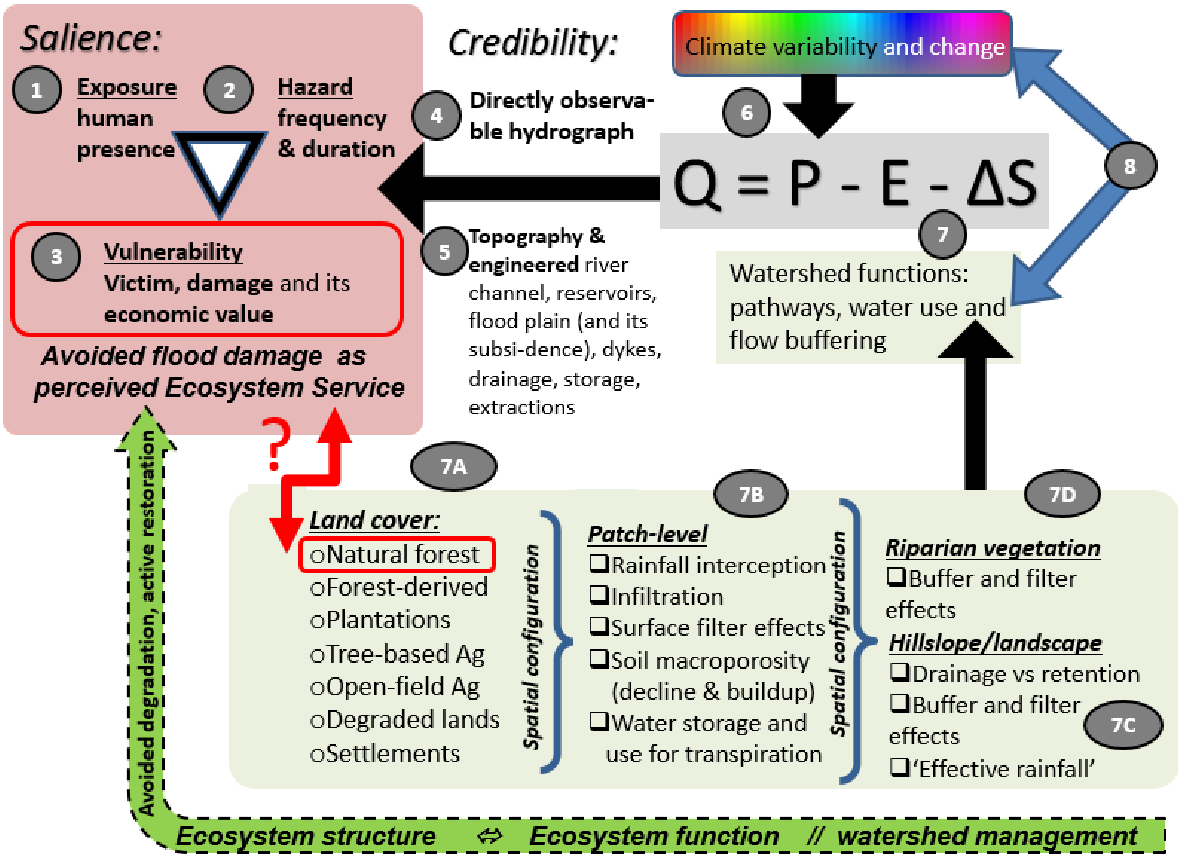

Figure 2. Steps in a causal pathway that relates the salience of 'avoided flood damage as ecosystem service' to the interaction of exposure (1; being in the wrong place at critical times), hazard (2; spatially explicit flood frequency and duration) and human determinants of vulnerability (3); the hazard component depends, in common scientific analysis, on the pattern of river flow described in a hydrograph (4), which in turn is understood to be influenced by conditions along the river channel (5), precipitation and potential evapotranspiration (E_{pot} as climatic factors (6) and the condition in the watershed (7) determining evapotranspiration (E_{act}), temporary water storage (ΔS) and water partitioning over overland flow and infiltration; these watershed functions in turn depend on the interaction of terrain (topography, soils, geology), vegetation and human land use; current understanding of a two-way interaction between vegetation and rainfall adds further complexity (8)

