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greenhouse gases, defined in terms of overall impact (amount in the atmosphere times impact per molecule integrated over time), are carbon dioxide (CO_2), chlorofluorocarbons (CFCs), methane (CH_4), and nitrous oxide (N_2O). If the trunk of the tree represents the greenhouse gas-producing effect of all human activities, the limbs can represent the contributing greenhouse gases. Table 3-1 presents the limbs during two different time periods and a projection for a future period.

2. Both natural processes and human activities result in emissions of greenhouse gases. For instance, carbon dioxide is emitted by respiration of animals and plants, burning of biomass, burning of fossil fuels, and so forth. If each limb of the tree represents human contributions to global emissions of a greenhouse gas, the branches off the limbs can represent the major anthropogenic sources of a gas, that is, the major categories of human activity that release it. These are proximate human causes of climate change, and their impact is equal to their contribution of each greenhouse gas times the gas's radiative effect, integrated over time. For the same emissions, the representation of impact will vary with the date to which the impact is projected. Tables 3-2 and 3-3 allocate emissions of the most important greenhouse gases during the late 1980s to human activities.

3. Major human proximate causes, such as fossil fuel burning, are conducted by many actors and for many purposes: electricity generation, motorized transport, space conditioning, industrial process heat, and so forth. A tree branch, such as one representing fossil fuel burning, can be divided into twigs that represent these different actors or purposes, each of which acts as a subsidiary proximate cause, producing a proportion of the total emissions. It is possible to make such a division in numerous ways. Fossil fuel burning can be subdivided according to parts of the world (countries, developed and less-developed world regions, etc.), sectors of an economy (transportation, industrial, etc.), purposes (locomotion, space heating, etc.), types of actor (households, firms, governments), types of decisions determining the activity (design, purchase, utilization of equipment), or in other ways. Different methods may prove useful for different purposes. Table 3-4 illustrates one way to allocate the carbon dioxide emitted from fossil fuel consumption to the major purposes (end uses) of those fuels.

4. The tree structure can be elaborated further by dividing the subsidiary proximate causes defined at the previous level into their components. Such analysis is important for high-impact activities.