

THE IMPACT OF AFFORESTATION ON TOTAL SUSPENDED SOLID CONCENTRATIONS IN SURFACE WATER AND RELATIONSHIP TO MAJOR IONS, ESPECIALLY TO PHOSPHORUS

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Introduction

Forestry activities can interact both positively and negatively with aquatic resources. Careful planning and management will mitigate against potential negative impacts (Anon, 2000). Afforestation and harvesting can lead to changes in the hydrology, sediment load and chemistry of streams. These changes may affect water resource management costs, stream biota and the health of fisheries. Some of the changes can be related to specific phases of the forest management cycle - mainly site preparation, thinning and felling (Hornung, Newson, 1986). Water quality parameters potentially affected by a clear-cutting include: the concentrations of total suspended solids (TSS) phosphorus and so on.

The main goal of this work was to demonstrate how the establishment of forestry on former agricultural land influences streamwater quality, specifically TSS concentrations and other related constituents.

Material and Methods

The study site located near Crossmolina, Co Mayo was previously used for agricultural purposes and was regularly fertilized up to 3 years before afforestation. The site preparation (mounding) took place in the spring 2003 prior to planting with Scots pine and oak. Monitoring of analysed variables was conducted for approximately a year both before and after forest establishment. Water samples were collected using passive stream samplers (PSS) in 4 sites that were likely under different environmental stress. A composite water sample was collected continually over the week of monitoring. From September 2002, an autosampler was installed on the bank of the stream outlet from the site. In water, the content of TSS was expressed in mg.L^{-1} of the sample dry matter and element concentrations were determined by the ICP method. In soil, TSS contents were determined using the Laser Analyser Economy 20, firm Fritsch and total element concentrations by the AAS method.

Results

Concentrations of TSS in surface water in the main outlet and at the study sites PSS1, PSS2, PSS3 and PSS4 in

Crossmolina fluctuated over the monitoring period depending on local weather conditions. Despite the high TSS concentrations ($> 50 \text{ mg.L}^{-1}$) recorded in the last quarter of 2002 in PSS1-PSS4, concentrations in the main outlet remained low (2 to 4 mg.L^{-1}), well below the threshold of 50 mg/L (Anon, 2001). Mean TSS concentrations for the whole period were lowest in the main outlet, highest at PSS4. Site preparation, in March 2003, produced no sustained increase in TSS concentrations. While the contents determined in the main outlet of the study area had a slightly upward trend, the levels of TSS, at PSS4 showed an opposite declining trend. The decline in TP concentrations at PSS4 was significantly correlated with TSS at that sampling point [1].

$$\text{TP} = 92.9077 + 4.48905 * \text{TSS}; R = 0.599; \\ p < 0.0002; (\mu\text{g.L}^{-1}; \text{mg.L}^{-1}) [1]$$

The correlations between available forms of Ca, Mg and K in the soil (Morgan's extractable concentration) and the content of clay and pH were investigated, some significant correlations were found.

Conclusion

- At the Crossmolina study site, no adverse impact of forest operations on surface water quality was detected. TSS contents in surface water were actually lower after afforestation than before;
- Total phosphorus in surface water in surface water correlated with TSS levels.

Acknowledgements

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