

## CURRENT APPROACHES TO QUANTIFYING THE NEW ZEALAND TERRESTRIAL CARBON BUDGET

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### ABSTRACT

New Zealand (NZ) is developing a system to quantify the national inventory of C stocks and changes in vegetation and soils, in order to meet its obligations under the UN Framework Convention on Climate Change (FCCC) and Kyoto Protocol. The current system applies an inventory-based approach applied to forests, shrublands and agricultural lands. Our approach emphasizes assessment of vegetation and soil C stocks, and changes due to afforestation and reforestation since 1990, as these activities represent an important component of NZ's greenhouse gas inventory. All estimates are based on the national Land Cover Database (LCDB), which is repeated through satellite remote sensing at ~5 year intervals, with current estimates based on 1996/7 and 2001/2. The current measurement-based approach for forest and shrubland biomass uses historical national datasets for indigenous and exotic forests, and defines remeasurement of plots on a national grid for both forest types. We highlight current research to develop complementary model-based approaches to estimating C stocks and fluxes for both vegetation and soils, to support forecasting and in anticipation of more rigorous future reporting requirements. Development of a regional- to national-scale vegetation model presently centres on a simple partially-constrained light-use efficiency approach with spatial representation of the primary growth limiting factor. More complex models, involving multiple environmental constraints and detailed physiological modelling of leaf-to-canopy processes within a multilayered canopy, provide a robust basis for estimation of parameters in the simple model. We currently use an IPCC tier-2 methodology for predicting soil C changes based on land-use categories, climate, soil class, and topography. The system assumes soil C attains a steady state under stable long-term land use and that differences between the steady-state C stocks under different land uses define the changes in soil C that result from land-use change. Current research aims to estimate rates of change using long-term data from sites of known land-use change and management history and natural abundance radiocarbon-based estimates of soil C pools and turnover rates. Present estimates suggest New Zealand's "Kyoto forests" sequester ~6.2 Mt C y<sup>-1</sup>, with a concomitant soil C loss of 0.7±0.3 Mt C y<sup>-1</sup>.

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