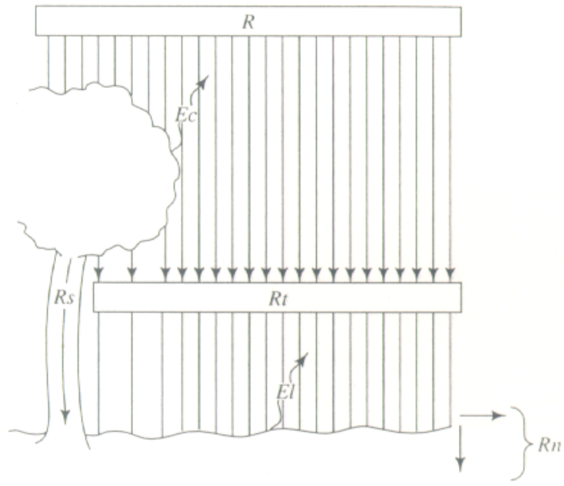

FIGURE 7-15
Definitions of terms used in describing the interception process. R = gross rainfall; Ec = canopy interception loss; Rt = throughfall; Rs = stemflow; El = litter interception loss; Rn = net rainfall.

7.6.1 Definitions

Figure 7-15 illustrates the following definitions used in describing and measuring interception:

Gross rainfall, R, is the rainfall measured above the vegetative canopy or in the open.
Throughfall, Rt, is rainfall that reaches the ground surface directly through spaces in the canopy and by dripping from the canopy.
Stemflow, Rs, is water that reaches the ground surface by running down trunks and stems.
Canopy interception loss, Ec, is water that evaporates from the canopy.
Litter interception loss, El, is water that evaporates from the ground surface (usually including near-ground plants and leaf litter).
Total interception loss, Ei, is the sum of canopy and litter interception losses.
Net rainfall, Rn, is the gross rainfall minus the total interception loss.

These definitions are applied over a representative area of the plant community of interest, so they take into account the typical spacing between plants. If the symbols given represent volumes of water during a given time period and have dimensions [L], we have

$$Rn = R - Ei, \quad \textbf{(7-57)}$$

$$Ei = Ec + El, \quad \textbf{(7-58)}$$

$$R = Rt + Rs + Ec, \quad \textbf{(7-59)}$$

and

$$Rn = Rt + Rs - El. \quad \textbf{(7-60)}$$

7.6.2 Measurement

As with other components of evapotranspiration, interception loss cannot be measured directly. The most common approach to determining the amounts of canopy interception loss in various plant communities is to measure gross rainfall, throughfall, and stemflow, and solve Equation (7-59) for Ec. However, this is not a simple procedure because of (1) the difficulties in accurately measuring rainfall, particularly at low rainfall intensities when interception losses are relatively large (see Section 4.2.2); (2) the large spatial variability of throughfall; and (3) the difficulty and expense of measuring stemflow.

Helvey and Patric (1965a) reviewed criteria for measuring interception quantities and concluded that averaging the catches in 20 rain gages spaced randomly over a representative portion of the community should give acceptable estimates of throughfall; typical inter-gage spacing for forest studies is on the order of 10 to 30 m (Gash et al. 1980). Large plastic sheets have also been used to get an integrated measure of net rainfall (Calder and Rosier 1976).

Stemflow is measured by attaching flexible troughs tightly around the trunks of trees and conducting the water to rain gages or collecting bottles. Helvey and Patric (1965a) stated that measuring stemflow from all trees on randomly selected plots gives the most representative results, with plot diameters at least 1.5 times the diameter of the crown of the largest trees. However, since stemflow is usually much less than throughfall, most studies have estimated stemflow less rigorously by sampling a few "typical" trees.

The few published studies of grass or litter interception have usually been done using artificial rain, either measuring the net rainfall from small isolated areas in the field (Merriam 1961) or by collecting undisturbed samples of the surface litter and setting them on recording scales in the laboratory (Pitman 1989; Putuhena and Cordery 1996).

