

3.6 SETTLEMENTS

This land-use category is described in Chapter 2 as including all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other land-use categories. In this chapter, the focus of settlements is on the terrestrial components of developed land that are managed and may influence CO₂ fluxes between the atmosphere and terrestrial carbon pools. In this context, the land-use category “Settlements” includes all classes of urban tree formations, namely: trees grown along streets, in public and private gardens, and in different kinds of parks, provided such trees are functionally or administratively associated to cities, villages, etc. While dead organic matter and soil carbon pools may also be sources or sinks of CO₂ in settlements and CH₄ and N₂O emissions may result from urban land management practices, little is known about the role and magnitude of these pools in overall greenhouse gas fluxes. Therefore, the focus of the methodological discussions is on the subcategory of change in carbon stocks in living biomass, where some research has been conducted (Nowak 1996, 2002).

Change in carbon stocks in living biomass in “Settlements” can be estimated in two parts: “Settlements Remaining Settlements (SS)” and “Land Converted to Settlements (LS)”. The latter part may be an important component of national estimates of deforestation (or other nationally important land-use conversions). Therefore, brief guidance is provided below on estimating change in carbon stocks due to conversion of forest land to settlements. Only living biomass is addressed in this section.

3.6.1 Settlements Remaining Settlements

A basic method for estimating CO₂ emissions and removals in settlements remaining settlements is provided in Appendix 3a.4 because the methods and available default data for this land-use conversion are preliminary. Countries with data on dead wood, soil carbon, and non-CO₂ gases in settlements are encouraged to report this information as well.

3.6.2 Land Converted to Settlements

The fundamental equation for estimating change in carbon stocks associated with land-use conversions has been explained in other sections of this chapter, namely Sections 3.2.2, 3.3.2 and 3.4.2 with regard to land converted to forest land, cropland and grassland, respectively. The same decision tree (see Figure 3.1.2) and the same basic method can be applied to estimate change in carbon stocks in forest land converted to settlements, following Equation 3.6.1.

EQUATION 3.6.1
ANNUAL CHANGE IN CARBON STOCKS IN LIVING BIOMASS
IN FOREST LAND CONVERTED TO SETTLEMENTS (FS)

$$\Delta C_{FS_{LB}} = A \bullet (C_{After} - C_{Before})$$

Where:

$\Delta C_{FS_{LB}}$ = annual change in carbon stocks in living biomass due to conversion of forest land to settlements, tonnes C yr⁻¹

A = area of land converted annually from forest land to settlements, ha yr⁻¹

C_{After} = carbon stocks in living biomass immediately following conversion to settlements, tonnes C ha⁻¹

C_{Before} = carbon stocks in living biomass in forest land immediately before conversion to settlements, tonnes C ha⁻¹

This method follows the approach in the *IPCC Guidelines* (Section 5.2.3, Forest and Grassland Conversion) where the amount of living aboveground biomass that is cleared for expanding settlements is estimated by multiplying the forest area converted annually to settlements by the difference in carbon stocks between biomass in the forest prior to conversion (C_{Before}) and that in the settlements after conversion (C_{After}). The tiered approaches for estimating change in carbon stocks in living biomass outlined in Sections 3.2.2, 3.3.2 and 3.4.2 apply here as well. A Tier 1 estimate is developed using default assumptions and default values for carbon stocks. At Tier 2, country-specific

carbon stocks are applied to activity data disaggregated to appropriate scales. At Tier 3, countries use advanced estimation methods that may involve complex models and highly disaggregated activity data.

The default assumptions for a Tier 1 estimate of change in carbon stocks in living biomass in land converted to settlements are that all living biomass present before conversion to settlements will be lost in the same year as the conversion takes place, and that carbon stocks in living biomass following conversion (C_{After}) are equal to zero. Countries should estimate the area of forest land converted to settlements, by major forest types, and use default carbon stock values in Tables 3A.1.2 and 3A.1.3 to develop estimates of carbon stocks in living biomass before conversion (C_{Before}) for each initial forest type.

In cases where fires are used to clear vegetation, emissions of non-CO₂ gases, i.e. CH₄ and N₂O, will also occur. Countries may choose to estimate non-CO₂ emissions from burning when fires are used to clear vegetation for development of settlements. The basic method for estimating non-CO₂ emissions from fires can be found in Section 3.2.1.4.