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Changes in soil properties along a forest succession gradient in mid Himalayan region, India

D.R. Bhardwaj[a], Sharmistha Pal[b] and Pankaj Panwar[b]

[a]University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh 173230, India; [b]ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Chandigarh 160019, India

ABSTRACT

In this paper we investigated how succession has altered soil properties in relation to plant biomass and litter characteristics in mid Himalayan region of India. The natural forest with four succession phases were identified. The early stages are (1) pure *Pinus roxburghii* forest of coniferous shade intolerant species (2) middle stage is a *Pinus roxburghii* + *Quercus leucotricophora* (60: 40) forest with combination of coniferous and deciduous species (3) later stage is a *Quercus leucotricophora* + *Pinus roxburghii* (60: 40) and (4) climax stage is a Pure *Quercus leucotricophora* forest of shade tolerant deciduous broadleaf species. The soil samples were collected from surface (0–15 cm) and subsurface (15–30 cm and 30–45 cm) levels. The soil properties showed gradual improvement with progress in succession phases. Our study shows that, there was a substantial increase in level of soil organic carbon and nitrogen from early to climax phase. Soil pH was significantly lower in early succession phase. The highest available nitrogen was under climax (pure oak) and least in early phase (pure pine) (402 and 347 Kg ha^{-1} in surface soil, respectively). The concentration of very labile carbon (fraction 1) was highest in climax and least in early stage. The highest biomass accumulation was in climax (pure oak, 420.6 $Mgha^{-1}$), followed by oak + pine (348.7 $Mgha^{-1}$) and least in pine + oak (299.3 $Mgha^{-1}$). Out of 4 stages, shrub biomass was maximum in early (pure pine) (20.5 M $Mgha^{-1}$), being 6.57% of total biomass and least in climax (pure oak) (10.7 $Mgha^{-1}$), being 2.54% of total biomass. Further, the labile carbon pools showed a strong positive correlation with total biomass at different succession stages. The recalcitrant carbon pool had significant negative correlation with biomass. Hence, the study suggests that, this increase in soil organic carbon, nitrogen and soil fertility parameters are in accordance to changes in biomass and litter fall characteristics with progress in forest succession.

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