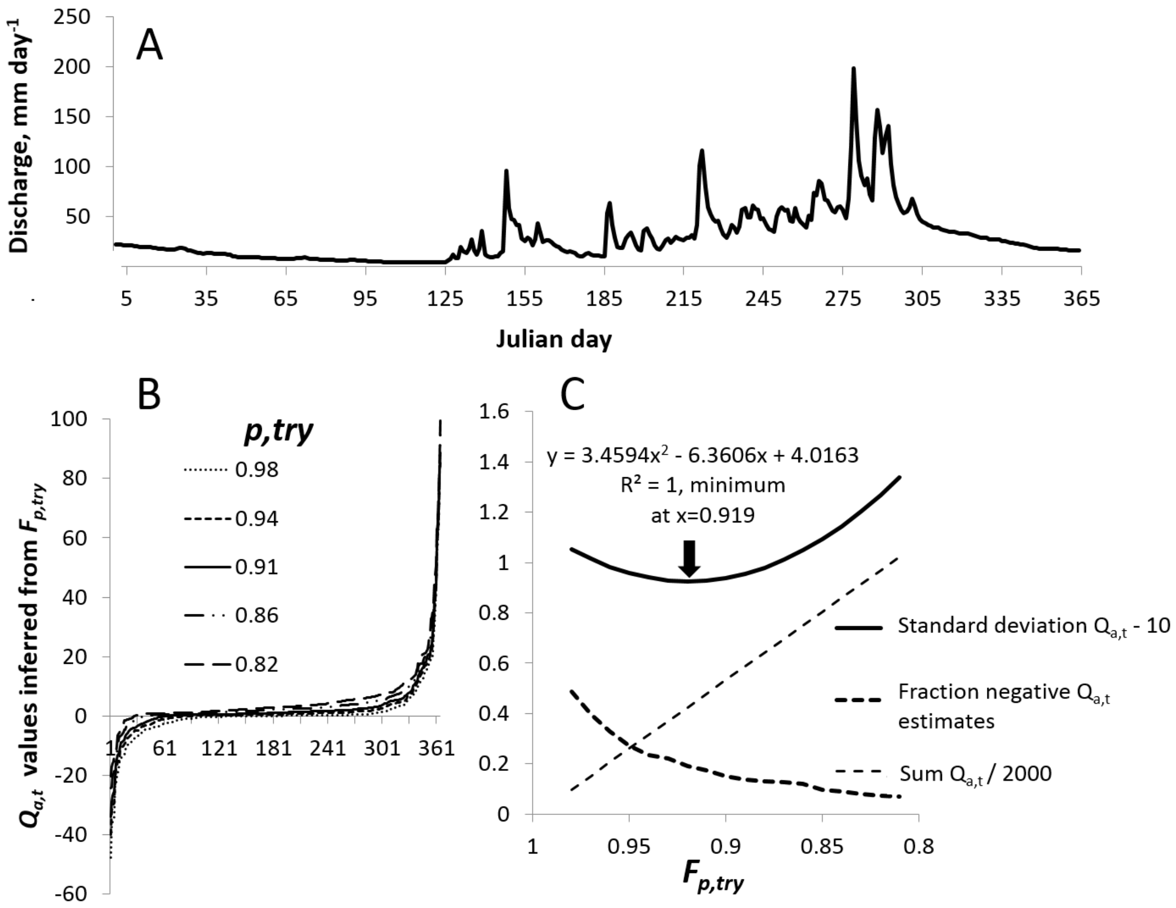

Figure 3. Example of the derivation of best fitting $F_{p,try}$ value for an example hydrograph (A) on the basis of the inferred Q_a distribution (cumulative frequency in B), and three properties of this distribution (C): its sum, frequency of negative values and standard deviation; the $F_{p,try}$ minimum of the latter is derived from the parameters of a fitted quadratic equation

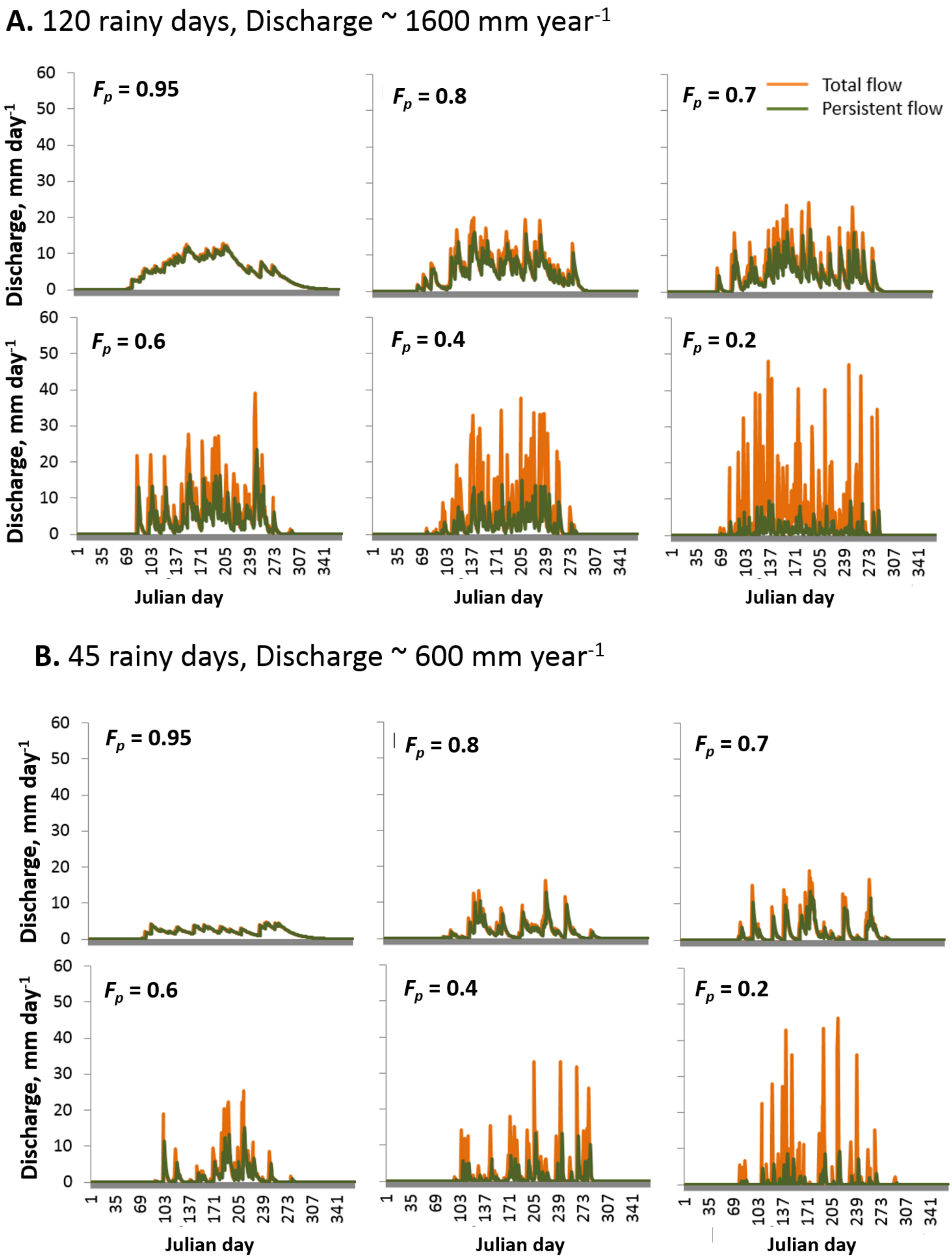

Figure 4. Effects of the F_p parameter on hydrographs of daily river flow generated by a random rainfall generator, with persistent and additional flow components indicated, for two settings with total rainfall of approximately 1600 and 600 mm/yr (NB river flow is here expressed as mm d^{-1} rather than as $m^3\ s^{-1}$ as in figure 3)

