

# Planning the forest roads in reforestation - cases in south Brazil

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## Abstract

This work examines two cases of reforestation with *Pinus sp.* in South Brazil, with the main focus of the forest road-net. The first case indicates the importance of using a better harvest system to reduce environmental damage and increase the productive area of undulating relief. In this case it was observed the productive area is enhanced by around 28 %, where a cable system is used. The second case, soil losses in secondary forest roads have been evaluated for segments of roads with and without conservation and firebreaks on soft undulating and plain relief, with various soil texture conditions. This work clarifies the importance of conservation measures with a reduction in 11% of soil loss when using conservation measures for undulating relief and soils with sand texture predominantly and 24.3% for gently undulating to plain relief and clay texture. Development of practical code for planning of forest roads is required, considering the economical and environmental aspects during the wood harvesting.

## Keyword

Environmental degradation, road-net, road density, technical parameters, planning,

## Introduction

In reforestation land, it is necessary to take care with planning the forest road-net, considering the high possibility to develop different kind of environmental degradation, like erosion and the water pollution, mainly during the occasion of wood harvesting and timber hauling, where this troubles are evidenced, in function the high level of traffic (machines and trucks).

The wood harvesting and timber hauling represent a substantial part of industrial's raw material costs, and have a major influence in the sector's overall competitiveness. In Brazil this costs represent surrounded by 60 and 70%, varying in agreement to the timber transported system adopted. If this activities represent the major part of costs, they are responsible for the main environmental damage, like (soil compaction, erosion process and water sedimentation), and the quality of road-net are the fundamental importance for the damages magnitude.

Inside the reforestation cycle, the planning of forest road-net comprehends two distinctive phases where it is essential to be linked, during the implantation (Basic Road-net) and during the harvesting and timber hauling (Complementary Road-net).

### *Basic Road-net or Main Roads (permanent roads and all-weather roads)*

For planning this Basic Road-net, it is thoughtful to provide work for stand's implantation, when the primarily focus are to attend the necessity of access and traffic the different kind of equipments and machines used for silvicultural operations: soil preparation, nursery operations, control (fire, pest and disease), cutting system, logging and transport methods, as well as the better choice for minimize the environmental impacts and reduce the costs.

The mainly characteristics observed in majority of Basic Road-net are: technical parameters are improved, like drainage system, paved (gravel or bituminous mixtures) and the road density is minimized. Through the planning of these roads, are necessary to attend the necessity of implantation the Complementary Road-net, during the wood harvesting operations (CAMARGO CORRÊA *et al*, 2006).

### *Complementary Road-net or Secondary Roads, Feeder Roads (seasonal roads)*

During the wood harvesting operations, the Basic Road-net are amplify for attend the necessity of high level of traffic with weighty machines used for timber haulage. The FAO (2009) have some advices for planning the Complementary Road-net it was necessary to ensure that all of the elements which go into the successful combination of: road which is right for the wood harvesting operation; which is capable of safely carrying the haulage traffic; ease interference in the natural drainage patterns; minimize the damage the landscape; try to takes account of the flora and fauna and can be satisfactorily and economically maintained are included. Camargo Corrêa (2005) suggest the inclusion the environmental control during the planning the

Complementary Road-net mainly during the wood harvesting, where the erosion process are increased, exposure the water body to sedimentation.

This work aimed to explain two situations observed in *Pinus sp.* reforestations located in South Brazil, where the objective was to expose the possibility of grow up in the production area and environmental concept when adoption adequate planning for road-net and the importance the adoption of conservation measure in forest road during the wood harvesting.

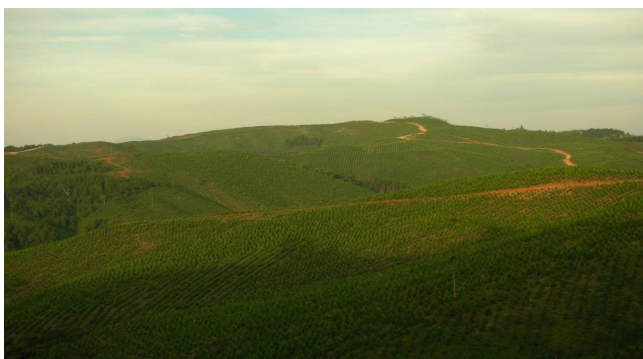
#### *First Case*

The first case refer the necessity of planning the Complementary Road-net taking careful attention for choice the wood harvesting system, if the landscape are highly waved, are increase the vulnerability for development the environmental harms. In the Figures 1 and 2, are exposed different kinds of wood harvesting system.



