

Possible Effects of Forest Harvesting Activities on Soil Respiration

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Introduction

Forests, which are an important part of the ecosystem, provide a variety of products and services to people, as well as providing habitat for many living things. Growing environment conditions directly affect the productivity of forests, which serve important purposes.

Forest soil is one of the most important habitat factors in this sense. Soil has a special importance as it contains the water and mineral nutrients necessary for the growth and development of forest trees. In addition, since it cannot accommodate the forest cover on a damaged soil structure, it can cause erosion and cause serious losses in forest areas.



Soil quality is expressed as soil properties and soils as an effective component of a healthy ecosystem. The concept of soil quality may differ according to the services and products that the soil provides. However, when evaluated in terms of **forest ecosystem** in general, the concept of soil quality is defined by foresters as “**the ability of the soil to produce biomass per unit area**”.



The extent of the damage to forests is very important as it may adversely **affect the sustainability of forests, the quality and quantity of products** to be obtained from forests in the future. **Soil is also one of the these.**

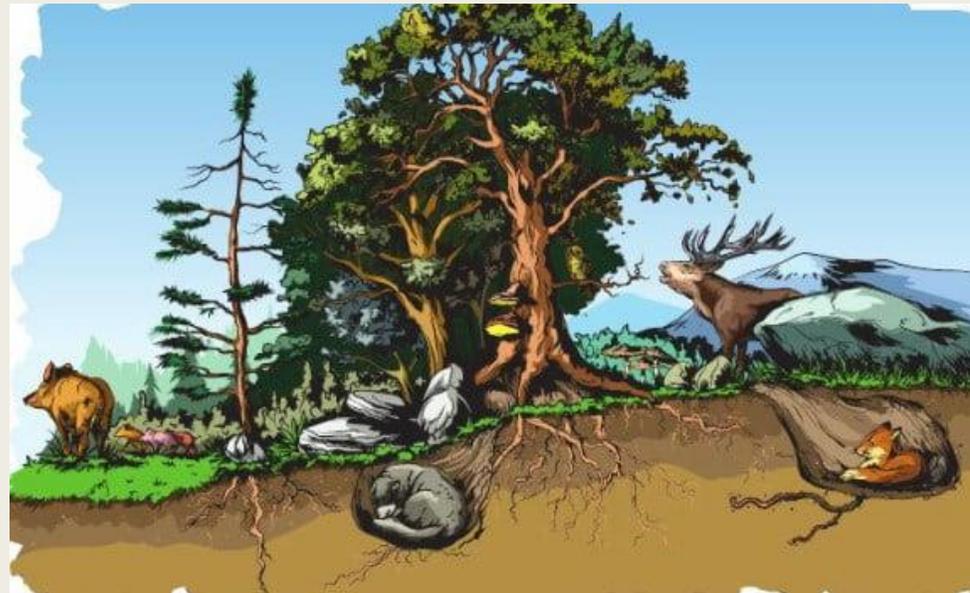


Soil plays an important role in the flow of **nutrients, water and energy to sustain forest productivity and biodiversity in forest ecosystems.**

Soil is highly susceptible to largely **inappropriate forestry activities.** Soil for forest ecosystems has serious importance for;

- all organisms living in that environment
- wood raw material production
- environmental quality

Forest soils form the basis of the whole forest ecosystem and there are long-term complex relationships and interactions between trees, soil animals and the microbial community.



The biosphere, which consists of living things, is in constant interaction with other environments.

During the forest harvesting activities, the log skidders and the harvest vehicles, which are known to be very productive in terms of forestry activities, cause various damages on the forest soil.

In general, the damage caused by skidding techniques shows itself in the form of **fragmentation and erosion** of the top layer in the uphill land and **soil compaction** in the flat land.