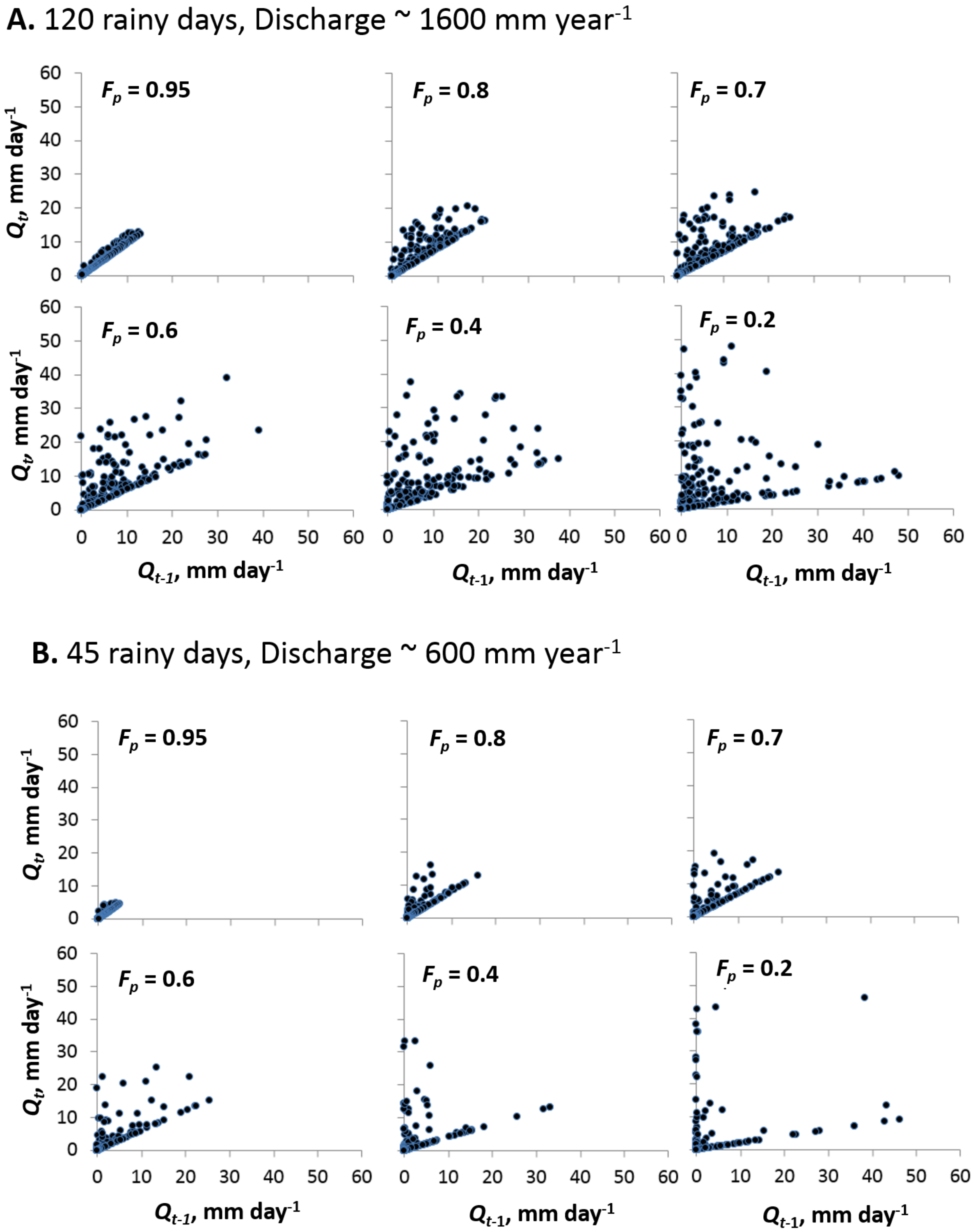

Figure 5 A and B Temporal autocorrelation of river flow for the same simulations as Figure 4; the lower envelope of the points indicated slope F_p, the points above this line the effect of fresh additions to river flow

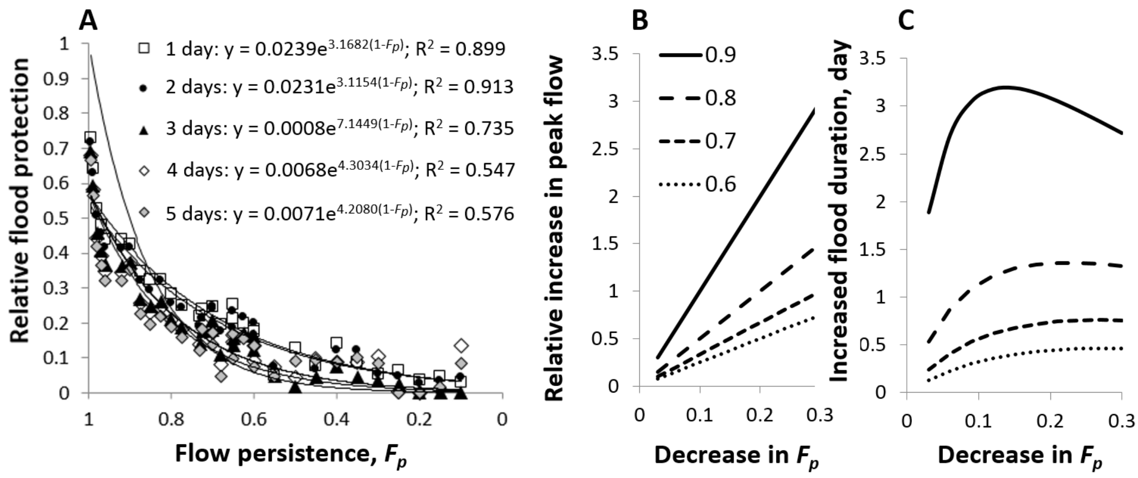

Figure 6. A. Effects of flow persistence on the relative flood protection (decrease in maximum flow measured over a 1 – 5 d period relative to a case with $F_p = 0$ (a few small negative points were replaced by small positive values to allow the exponential fit); B and C. effects of a decrease in flow persistence on the volume of water involved in peak flows (B; relative to the volume at F_p is 0.6 – 0.9) and in the duration (in d) of floods (C)

