Work with the Nilgiri South Division

Estimating impact of wattle removal on discharge volume and sediment

Hydrologic and carbon services in the Western Ghats: Response of forests and agro-ecosystems to extreme rainfall events

Introduction

In recognition of the ill effects of invasive alien species (IAS), the forest department of Tamil Nadu has embarked on an aggressive wattle (*Acacia mearnsii*) removal campaign in the Nilgiris. However, being mindful of the possible ill-effects of large scale removal of tree cover on hydrology and erosion, it was suggested that we measure the impact of wattle removal on erosion and both the volume and duration of discharge before and after the wattle clearing. This was a unique opportunity for research as rarely are projects, able to afford or carry out large scale vegetation removal in an experiment.

In May, 2015, a suitable catchment where wattle removal was to take place was identified with the help of forest department staff. A weir (v-notch) was installed at this location along with a stilling well for automatic water level measurements. Regular sampling of water quality from the site was commenced.

This poster presents some of the preliminary outputs from the analysis of the data collected from this site.

Study Site

The instrumented catchment is located near Devar betta. The study site is dominated by wattle plantations in the upper reaches which feed into a sharp drop through a grassland with a few Shola forest trees. The soils are black and well drained and have been described as having “a bisequal profile (i.e. a profile showing two sequa): an Andisol developed over a low-activity clay tropical soil inherited from much warmer conditions.”(1)

The larger region comprises of steep slopes with a mix of plantations of wattle, pine and natural Shola forests and grassland systems. The natural Shola forests comprise of over 57 species of trees dominated by *Psychotria nilgiriensis* and *Lasianthus venulosus*, and grasslands dominated by *Eulalia phaeothrix* and *Dicanthium polyptychum*(2,3).

However, over the past century, a number of alien invasive species have been introduced into the region. Some such as pine (*Pinus patula*), blue gum (*Eucalyptus globulus*) and wattle were planted during forestry operations while others such as Scotch broom (*Cytisus scoparius*) and Gorse (*Ulex europaeus*) have spread in-advertently.

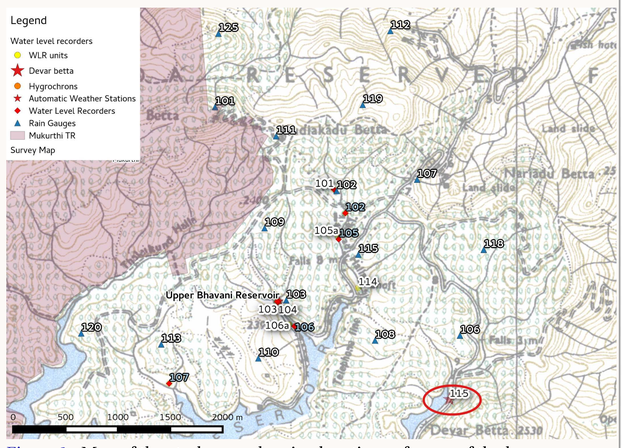


Figure 1 : Map of the study area showing locations of some of the loggers. Station 115 is marked in a red ellipse.

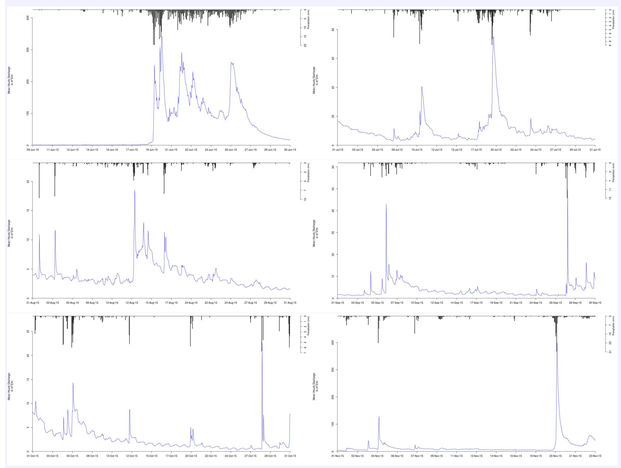
Methods and analysis

A 40cm high v-notch (weir) was installed at the suitable site, along with a stilling well and capacitance based water level recorder. The logger was set to record water levels at every five minutes. Nearby, a tipping bucket rain gauge was installed which recorded precipitation every minute.

A stage and a grab sampler were used to collect water samples. The former was designed to collet samples from the rising water levels of 10, 25 and 40cm. The grab sampler provided integrated samples across the depth profile.

Figure 2 : The weir installed at the site along with the stilling well and water level recorder (left). The stage sampler based on the USGS design used to collect samples from rising water levels of streams.

Initial Observations

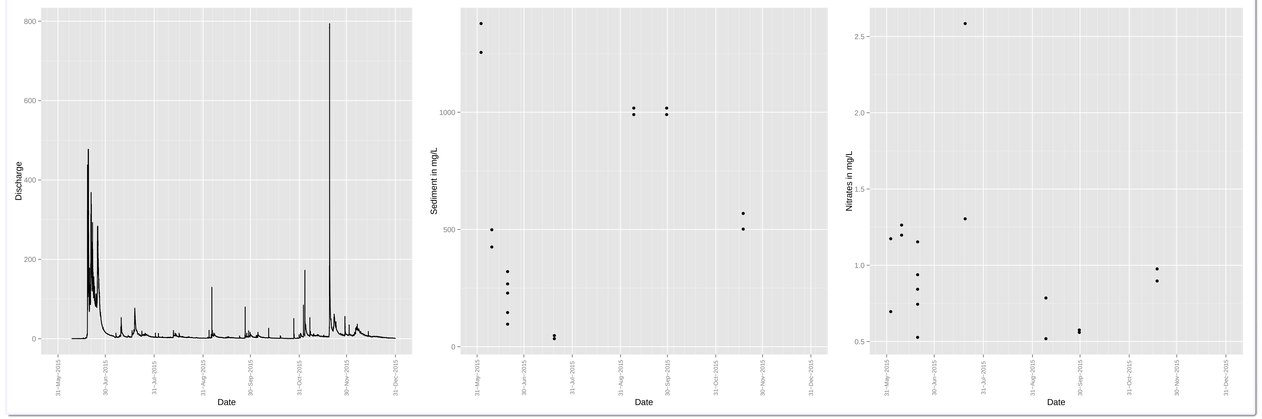


The results shown here are based on a preliminary analysis of the data.

Hydrographs on the left show the rainfall in mm (from the top) and the discharge in m^3/hr from the flume at station 115 and rain gauge at station 105. Records for the last six months of 2015 have been presented, covering both the South West and North East monsoon. The resolution of the discharge data above is hourly averages.

Below is a graph showing the relationship between discharge and sediment and nitrate proportions. Note that here the resolution of the discharge data is one minute so it captured the very high flow on the 21st of November. Also note the outlier in the nitrate concentrations in July.

A comparison with hydrographs once the wattle has been removed from the catchment will give us insights into how wattle influences discharge patterns. We hope these observations will continue for a few more years providing information of the impact of re-establishment of natural grassland species on hydrologic processes.



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