INFLUENCE OF FOREST COVER CHANGE ON WATERSHED FUNCTIONS IN THE WESTERN GHATS: A Coarse-Scale Analysis

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[In collaboration with ATREE and National Institute of Hydrology]

The relationship between the forest cover in river catchments and the pattern of flow in the river is a controversial one. Popularly, it is assumed that forest cover enhances total water yield, increases lean-season flows and reduces sediment load. However, research over the past several decades has suggested that this relationship may much more ambiguous and context-specific. Given that substantial public funds are being invested in forest conservation and afforestation (with watershed benefits as one of the touted benefits of such investments) and given the dependence of many people on the flow in these streams for their livelihoods, it is necessary to arrive at a better understanding of the actual relationship between forest cover (or land cover in general) and streamflow.

We have attempted a unique approach to examining this relationship in the densely forested and high rainfall region of the Western Ghats of peninsular. This approach involves a statistical analysis of cross-sectional and time-series data for a sample of catchments in this region for which streamflow data are being collected by state agencies for several years. With streamflow data from Karnataka's Water Resources Development Organisation, rainfall data from the Directorate of Economics & Statistics, land-cover data from the interpretation of satellite imagery and ancillary data from various other sources, we have so far put together a dataset for 20 catchments within the Karnataka region of the Western Ghats.

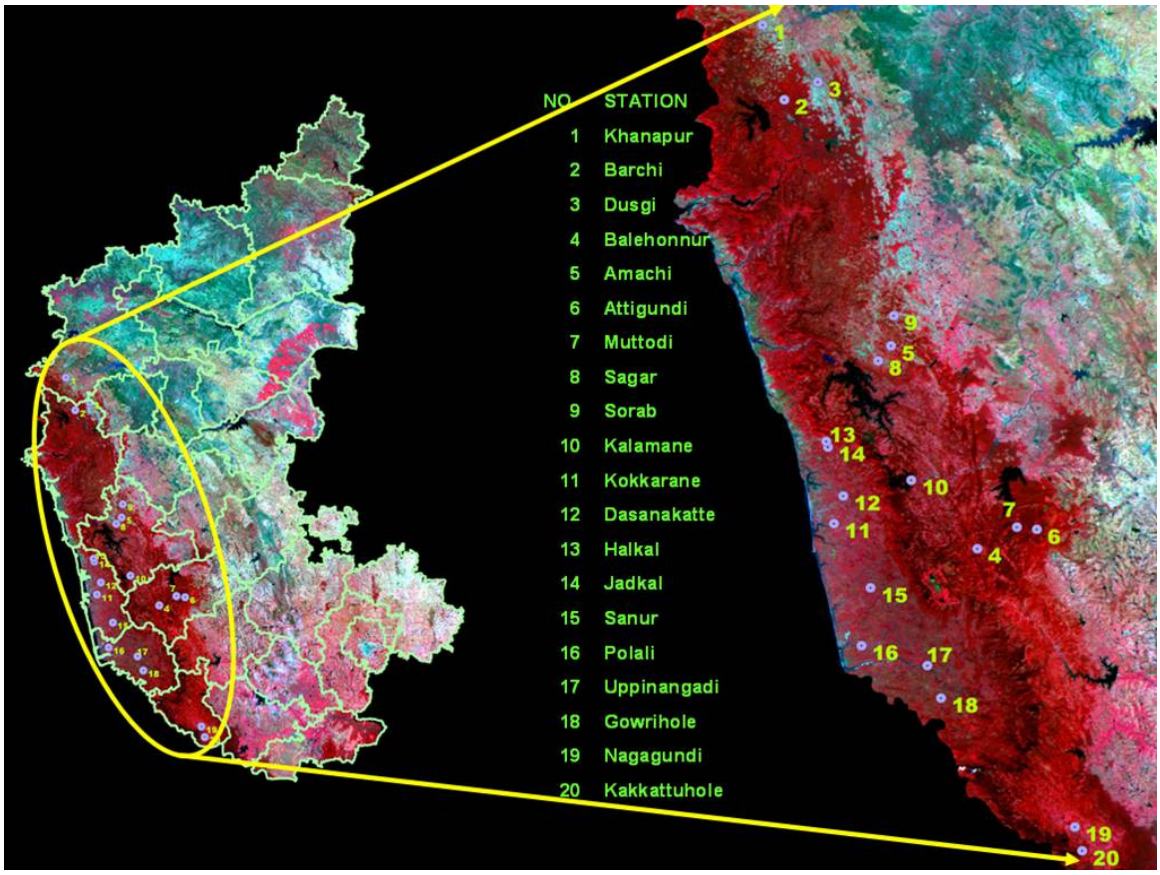


FIGURE XXX: Location of streamgauging points used in the analysis of the relationship between forest cover and streamflow in the Karnataka Western Ghats.