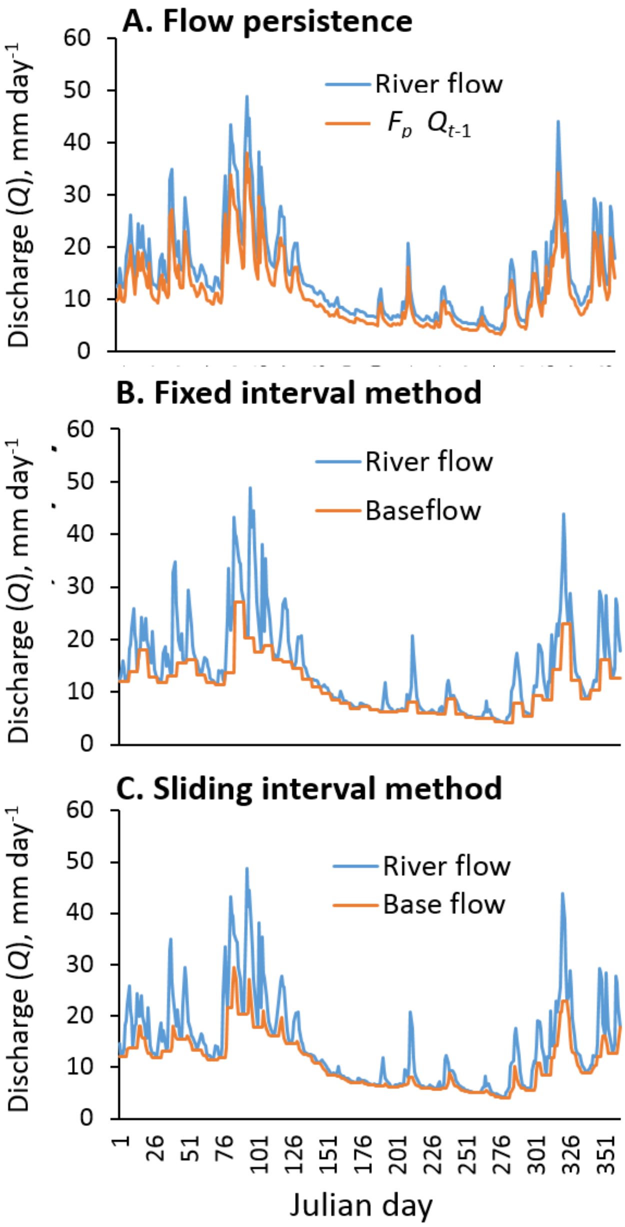

Figure 7. Comparison of base flow separation of a hydrograph according to the flow persistence method (A) and two common flow separation methods, respectively with fixed (B) and sliding intervals (C)

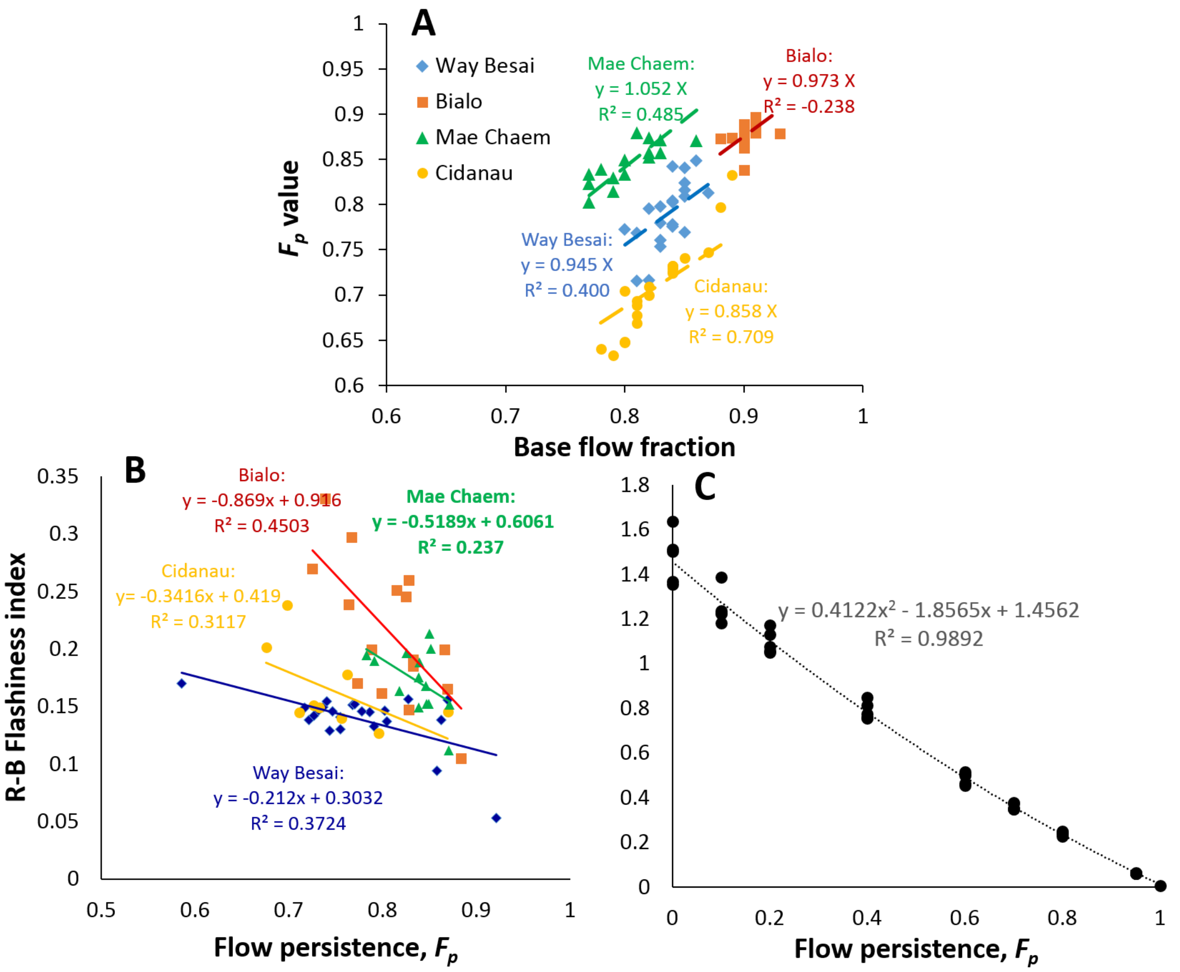

Figure 8. A) Comparison of yearly data for four Southeast Asian watersheds analysed with common flow separation methods (average of results in Fig. 7) and the flow persistence method and comparison of the Richards-Baker Flashiness Index (Baker et al., 2004) and the flow persistence metric F_p for B) four Southeast Asian watersheds, C) a series of hydrographs as in Fig. 4A, with 5 replicates per F_p value

