Case Study: Sediment Control Using Vegetative Barriers

Location: Toolara, Queensland

Client: Qld Department of Primary Industries — Forestry

The aims of the study were to:

- Assess the sediment-trapping effectiveness of vegetative barriers typically available in forest practice; and to
- Develop a methodology for predicting sediment movement through vegetative barriers that would allow assessment of current practice and ensure greater success in use of vegetative filter strips (VFS) to control water quality.

For sites at Toolara and Imbil, small field flumes were established on a range of vegetation types and slope gradients, and sediment-laden flows passed through the flumes. Sediment trapping in the test areas was assessed via measurements made on paired samples from the inlet and outlet of the flumes at pre-determined sampling times. Measurements included total sediment and equivalent size distributions of sediment particles (all such measurements being based on settling velocities).

For plots that did not erode, the degree of sediment trapping, if based on total sediment only, was quite variable. However, if rates of transport were considered in terms of the various size fractions, the results were very consistent.

VFS have been widely recommended for control of sediment and sediment-bound contaminants in runoff. A range of experiments have shown reductions in sediment when runoff passes through VFS (Tollner et al. 1977, Young et al. 1980, Dillaha et al. 1989, Meyer et al. 1995, and Raffaelle et al. 1997). However, in the absence of fundamentally based procedures for estimating sediment trapping efficiency, there are currently no generally accepted methods for design of VFS to ensure their effectiveness (Chaubey et al. 1995).

Temporary field flume set up in swamp grass at Toolara.

Heavy sediment deposition in swamp grass.

Testing effectiveness of Hoop Pine litter — sediment samples taken at the flume inlet and outlet.

Outcomes of filter strip study:

A simple conceptual approach equating the vegetated area to a sedimentation pond enabled deposition to be calculated on the basis of settling velocity, flow depth, and residence time within the vegetated area. Estimated transport rates of sediment through the vegetated areas were in close agreement with measured transport rates, confirming the success of this approach.

Application of this simple model showed that sediment sizes >0.02 mm would be trapped by relatively short (5-10 metre) widths of filter strip. However, extremely wide strips would be needed to trap finer particles.

Subsequent (related) studies by Landloch and Queensland Forestry have shown that up to 80% of the sediment eroded from forest roads is <0.02 mm and, therefore, too fine to be deposited in the widths of filter strip commonly available. This has highlighted the importance of enhanced infiltration within vegetative filter strips as a means of trapping fine sediment. Based on hydrologic analysis of overland flows, recommendations have been developed for design of roads, turnout drains, and vegetated areas where runoff from roads is discharged.