The preliminary results of our cross-sectional analysis across these 20 catchments indicate that, across the range of forest types occurring in the sample (ranging from evergreen to dry deciduous), the primary drivers of streamflow are rainfall and catchment morphology. Within catchments with similar levels of rainfall, the effects of differences in land cover seem to be rather limited and complicated by the different non-forest land cover types prevailing in various proportions. In attempting a time-series analysis, we found that there were actually few catchments where significant changes in forest cover had occurred over the period 1973 to 2000 (the period for which satellite imagery is available). Even in such catchments, the major determinant of inter-annual variations in streamflow and baseflow is the quantity and distribution of rainfall. Significant effects of changes in land cover have as yet not been discerned. More detailed analysis, with if possible a larger number of catchments and the use of physical (rather than purely statistical) models is planned.

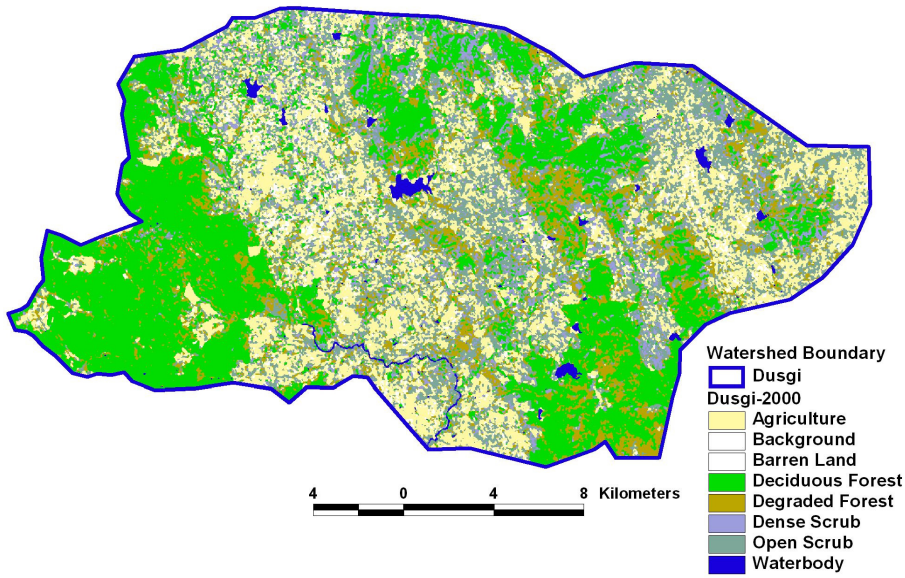
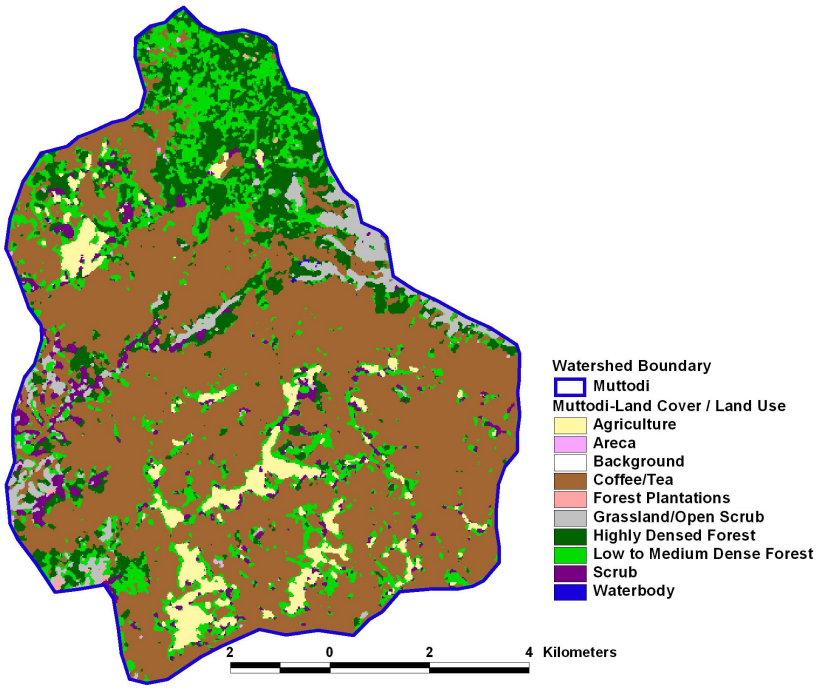
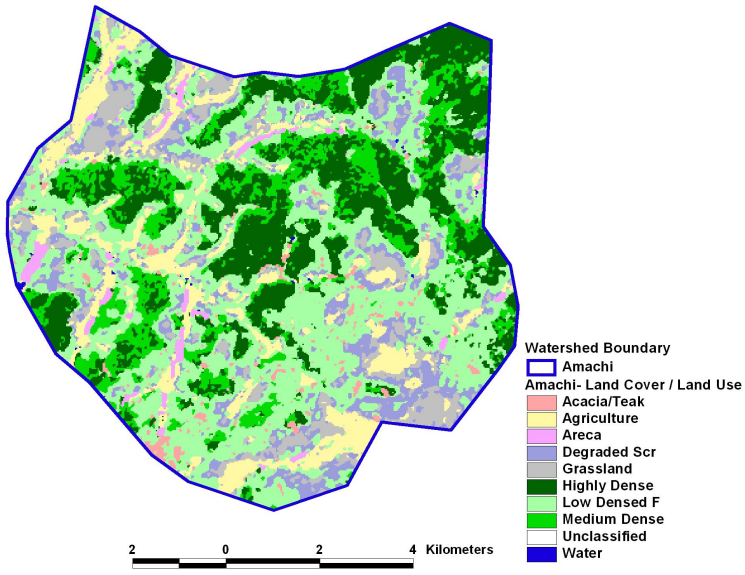