Part II:

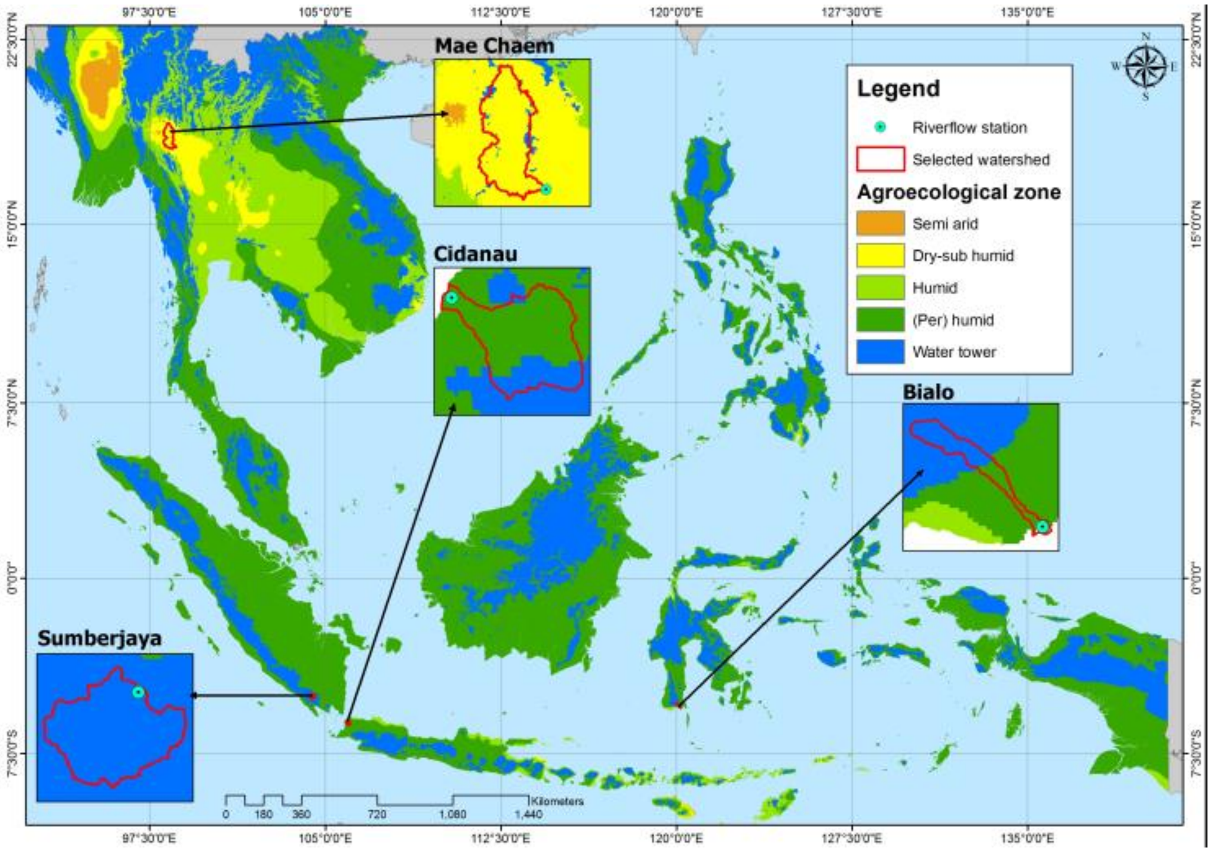

Figure 1. Location of the four watersheds in the agroecological zones of Southeast Asia (water towers are defined on the basis of ability to generate river flow and being in the upper part of a watershed)