Effect of logging operations activities on soil respiration and soil quality

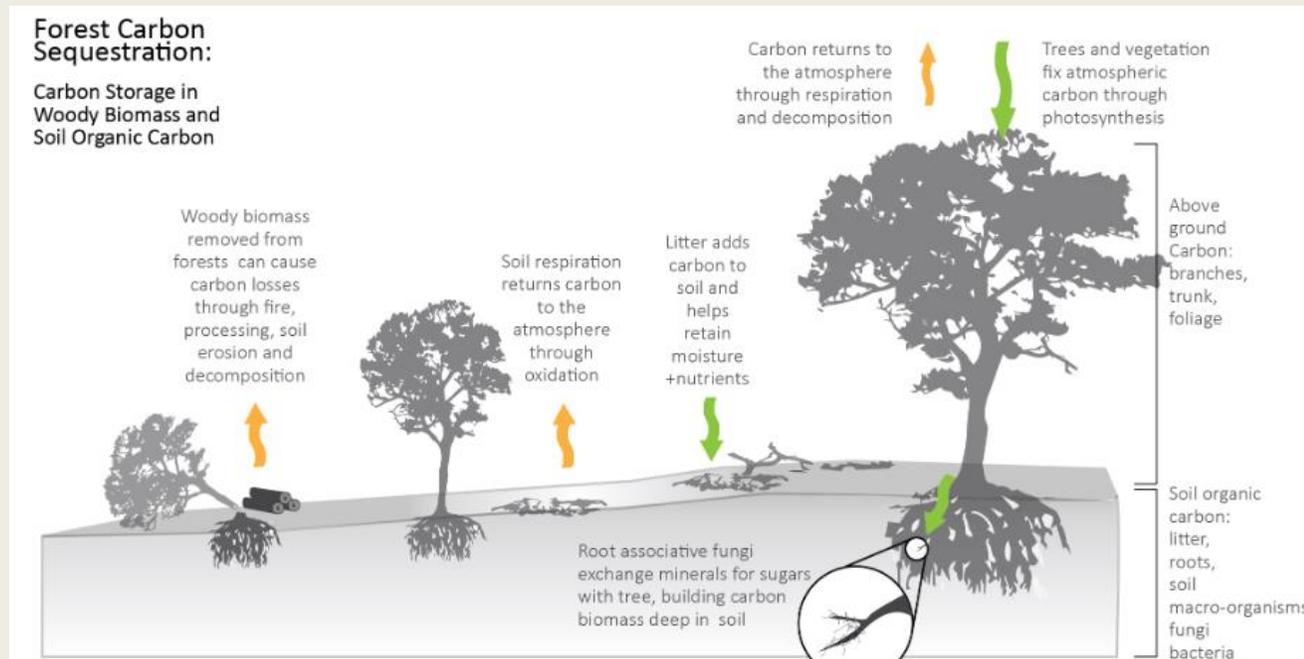
Heavy vehicles such as Tractor, Harvester (cutter-destroyer-sorter), Forwarder (loader-carrier), Combined Harvester (Cutting-Stying-Loading-Carrier) used during logging operations in forest ecosystems can adversely affect the physical, chemical and biological properties of the soil and change the forest site productivity. These vehicles used work in approximately 66% of the area. This causes the transport of the mineral topsoil together with the organic matter and the soil compaction. Soil compaction damages the soil ecosystem and quality by changing the soil physical, chemical and biological properties. **In addition**, heavy soil damage significantly reduces **the carbon storage capacity of soils** and seriously affects the ecosystem cycle.



Harvesting activities can seriously damage soils and cause short and long-term changes in some soil properties. **Significant reductions in organic carbon and microbial biomass** can be observed, especially at **skid trail**.

As a result of the harvesting activities, it is observed that **the microbial properties of the soils decrease in parallel with the increasing soil temperature and decreasing soil moisture** as a result of the removal of the litter from the soil surface. Thus, it is important for forest and soil health to monitor the changes in the microbiological properties of soils after logging operations in forests in the long term and to produce in a way that causes the least damage to the soil.

Again, soil compaction, which is usually the most obvious result of skidding **increases soil endurance and limits gas diffusion, which inhibits root growth and microbial activity, delaying the physiological and growth characteristics of seedlings-tree.**

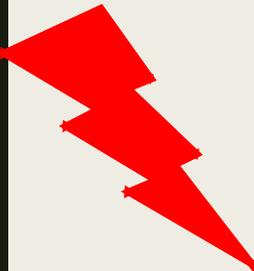


Soil respiration is one of the important indicators of soil quality, especially soil biological activity. Soil respiration is controlled by soil organic matter, texture, pH, soil moisture, soil temperature, vegetation type and similar properties.

Respiration is one of the largest global carbon flows, emitting 10 times the amount of carbon released by the combustion of fossil fuels. Soil respiration is soil CO₂ flux that represents 30% to 80% of the total forest ecosystem. It consists of subterranean autotrophic (roots and related mycorrhiza) and heterotrophic (mainly microbes, microfauna and mesofauna) respiration. Soil respiration consists of three sources. These are soil organic matter, litter and soil-dwelling organisms. These sources change throughout the year as soil moisture and temperature affect microbial activity. In addition, soil respiration of soils varies depending on vegetation type, harvesting activities, skidding activities, environmental conditions and land use types.

Harvesting activities affect forest soil respiration by changing soil carbon input, soil organic matter, forest structure and microclimate, microbial biomass and microorganism community structure, root dispersal and biomass.





