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The Impact of Albedo Change on Carbon Sequestration Strategies

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Many studies have suggested that carbon sequestration in terrestrial ecosystems can be an effective strategy for mitigating climate change. An increase in the carbon stocks of the biosphere results in a decrease in atmospheric CO₂. However, changes in the terrestrial biosphere have climatic impacts beyond affecting the atmospheric concentration of CO₂. In particular, changes in the surface albedo can have a significant impact on the Earth's climate. Several recent studies suggest that the effect on mean Earth surface temperature due to changes in albedo, for instance from increasing biosphere carbon stocks, may be of comparable magnitude but opposite in sign to the temperature effect of removing the CO₂ from the atmosphere. This is particularly true if, for example, forests are established in areas where there is extensive snow cover and hence the albedo difference between forest and non-forest is large. We use simple examples to demonstrate the relative magnitudes of the carbon and albedo effects on mean Earth-surface temperature and how these can be expected to evolve with time. These illustrations suggest that, in terms of climate protection, we re-examine the relative merits of 1.) protecting existing forests vs planting forests where forests did not previously exist, and 2.) managing forests to replace alternate fuels or energy-intensive products vs. managing forests to accumulate and store carbon.

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