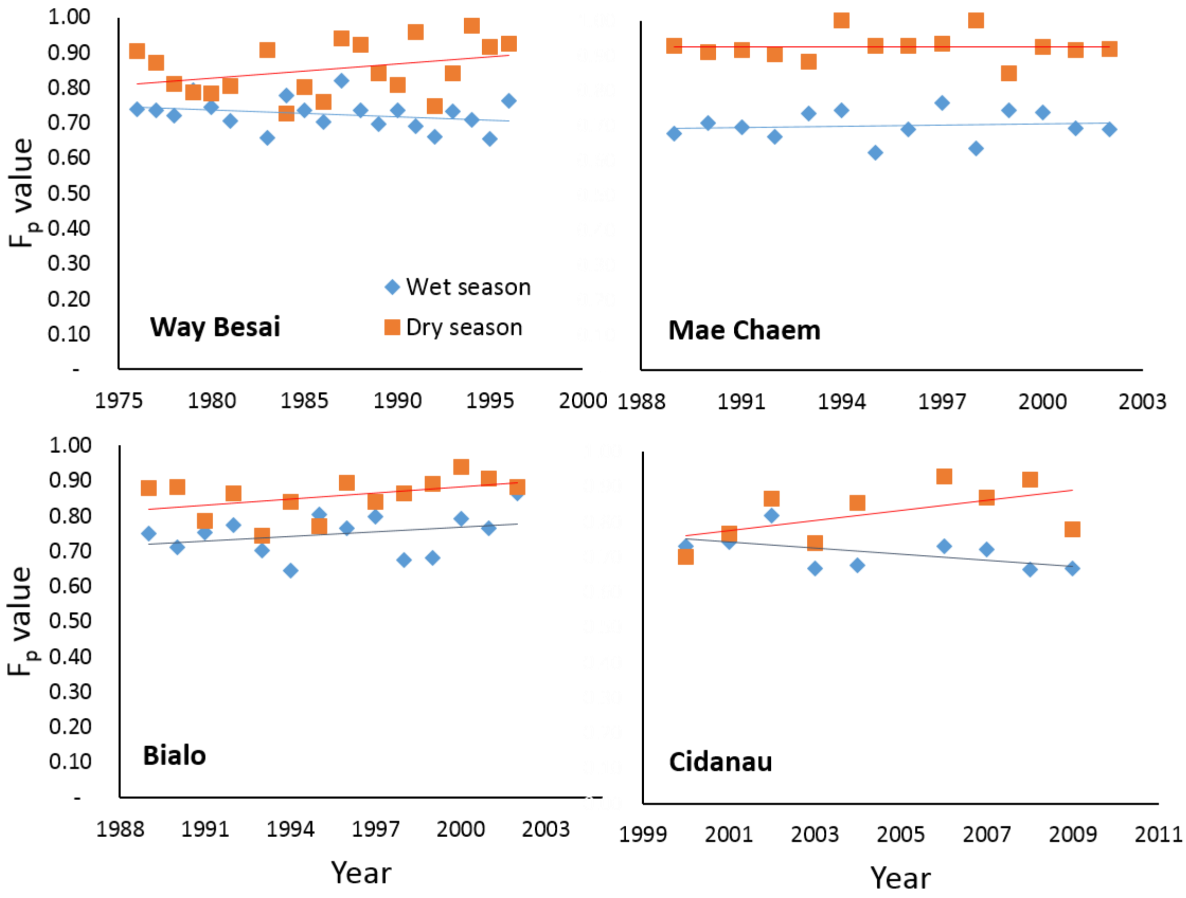

Figure 2. Flow persistence (F_p) estimates derived from measurements in four Southeast Asian watersheds, separately for the wettest and driest 3-month periods of the year

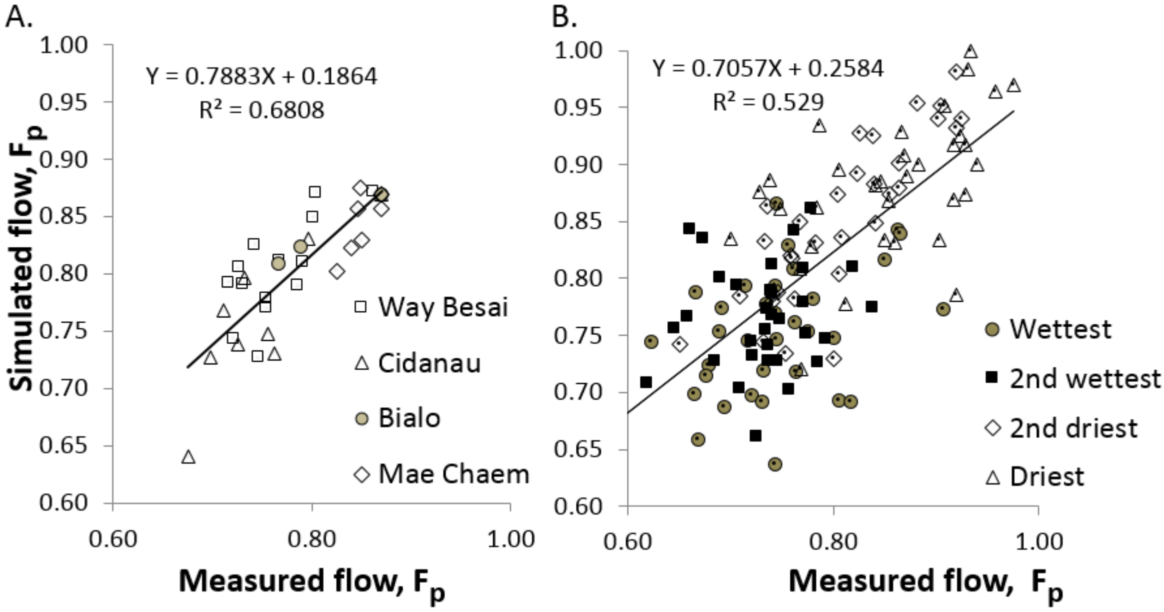

Figure 3. Inter- (A) and intra- (B) annual variation in the F_p parameter derived from empirical versus modelled flow: for the four test sites on annual basis (A) or three-monthly basis (B)

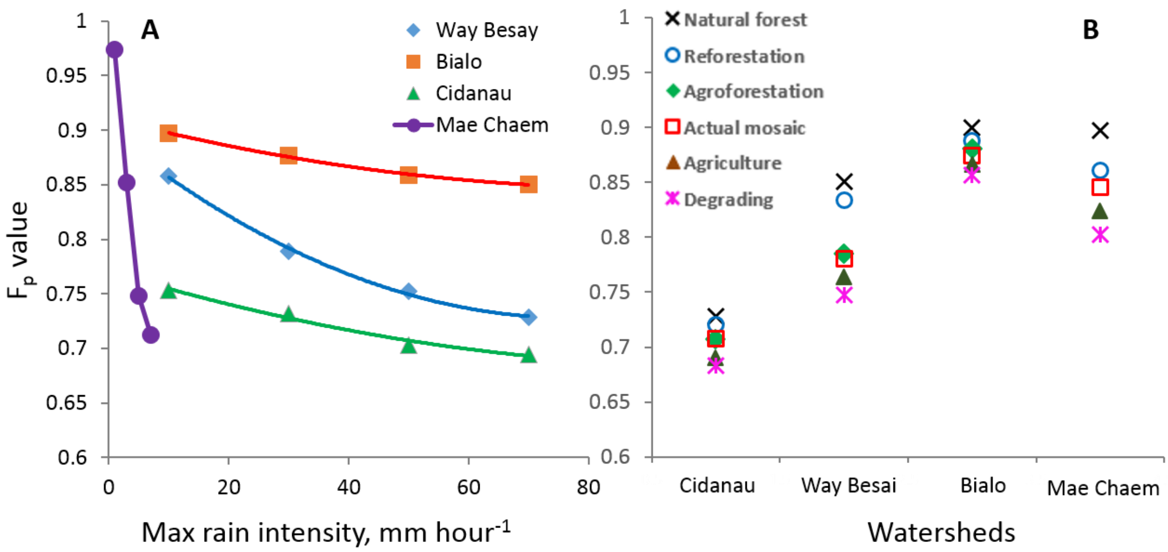

Figure 4 Effects on flow persistence of changes in A) the mean rainfall intensity and B) the land use change scenarios of Table 4 across the four watersheds

