Wisuwat Taesombat 2010: The Effects of Land Cover Changes on Flooding.
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Land cover is considered to be an important factor affecting the frequency and severity of flooding in a river basin. An assessment of how changes in land cover over time affected flood behaviour from 1988 to 2005 in the upper Ping river basin in Northern Thailand was undertaken in this study. Correlations between these land cover changes and rainfall-runoff behaviour for flood and flow events taking place during this period were examined. To quantify land cover, nine LANDSAT-5TM images taken during the dry season (January or February) were obtained and processed to examine inter-annual land cover changes. From the networks of daily read rainfall data and stream gaugings available across the basin, 68 rainfall stations and 11 runoff stations were selected to evaluate peak flow rate and Rainfall-Runoff Factor (RRF) for flood events. For individual sub-catchments, strong nonlinear correlations between the overall RRF and peak flow rates for flood events were found. These RRF to peak flow relationships varied from year to year with different land cover for each sub-catchment. From these relationships within a particular sub-catchment, relationships between different land cover and RRF for the 2, 5, 10 and 25 year ARI peak flood events were determined. The results showed that RRF increased with increasing forest proportion for these specified peak flood conditions on nine out of eleven sub-catchments. On the other hand, the RRF associated with these peak flood events decreased as agricultural and disturbed forest areas increased. The influence of land cover on RRF was however found to be very different between flood and flow events. RRF is higher with for high forest cover under flood events (greater than around one year ARI); but for flow events (less than around one year ARI), RRF is lower when forest cover is high. The correlations between RRF and percentage of forest cover for flood and flow events were then generated for the scenarios runs to see the effect of forest cover on flood and flow hydrographs. Two scenarios of deforestation in 2005 and 2010 and one scenario of aforestation in 2005 were applied on the selected flood event in 2001. Flood inundation maps for these three scenarios and the baseline flood event in 2001 were prepared by GIS software using the input data of the maximum water level at each cross-section determined by FLDWAV together with the DEM data of the basin. The result of flood maps confirmed that deforestation tend to relieve flooding for both flood peak magnitude as well as flood volume but aforestation showed a reverse effect. To be expected, an impact of deforestation and aforestation on flow hydrograph showed an opposite direction as presented within flood events. It seems as if the catchment has a flood saturation threshold: for a flood exceeding the threshold then a high proportion of the rainfall is transformed to runoff. These thresholds are most likely controlling by soil saturation within the basin. For smaller events lower than the saturation threshold a much lower proportion of rainfall is transformed to runoff. As the forest cover increases, this seems to magnify this effect making RRF even larger for flood events and smaller for small events. This finding revealed a very new understanding of the effect of changing land cover on flood behaviour for different catchment saturation conditions within the basin.

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