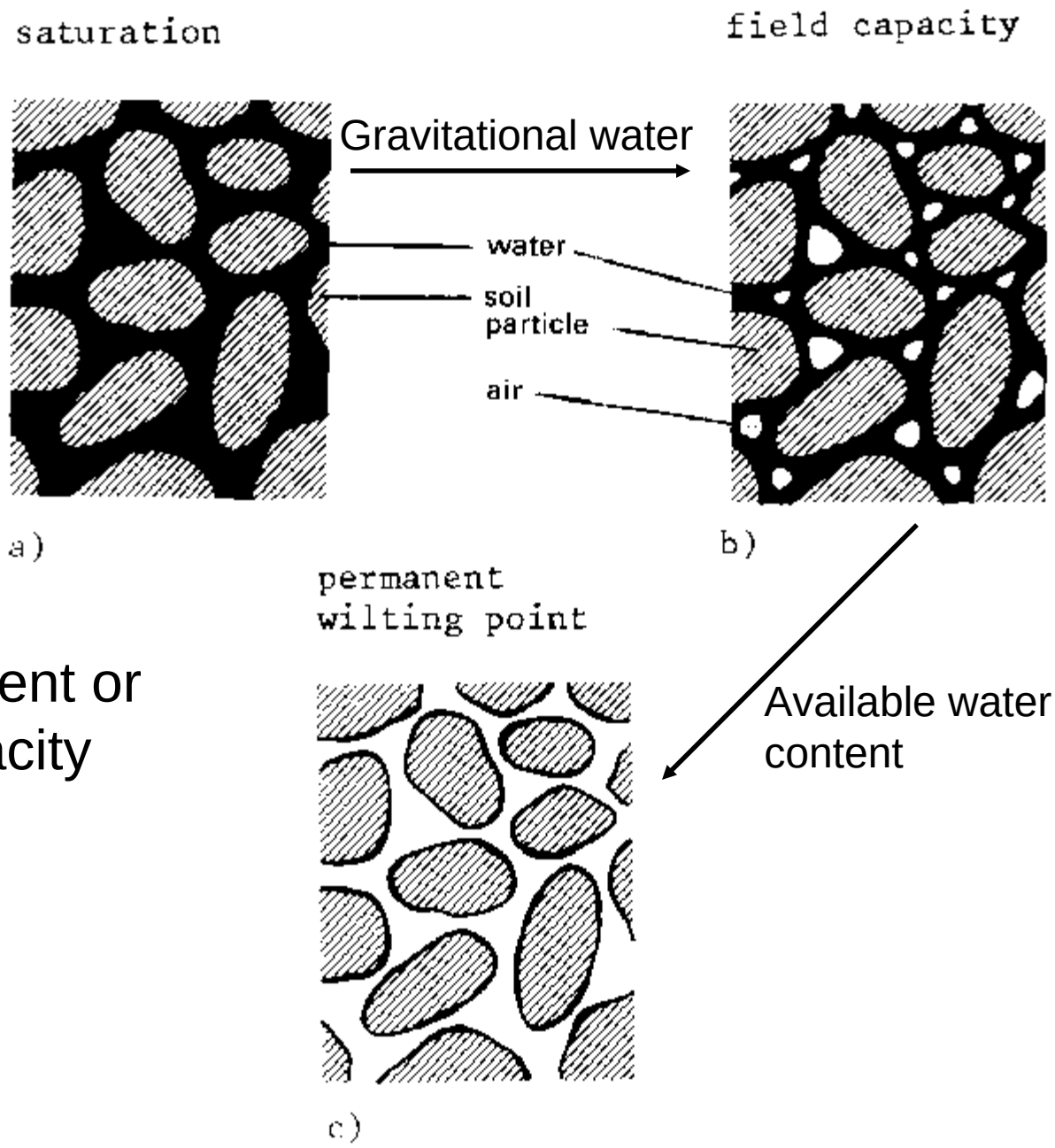
Important Bulk Properties of Soil

- Particle density $\rho_m = \frac{M_m}{V_m} \approx 2.65 \frac{g}{cm^3}$
- Bulk density $\rho_b = \frac{M_m}{V_s} = \frac{M_m}{V_a + V_w + V_m}$
- Porosity $\phi = \frac{V_a + V_w}{V_s} = 1 - \frac{\rho_b}{\rho_m}$
- Gravimetric water content $\theta_g = \frac{M_w}{M_m} = \frac{M_{wetsoil} - M_{drysoil}}{M_{drysoil}}$
- Volumetric water content $\theta = \frac{V_w}{V_s} \approx \rho_b \theta_g$
- Saturation $S = \frac{\theta}{\phi} = \frac{V_w}{V_a + V_w}$