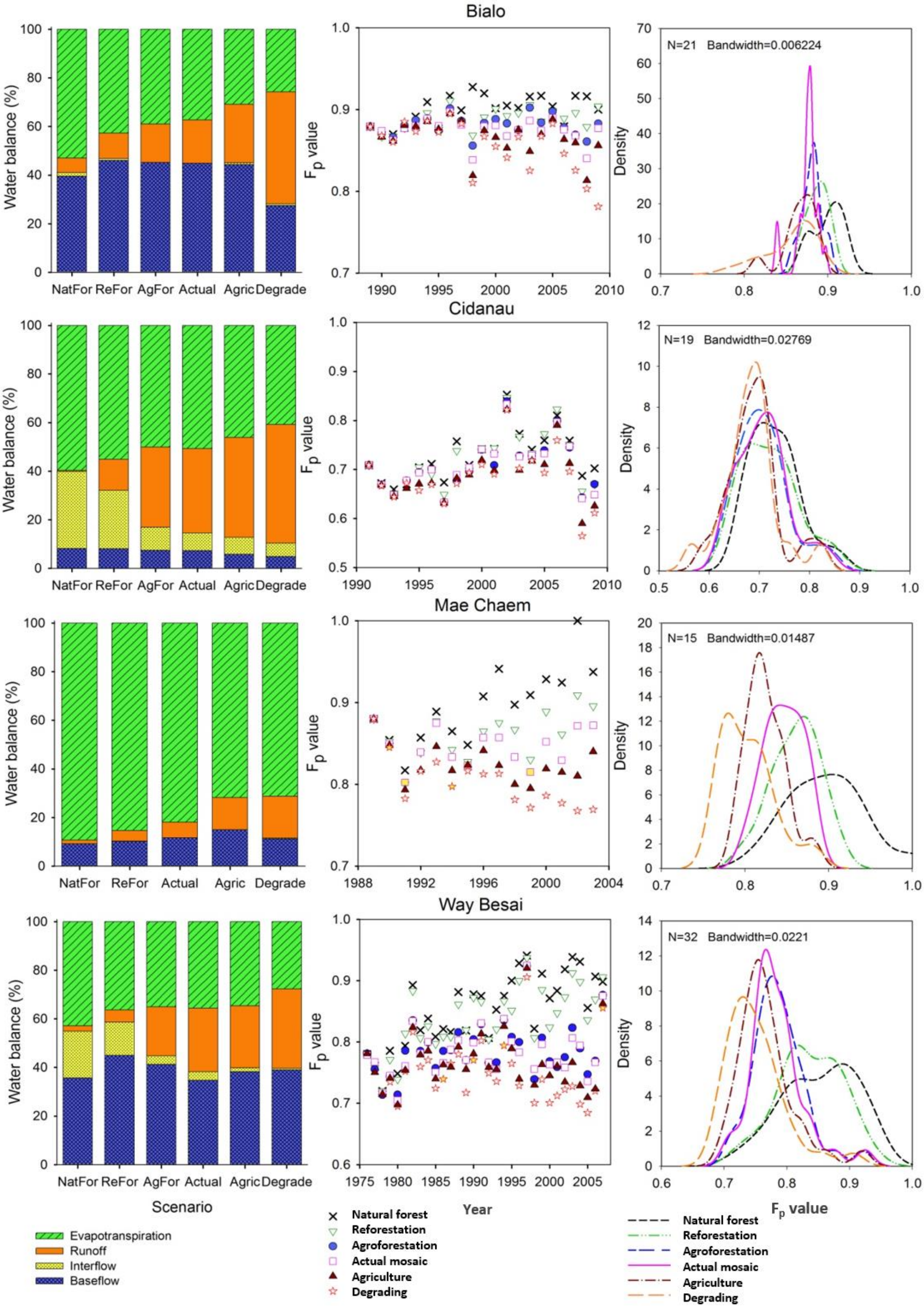

Figure 5. Effects of land cover change scenarios (Table 4) on the flow persistence value in four watersheds, modelled in GenRiver over a 20-year time-period, based on actual rainfall records; the left side panels show average water balance for each land cover scenario, the middle panels

the Fp values per year and land use, the right-side panels the derived frequency distributions (best fitting Weibull distribution)

