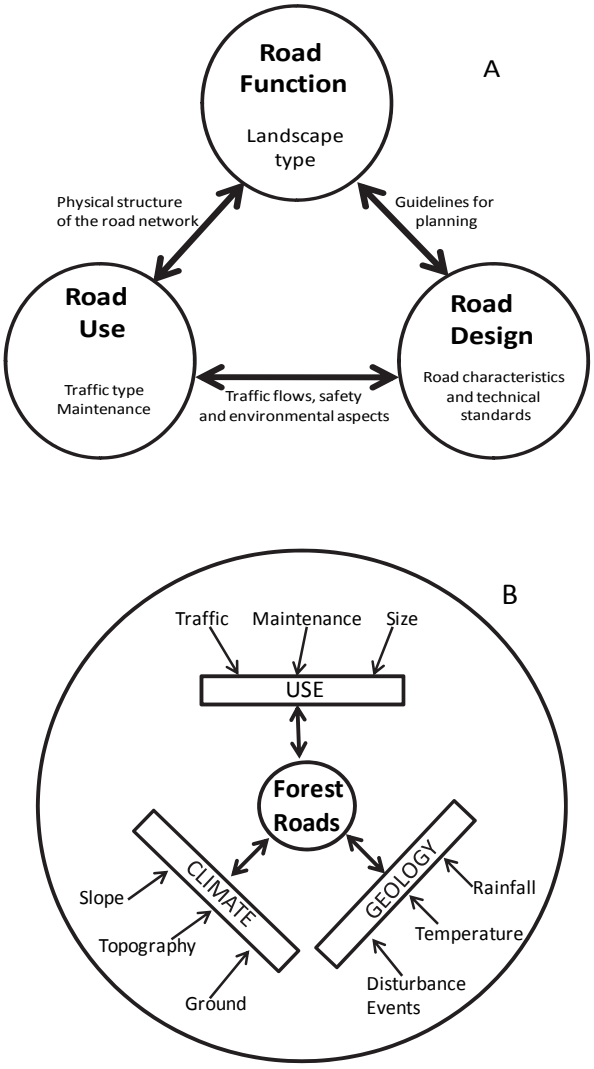
February 2013
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Forestry & Water

Influence of Unpaved Access Roads on Surface Runoff, Sediment Loss and Soil Water Movement within Forest Plantations

A WRC-funded study investigated the influence of unpaved access roads on surface runoff, sediment loss and soil water movement within forest plantations.



Parameters of forest road ecosystems and relationships between road function and design

Forestry infrastructure

Forestry access roads are an integral component of the infrastructure needed to carry out the core functions of managing a commercial plantation. Compared to surrounding undisturbed forested land roads forestry roads are hydrologically active areas as they are compact and frequently denuded of vegetation.

Road networks have frequently been cited as the leading cause of sedimentation to water courses and therefore forestry managers must continually strike a balance between limiting off-site damage caused by roads and preserving the functionality of the road network.

Sedimentation of water courses

This project concerns itself with unpaved forestry roads as the general perception is that these roads are highly vulnerable to accelerated soil loss and contribute substantially to the sedimentation of water courses.

Road management programmes

As the forestry industry in South Africa increases its commitment towards self-regulation and governance it becomes increasingly important that reliable and realistic estimates of surface runoff generation, erosion and transport of sediment from forestry access roads are available. This is the first and necessary step in the development of sound road management programmes and defensible policies, and forms the basis upon which this study was realised.

Conceptual framework

An attempt was made to develop a system of classifying the

state of degradation of forestry access roads. As it stands this is a highly conceptual framework but has been refined to the stage where it does have some practical relevance, if only to develop a common platform against which to assess the state of individual road segments or road lengths. The potential value of fully developing such a tool cannot be underestimated as it will allow for early identification of those road segments that are at high risk for excessive sediment production and allow for timely management intervention.

Organic matter contain the sediment

Given that unpaved roads are usually compact bare areas and accepting that these are going to be high runoff production areas the challenge then is to manage the movement of this water in such a manner that scour and entrainment of sediment is minimised. The study showed that road drainage is an important consideration in this regard and that mitre drains are effective at removing water from the road surface.

Field evidence showed that once the sediment-entrained runoff enters the forestry compartment there is a rapid decrease in energy near the exit of the mitre drain. This process is aided by the high organic matter loads on the forest floor which trap and contain the sediment. The goal thus is to manage the process such that the water and sediment are contained close to its source of origin.

Sediment delivery pathways

If information on sediment delivery pathways from roads to streams are known then it may be possible to limit the travel of sediment by its management at the source of origin. At present, for the South African situation, combinations of models are needed and one has to adapt the data entry to produce meaningful results.

Valuable model

The field results were used as a common dataset against which a wide range of numerical models were tested for their applicability in predicting sediment loss and runoff from forestry access roads. Although not ideal, The Water Erosion Prediction Project: Road model which is accessed via an online Web-based interface, was selected as the most appropriate model of choice and provided that the source code can be modified for a wider degree of local data entry this could prove to be a valuable tool that could be adopted by foresters.

Management of runoff and sediment

Although an improved understanding of the effect of roads on the subsurface movement of water in hill slopes has followed from this investigation, local site conditions precluded an in-depth analysis of the extent to which roads alter natural subsurface flow pathways. The study did show that runoff and sediment from roads could be managed by redirecting this via mitre drains into the forest compartments for its infiltration and filtration respectively.

Further reading:
To obtain the report, ***The influence of unpaved access roads on surface runoff, sediment loss and soil water movement within forest plantations*** (**Report No: 1807/1/11**) contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.