Agricultural Bulk Properties

- **Gravitational water:** the water drained away by gravity when gravity > attraction.
- **Field capacity** θ_{fc} is the water that can be retained in the soil matrix against gravity.
- **Permanent wilting point** θ_{pwp} is the water content at which plants can no longer draw water out of the soil.
- **Available water content** or **Available water capacity** is the water available to plants for transpiration, $\theta_a = \theta_{fc} - \theta_{pwp}$

Agricultural Bulk Properties



Available water content or available water capacity

$\theta_a = \theta_{fc} - \theta_{pwp}$

Soil Pore Water Status

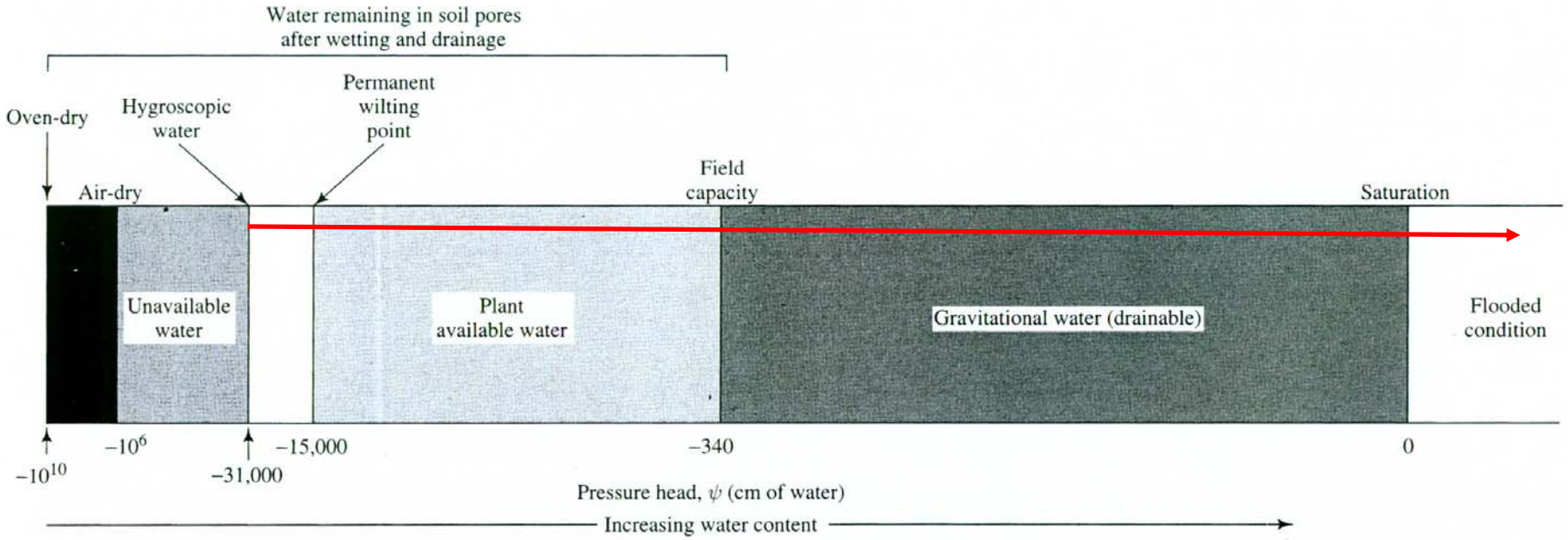
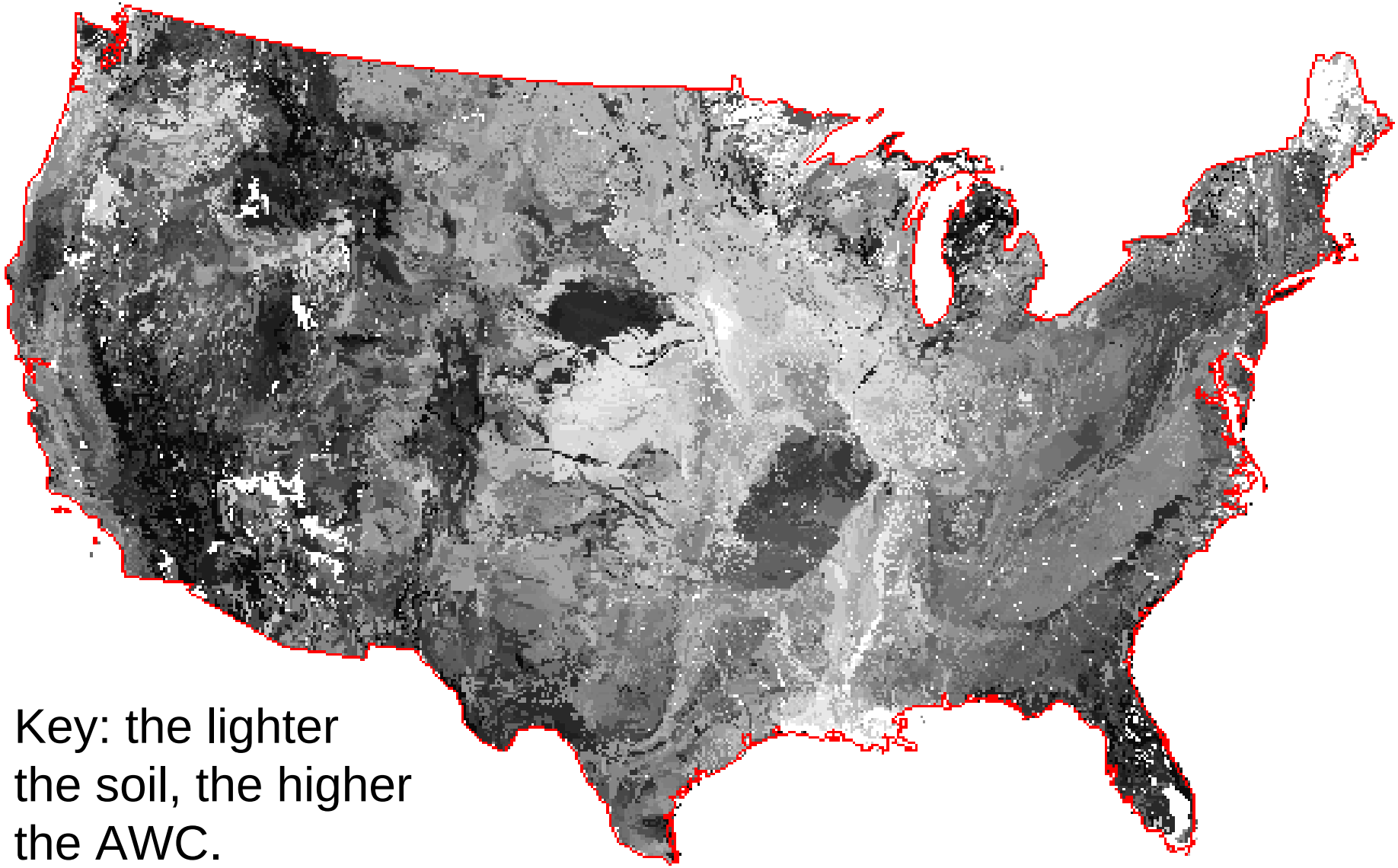


FIGURE 6-13
Soil-water status as a function of pressure (tension). Natural soils do not have tensions exceeding about −31,000 cm; in this range, water is absorbed from the air. After Donahue et al. (1983).

The red arrow represents the range of water contents that an undisturbed soil can have. Water contents below hygroscopic can only be achieved by human interference.

Available Water Capacity in the US



Key: the lighter the soil, the higher the AWC.