**Figure 1. Forest Road-net with conventional harvesting system (tree length)**

In this case, the *Pinus sp.* was harvested thought the tree length system, where the major road density and the awful forest road-net planning it was observed. This road-net are very susceptible to surface damages (potholing, rutting, corrugation and disaggregation the soils particles) and associated with the absent of paved and waved relief, where the sandy soil are predominant, the necessity of project with erosion prevention measure are eminent, but it is not observed in field.



**Figure 2. Forest Road- net integrated with cable system**

This figure is around the former region, where the system adopted for harvester operations are cable, the improvement of this system in contrast with another harvesting systems consist in increase the productivity area, in this case it was appraise around 28 %, beyond the environmental advantage associated, as erosion process reduction and water preservation in susceptible areas.

#### *Second Case*

The second case refers the use of conservation measure (water bars equidistant in 50 meters) in secondary forest roads considering two sampling: undulating relief conditions with sand soil texture predominately and another in soft undulating to plain relief conditions with clay soil texture for the most part. They had been evaluated tree treatments being: road with conservation, road without conservation and firebreaks, and measure the rainfall during the period of one year, and the results are represented in Figures 3 and 4.

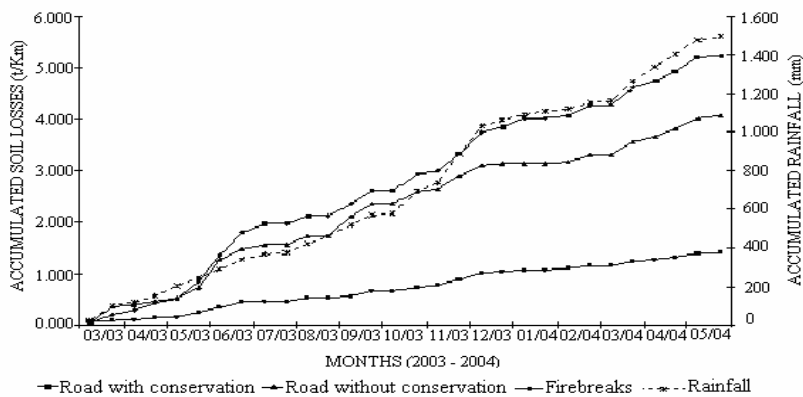


Figure 3. Secondary forest roads in soft undulating relief whit sand soil texture

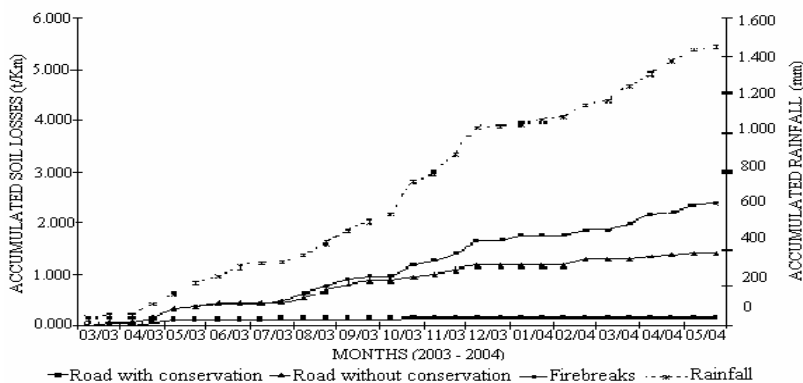


Figure 4. Secondary forest roads in plain relief whit clay soil texture

The soil losses proceeding from secondary forest road observed on the first sampling (undulating relief with sand texture predominantly) it was represented around 48,9 % in secondary roads without conservation, 38,0% in secondary roads with conservation and 13,1% in firebreaks. And in second sampling (soft to plain relief with clay texture mainly) the soil losses was represented 60,4% in secondary roads without conservation 36,1 % in secondary roads with conservation and 3,5% in firebreaks (CAMARGO CORRÊA, *et al.* 2007).

These cases wanted to collaborate for development the knowledge the susceptibility of environmental damage in forestland, and the importance of planning the wood harvesting and timber hauling and the proposition of measures were want minimize the this harms, and perhaps develop the wood harvesting practical code considering the environmental weakness associated with economical aspects.

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