Soil erodibility and erosion hazard: extending these cornerstone soil conservation concepts to headwater streams in the forestry estate in Tasmania

Peter McIntosh[a] and Mike Laffan[b]

[a]*Forest Practices Board, 30 Patrick Street, Hobart, Tasmania 7000, Australia*

email: peter.mcintosh@fpb.tas.gov.au; fax 0061 (0)3 6233 7954

[b]*Forestry Tasmania, 15962 Midlands Highway, Perth, Tasmania 7300, Australia*

Abstract

Soil erodibility is defined as 'the inherent susceptibility of soil particles or aggregates to become detached or transported by erosive agents such as rainfall, runoff, throughflow, wind or frost'. In Tasmania soil erodibility is routinely assessed using a combination of standard laboratory methods and observations of profile characteristics. Five soil erodibility classes are defined: low, moderate, moderate-high, high and very high.

A plot of soil erodibility against slope produces an erosion hazard matrix. Erosion hazard increases with increasing soil erodibility or slope. Informal matrices have been used in the Tasmanian Forest Practices Code to define the harvest machinery and cultivations techniques appropriate for different soil erodibility/slope combinations. We formalising these matrices to define five erosion hazard classes, ranging from Class A (low erosion hazard) to Class E (very high erosion hazard), and extending the erosion hazard concept to riparian zones.

At present forest streams in Tasmania receive riparian protection related to the size of the upstream catchment. Streams are classified into Class 1 (largest), Class 2, Class 3 and Class 4 (headwaters). Class 4

streams, which have a catchment area of 50 ha or less, are least protected. In the Tasmanian Forest Practices Code the standard prescription for Class 4 streams is to allow harvest of timber trees but to apply a 10 m machinery exclusion zone. Protection can be upgraded for biological conservation reasons or by the recommendation of a Forest Practices Officer or a specialist advisor.

Observations in >400 headwater 4 streams in forestry coupes (harvest areas) indicates that, within a stream or its 0–10 m riparian zone, the incidence of seven 'erosion features' (channel >4 m wide; recent boulder movement; near-vertical stream banks >1 m high; significant sediment accumulation; tunnel gully, gully and rill erosion; sheet erosion; landslides or slumps) is correlated with riparian erosion hazard class. For 66% of streams in coupes in which advice was sought for environmental protection reasons, measures to provide greater protection than the standard 0–10 m machinery exclusion zone were recommended. These measures ranged from wider machinery-exclusion zones where riparian zones are steep, to 20 m no-harvest streamside reserves where erosion risks are considered to be high. This paper formalises the decision-making process for applying such protection measures to 'at-risk' headwater streams.

Prescribing headwater stream riparian buffer types and widths using the erosion hazard and erosion features concepts is considered to be superior to using riparian slope alone (as commonly done in overseas codes of practice) because the defined erosion hazard classes and erosion features identify the most vulnerable streams and riparian zones in the proposed forest harvest area, allow environmental risks to be objectively assessed, and tailor protection measures to the specific risks identified. The proposed system is generic and likely to be applicable to headwater streams in other temperate regions.

Keywords: Headwater streams, riparian; soil erodibility; erosion hazard, erosion risk, Tasmania, forest soils