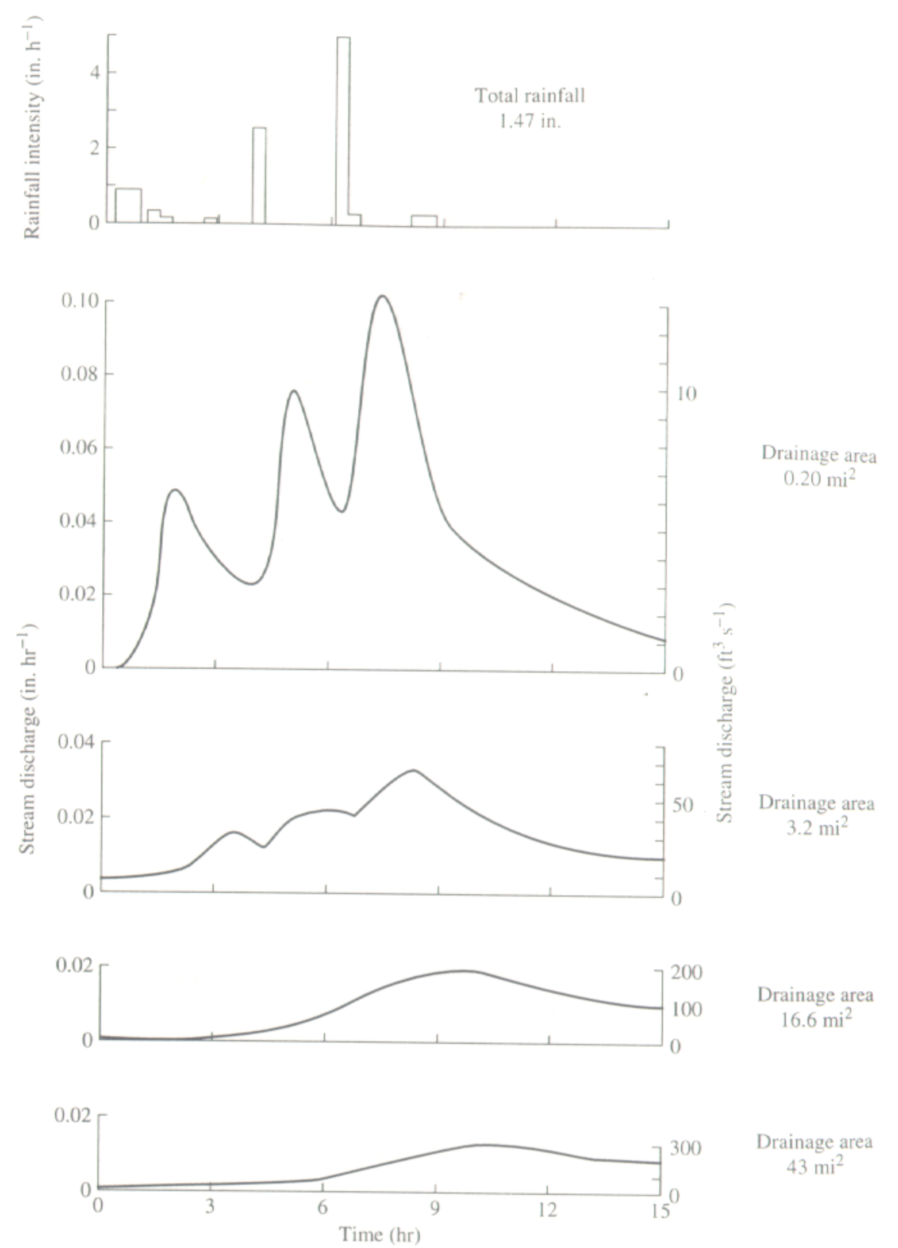

FIGURE 9-3
Changes in hydrograph shape at a series of gaging stations along the Sleepers River in Danville, VT, in response to an intense rainstorm (hyetograph at top). Note that the left-hand hydrograph ordinates show flow rates per unit drainage area, while right-hand ordinates show actual flow rates. From *Water in Environmental Planning*, by Thomas Dunne and Luna B. Leopold. Copyright © 1978 by W.H. Freeman and Company. Reprinted by permission.

total input. The remainder of the water input ultimately leaves the watershed as (1) evapotranspiration, (2) streamflow that occurs so long after the event that it cannot be associated with that event ("base flow"), or (3) ground-water outflow.

- The water identified as the response to a given event may originate on only a fraction of the watershed; this fraction is called the **contributing area.**
- The extent of the contributing area may vary from event to event and during an event.
- At least some of the water identified as the response to a given event may be "old water" that entered the watershed in a previous event.

These points are elaborated in subsequent sections of this chapter.