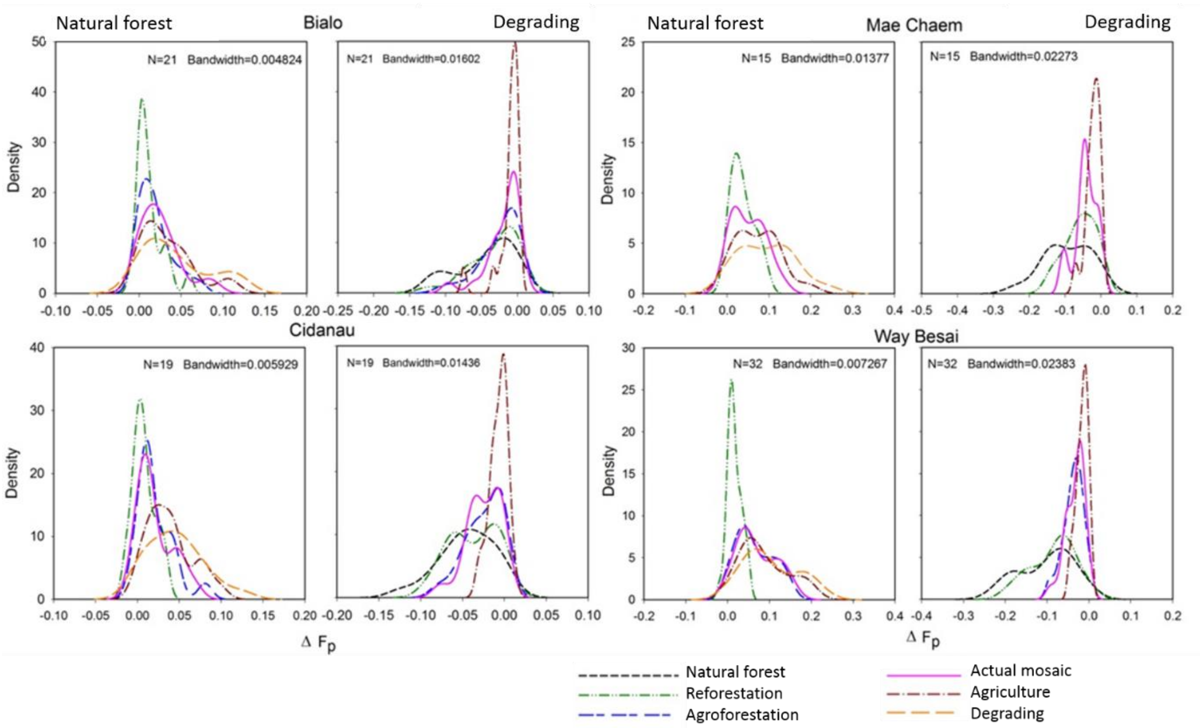

Figure 6. Frequency distribution of expected difference in F_p in 'paired plot' comparisons where land cover is the only variable; left panels: all scenarios compared to 'Reforestation', right panel: all scenarios compared to degradation; graphs are based on a kernel density estimation (smoothing) approach

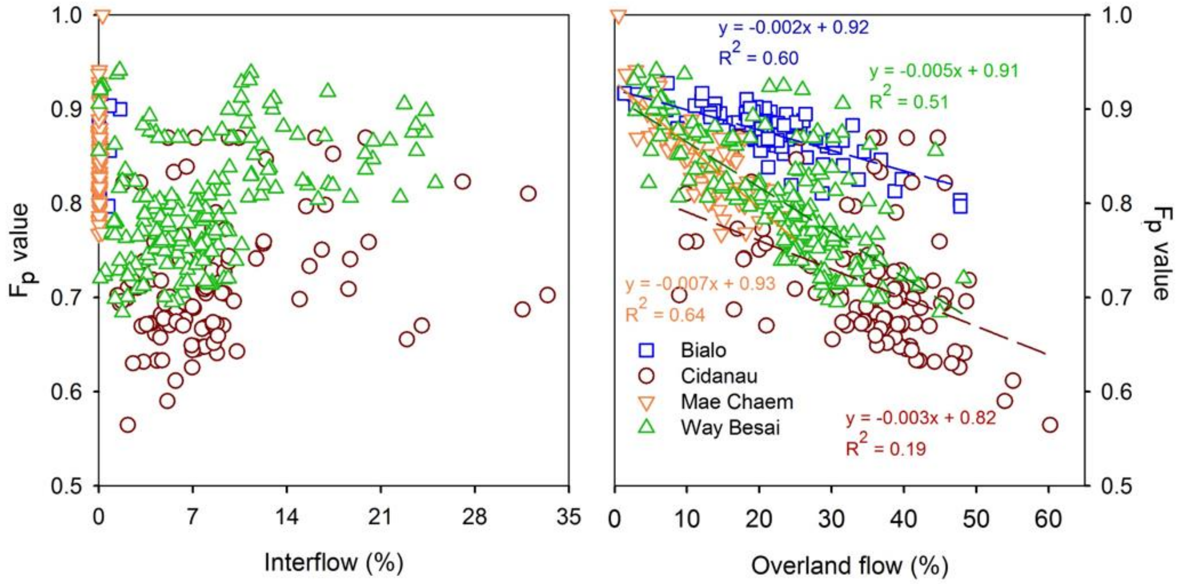

Figure 7. Correlations of F_p with fractions of rainfall that take overland flow and interflow pathways through the watershed, across all years and land use scenarios of Figure App2

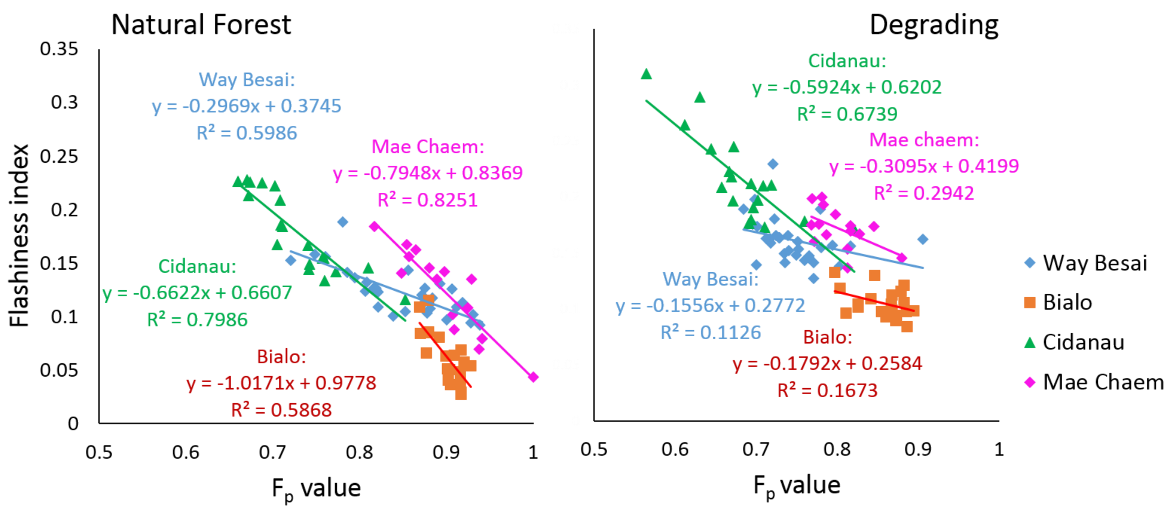

Figure 8. Relationship between F_p value and R-B Flashiness index across years in foru Southeast Asian watersheds under a ‘natural forest’ and ‘degradation’ scenario, simulated with the GenRiver model