## 14.2 Termites—Greenhouse Gases

### 14.2.1 General[1-2]

Termites inhabit many different ecological regions, but they are concentrated primarily in tropical grasslands and forests. Symbiotic micro-organisms in the digestive tracts of termites (flagellate protozoa in lower termites and bacteria in higher termites) produce methane ($CH_4$). Estimates of the contribution to the global budget of $CH_4$ from termites vary widely, from negligible up to 15 percent.

Termite $CH_4$ emissions estimates vary for several reasons. Researchers have taken different approaches to approximating the number of termites per area for different ecological regions (e.g., cultivated land, temperate grassland, tropical forest) and different species. In addition, the total area per ecological region is not universally agreed upon, and not all of the area in an ecological region is necessarily capable of supporting termites. For example, cultivated land in Europe and Canada is located in a climatic zone where termites cannot survive. Some researchers have tried to estimate the percentage of each region capable of supporting termites while others have conservatively assumed that all of the area of a given ecological region can support termites. Finally, the contributions to atmospheric $CH_4$ from many other related $CH_4$ sources and sinks associated with termite populations (i. e., tropical soils) are not well understood.

### 14.2.2 Emissions[3-4]

The only pollutant of concern from termite activity is $CH_4$. Emissions of $CH_4$ from termites can be approximated by an emission factor derived from laboratory test data. Applying these data to field estimates of termite population to obtain a realistic, large-scale value for $CH_4$ emissions is suspect, but an order-of-magnitude approximation of $CH_4$ emissions can be made. Termite activity also results in the production of carbon dioxide ($CO_2$). These $CO_2$ emissions are part of the regular carbon cycle, and as such should not be included in a greenhouse gas emissions inventory.

Table 14.2-1 reports typical termite densities per ecological region, and Table 14.2-2 provides the $CH_4$ emission factors for species typical to each ecological region.

A critical data gap currently exists in determining the activity rate for these emission factors (which are given in units of mass of $CH_4$ per mass of termite). Estimates of termites per acre are given in Table 14.2-1, but converting the number of termites into a usable mass is difficult. If the species of termite is known or can be determined, then the number of termites or the number of termite nests can be converted into a mass of termites. If the species is not known for a particular area, then a typical value must be used that is representative of the appropriate ecological region. Reference 4 provided information on termite density for various North American species, with an average denisity of $4.86 \times 10^{-6}$ lb/worker termite.

An example calculation to estimate annual emissions from termites on 5,000 acres of cultivated land is as follows:

$$5000 \text{ acres} * \frac{11.38\text{x}10^{6} \text{ termites}}{\text{acre}} = 5.69\text{x}10^{10} \text{ termites}$$

$$5.69\text{x}10^{10} \text{ termites} * \frac{4.86\text{x}10^{-6} \text{ lb}}{\text{termite}} * \frac{1.8\text{x}10^{-3} \text{ lb } CH_4}{1000 \text{ lb termite}} * \frac{1}{\text{hr}} * \frac{8760 \text{ hr}}{\text{yr}}$$

$$= 4360.39 \frac{\text{lb } CH_4}{\text{yr}}$$

To convert pounds to kilograms, multiply by 0.454.

Table 14.2-1. TYPICAL TERMITE DENSITIES PER ECOLOGICAL REGION[a]

| Ecological Region | $10^6$ Termites per Acre |
|---|---|
| Tropical wet forest | 4.05 |
| Tropical moist forest | 18.01 |
| Tropical dry forest | 12.80 |
| Temperate | 2.43 |
| Wood/shrub land | 1.74 |
| Wet savanna | 17.81 |
| Dry savanna | 3.48 |
| Temperate grassland | 8.66 |
| Cultivated land | 11.38 |
| Desert scrub | 0.93 |
| Clearing and burning | 27.62 |

[a] Reference 3.

Table 14.2-2. METHANE EMISSION FACTORS FOR TERMITES[a]

EMISSION FACTOR RATING: E

| Termite Species (Ecological Region) | Methane Emissions (lb $CH_4$/1000 lb termite/hr) |
|---|---|
| Tropical forest | 4.2 E-03 |
| Temperate forest | 1.8 E-03 |
| Savanna | 8.0 E-03 |
| Temperate grassland | 1.8 E-03 |
| Cultivated land | 1.8 E-03 |
| Desert scrub | 1.0 E-03 |

[a] References 5 and 6. Reference 7 suggests the following seasonal variation based on studies of the species *Coptotermes lacteus:*

Spring - 22%
Summer - 49%
Fall - 21%
Winter - 8%

References For Section 14.2


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4. K. Krishna and F. M. Weesner, *Biology Of Termites, Volume I*, Academic Press, New York, 1969.

5. Written Communication from M. Saegar, SAIC, to Lee Beck, Project Officer, U. S. Environmental Protection Agency, regarding *Summary Of Data Gaps Associated With County-Specific Estimates Of $CH_4$ Emissions*, July 6, 1992.

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7. T. M. Lynch, *Compilation Of Global Methane Emissions Data, Draft Report*, Alliance Tech. Corp. for U. S. Environmental Protection Agency, Nov. 1991.