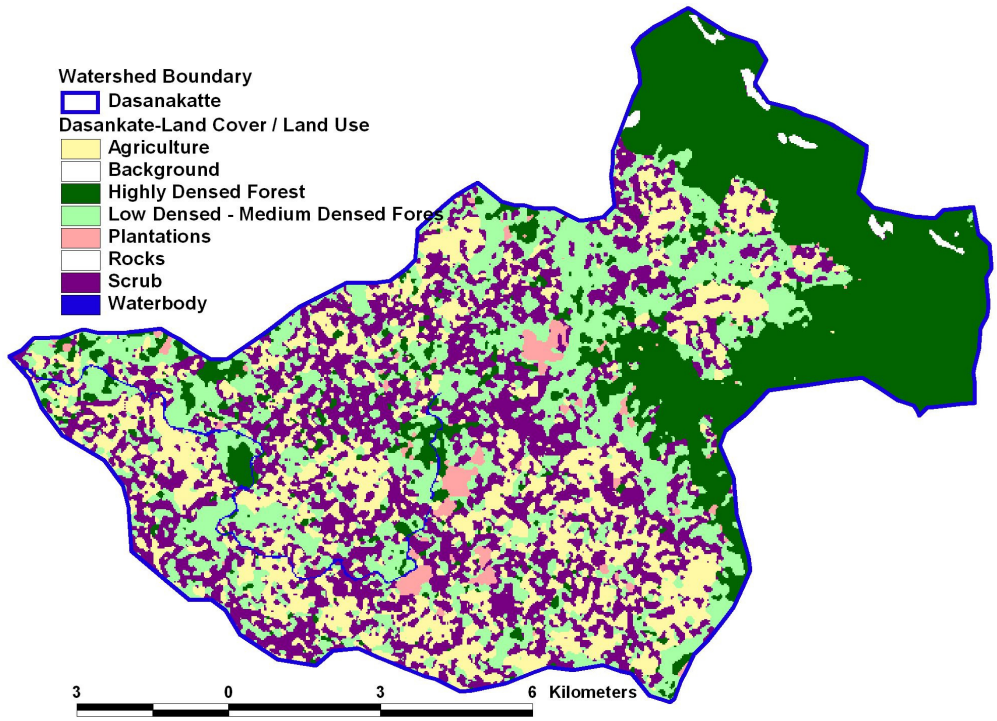
FIGURE XXX: Land cover in Dusgi catchment, representing a dry deciduous region



Land cover in Muttodi catchment, representing the coffee-cultivating region



Land cover in Amachi catchment, representing the moist-deciduous region



Land cover in Dasanakatte catchment, representing the downghat evergreen region

In passing, we have identified vital gaps in the network of rain gauges in the Western Ghats. In particular, we find that the crestline region of the Ghats, which receives the maximum rainfall and around which there is high spatial variation in rainfall, has an inadequate density of raingauges, often resulting in lower estimates of the total rain falling into the study catchments.