While many articles investigating the effect of silviculture studies on soil respiration can be found as a result of literature studies, **there are not many articles dealing with the effect of harvesting and skidding techniques on soil respiration.** The effects of different skidding techniques on soil respiration and the comparison of these techniques are important for optimizing both **soil quality and forest carbon sequestration strategies.**

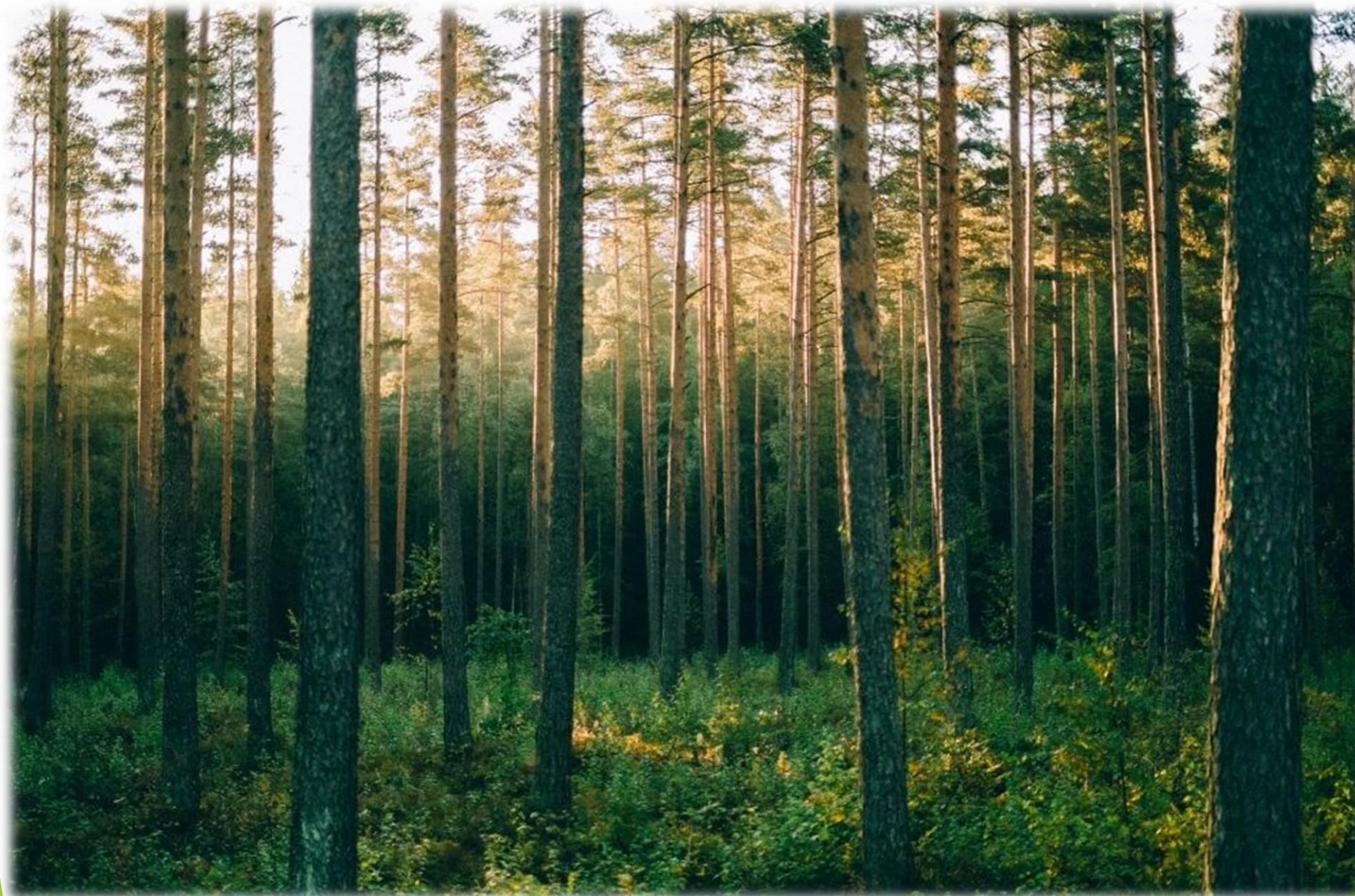
Conclusions and Recommendations

When considering the relationship between wood production and consumption in our country, it is known that the amount of production is less than the demand, and that damages and losses occur in the environment as a result of unplanned and irregular harvesting activities and the use of wrong methods. **Within the scope of sensitive forestry, it is very important to determine soil losses and quality in terms of sustainability in forestry and to make plans to reduce these environmental damages.**

In this study, **it is emphasized that soil respiration may change as a result of the destruction caused by the skidding operations, which is the most difficult part of forestry.** In addition, the study underlines the possibility of identifying and developing an appropriate skidding techniques that increases the soil carbon sequestration capacity, aiming to reduce atmospheric CO₂ concentrations by considering the CO₂ output from the soil surface.

In this context, **it is very important that the selection of secondary transportation modes, harvesting vehicles, log sizes and skidding techniques are suitable for the site.** Only in this way will it be possible to implement a safe, environmentally friendly and rational forest management.

Thus, with the most suitable harvesting and skidding plan, a healthy ecosystem will be achieved and less damage to the environment will be possible.



Thank you for your interest