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Particulate organic matter, suspended sediment and turbidity in Otago, New Zealand tussock grasslands

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Suspended material transported by rivers is mostly comprised of inorganic material; but also includes organic material. The amount of organic material in suspended load depends on land cover, catchment characteristics and hydrology. Turbidity is a measure of water clarity, and is widely used as a proxy for determining the concentration of suspended sediment (SS) in river systems, as changes in turbidity usually relate to predictable changes in the suspended sediment concentration (SSC). However, SS is not the only component of the total suspended material (TSM), as an organic component (particulate organic matter, POM) is also present. Turbidity responds to both the presence of SS and POM, and it is therefore necessary to understand the portions of both types of particulates in suspension and their respective influences on turbidity. A preliminary study focused on assessing the impacts of forest clearance on water quality in the Glendhu Experiment Catchments in Otago, New Zealand identified a high export of POM that impeded using turbidity as a predictor of the SSC. The objective of our study is to determine POM export from tussock grasslands in Otago to assess whether a high export of organic matter is typical of all Otago tussock grasslands, and what controls the release and transport of organic matter in the fluvial environment.

Automatic water samples (500 mL) were collected daily, including monthly 1 L grab samples from the Glendhu catchments. Monthly 1.5 to 2 L grab samples were also collected from other tussock grassland catchments in Otago. A 15 mL subsample was decanted and used to measure turbidity using two different Hach portable nephelometers; Hach 2100P and Hach 2100Q-is. Standard methods for determining suspended material where by a known volume of water is filtered through 0.7 μm glass fibre filters and oven-dried at 105 degrees Celsius were used. TSM was recorded, and then the glass fibre filters were subject to a loss on ignition method by heating in a muffle furnace at 500 degrees Celsius for 30 minutes. The filters are then reweighed to determine the amount of mass loss, which is equivalent to POM.

Results from the Glendhu daily time series reveal that POM comprises 56% of TSM in the tussock control catchment, and 73% in the Pinus radiata catchment undergoing forest clearance. Preliminary results from data collection in the wider Otago area suggest that organic matter export from other tussock grasslands (sub catchments within the Taieri Catchment) is similar, ranging 12 to 77% POM of TSM in catchments with greater than 50% tussock grassland land cover. However, alpine catchments with headwaters in the Southern Alps with a mixture of land covers have relatively low portions of POM (<5% of TSM) and there is a strong relationship between turbidity and inorganic sediment concentration. Early analysis suggests that the percentage of POM correlates inversely with catchment size, geology, soil type and topography. Further research is focussed on establishing what combinations of environmental characteristics and processes specific to catchments are responsible for producing high exports of organic matter.