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Negative Impacts of Carbon Sequestration Strategies

An international group of experts have explored the environmental impacts of plantation of trees as the main tool for biological carbon sequestration. Their results show that the afforestation of grasslands, scrublands and croplands for carbon sequestration may cause important water and nutrient depletion and increased soil salinity and acidity.

Most experts agree that the current warming trend is mainly due to the rapid increase in atmospheric CO2 from anthropogenic sources.

In order to reduce and/or mitigate the potential adverse effects of increasing temperature on ecosystems and human well-being, a variety of strategies are needed to reduce CO2 emissions and remove carbon from the atmosphere.

One way to manage carbon is to use energy more efficiently and to reduce fossil fuel combustion. Another way is to increase the use of environmentally friendly fuels and technologies. The third and the most recent way implies the so called biological carbon sequestration.

One of the most prominent tools for biological carbon sequestration is the plantation of trees, known to store carbon from CO2 during the photosynthesis process. Although the plantations provide a tool to manage the Earth's carbon cycle, the existent sequestration strategies do not seem to account for their full environmental consequences.

A group of international scientists have explored the trade-offs and benefits of carbon sequestration by existing tree plantations worldwide. After combining field research, synthesis of more than 600 observations and climate and economic modelling, the results of the study show that afforestation of grasslands, shrublands, and croplands for carbon sequestration may indeed cause several environmental problems that could outweigh the benefits.

In particular, the global analysis has shown that trees of all ages have larger water demands than crops or pastures. Consequently, the existing plantations dramatically decrease stream flow causing reductions of 38% in water supply with losses increasing as the trees aged and 13% of streams drying up completely for at least one year.

The study also shows that plantations not only have greater water demands, but they typically have higher nutrient demands as well. These demands may change soil chemistry in ways that affect its fertility and sustainability leading to soil salinisation and acidification in some cases.

However, these general trends in water use and soil chemistry must be adjusted to include local factors, viz. site history, soil texture, and the availability and quality of the groundwater.

The study cited cases where conversion of croplands to forest might improve water quality through the reduction of nutrient, pesticide, and erosion runoff from crop production. Reforestation of floodplains could also be beneficial for maintaining biodiversity, reducing erosion, and controlling groundwater discharge.

Based on their findings, the authors argue that the evaluation of the benefits and trade-offs of tree plantations will be crucial for the development and implementation of sustainable sequestration policies worldwide. They suggest that one way to do this is by comparing the value of other ecosystem services gained or lost with those of carbon sequestration.

Source: Jackson R.B et al (2005) "Trading Water for Carbon with Biological Carbon Sequestration", Science 310(23):1944-1947.
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