COST Action ES1306
Short Term Scientific Mission Report

The functioning of resprouter patches as sink of overland flow and associated sediment transport on a recently burnt hillslope

Beneficiary: Taco Regensburg, Wageningen University and Research centre, The Netherlands
Host: Jan Jacob Keizer, University of Aveiro, Portugal
Period: 01/09/2015 to 31/12/2015
Reference code: COST-STSM-ECOST-STSM-ES1306-010915-063627

1. Introduction

Wildfire often removes the protective cover of vegetation and thereby leaves soils more prone to erosive forces of rainfall and wind. Wildfires produce intangible changes to soil: reduced soil cover, reduced soil porosity, loss of soil organic matter, and change of vegetation composition due reduced seed bank survival. In sloping terrain, erosion rates from bare areas are reported often to be higher following wildfire.
Bare surfaces such as inter-plant-patches influence runoff routing and associated soil losses, if well-connected. In sloping terrain, these 'inter'-patches are known to act as sources of runoff, transporting sediments that can be accumulated in down slope vegetated patches. The interplay between source and sink patches is often seen as a key explainable for the routing of overland flow and sediment transport. Connectivity research opts to bring together an understanding of hydrological and erosion processes measured at different scales, whilst scale comparability is still subject of debate.

2. Purpose of the STSM

The main objective of this Short-Term Scientific Mission (STSM) was to learn how to analyse runoff and erosion data collected at experimental plots under natural rainfall in burnt areas, for determining the connectivity of overland flow and associated erosion, and, ultimately, to gain experience and learn more about what it takes to publish the results of an experimental study in an international journal.

This STSM consisted of a follow-up of a MSc study that aimed to assess how re-sprouted shrubs influence the dynamics of runoff and erosion connectivity at patch scale at a burnt hillslope.

To carry out this investigation, in addition to other studies carried out in the same study area, four plot types were constructed and measurements were undertaken to quantify:
1) runoff and erosion in inter-patch and vegetated areas;
2) the soil moisture response of soils underneath inter-patches and vegetation patches;
3) their spatial variation and dynamics in time.

3. Description of the work carried out during the STSM

Over the course of this 4-month STSM I have carried out several field campaigns, extensive laboratory analyses of runoff samples, analysis of the collected data, writing-up and presenting the obtained results. In more detail, I have:

- collaborated in the setup of a new experimental field study, looking into sediment connectivity in re-sprouting eucalypt;
- performed various analyses to understand the potential of the available data;
- discussed implications of available data for runoff/sediment connectivity at patch scale;
- examined new approaches to explain the newly obtained data;
- summarized new ideas on available data to be included in the paper;
- presented the preliminary results at the Connecteur workshop held in Aveiro on 1-3/12/2015.

The field works and interactions with the members of the host team allowed getting hands-on training about:

1. field measurements,
2. rainfall, runoff and erosion data analysis,
3. paper writing,
4. general rules of research.

The multidisciplinary setting supported an out-of-the-box approach to newly obtained data, focusing on hydrological connectivity at patch scale.

4. Description of the main results obtained

The main results of this STSM are a summary of my experiment findings:

- Shrubs in erosion plots of 0.5mx0.5m did not behave as effective sinks of runoff, as they do not differ significantly in runoff response from comparable plots with a bare surface (ANOVA, $P<0.05$).
- Erosion plots consisting of a shrub and bare upslope areas (0.5mx1m or 0.5mx1.5m), produced significant less runoff with increasing plot length (ANOVA, $P<0.05$).
- Shrub in erosion plots of 0.5mx0.5m acted as a sink for sediment, as sediment losses were significant lower (ANOVA, $P<0.05$) than those produced by comparable plots that were bare.
- Erosion plots consisting of a shrub and bare upslope areas (0.5mx1m or 0.5mx1.5m), produced significant less sediment with increasing plot length (ANOVA, $P<0.05$).
- Soil moisture content beneath shrub canopy showed higher values and larger amplitudes under all weather conditions than soil moisture content of inter-plant patches.
- Plots consisting of a shrub and bare upslope areas (inter-plant surface) produced less runoff and erosion than comparable plots with a shrub, indicating that the shrub acted as an effective sink of overland flow from upslope areas and associated sediment losses.

The overall conclusion of this STSM was therefore that in recently burnt shrublands consisting of a mosaic of vegetation and inter-patches resprouting shrubs can function as an effective sink of overland flow and sediments.

5. Description about how the results contribute to the Action aims

This STSM has contributed to COST Action ES1306 by providing further insights in the functioning of resprouter patches in post-fire runoff and sediment losses, and, thereby, a better understanding of the role of vegetation in hydrological and sediment connectivity at small spatial scales

6. Other comments

A letter from Jan Jacob Keizer from University of Aveiro confirming the successful execution of the STSM is attached. I hereby authorize posting this report at the COST ES1306 Action exercise.

Wageningen, 07/02/2016
Taco Regensburg MSc