

Carbon Capture Potential Across Northern Forest of Iran, Case Study: Asalem Forests

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Abstract: In the context of global climate change, carbon sequestration has become a highly valued function of forest ecosystems. Forests harbor approximately 44% of the global carbon pool, storing carbon dioxide (CO₂) in their woody biomass, and playing an irreplaceable role in regulating global carbon balance. So, the main purpose of this research is to discover the importance of Iran's northern forests in carbon capture potential through scientific approaches. To evaluate CO₂ absorption, 164 400 m² (20 × 20 m) temperate forest plots were established along altitudinal gradients (400-1800 m) within Asalem forests located in northwest Iran. We applied the allometric equations relate individual aboveground biomass (AGB) with diameter at breast height (DBH), height and wood density to calculate AGB and multiply each value by organic carbon content (%) derived from combustion method to quantify aboveground carbon (AGC) sequestration potential. The CO₂ absorption amounts were further estimated by multiplying total AGC sequestration by 3.67 as a conversion factor. The regression and correlation analyses were used to model carbon capture potential along altitudinal gradients. We found 3837 individuals belong to 21 species, 15 genera, and 11 families. The total value of annual AGC sequestration and CO₂ absorption was about 31.23 and 114.61 gigatons per hectare (Gt ha⁻¹), respectively that showed negligible correlations with elevation. The one-way analysis of variance (ANOVA) and Tukey's post hoc test indicated the significant differences in carbon capture potential among 21 species. The highest AGC sequestration (17.21 Gt ha⁻¹) and CO₂ absorption (63.17 Gt ha⁻¹) were recorded for beech trees (*Fagus orientalis* Lipsky). The results revealed an important basis role of our northern forests (beech trees) in mitigating climate change consequences that have to improve by applying appropriate conservation management strategies.

Keywords: Climate regulation, Carbon sequestration, Tree species, Natural forests.