Chapter 2. Drought

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Drought occurrence is a function of temperature, moisture, and soil characteristics. In some regions, such as much of the Western United States, drought is a regular occurrence, while in others, such as the Northeastern United States, drought occurs on an irregular basis. Moderate drought stress tends to slow plant growth while severe drought stress also reduces photosynthesis (Kareiva and others 1993).

Drought also interacts with other forest stressors. For example, Mattson and Haack (1987) identified 10 insect families that historically reach outbreak status following drought episodes. Drought also affects the level of damage plants receive due to ozone. Plant injury from elevated ozone exposure occurs during gas exchange, which is partially regulated by moisture. Under drought conditions plants close their stomates to conserve water. When stomates are closed, gas exchange does not occur, and plant injury from ozone does not result. Drought can also influence fire characteristics. For example, Taylor and Beaty (2005) found that drought intensity over a 200-year period (1650–1850) affected fire extent in the northern Sierra Nevada Mountains.

Brief Methods

The National Climatic Data Center (NCDC) calculates the Palmer Drought Severity Index (PDSI) monthly by climate division for the conterminous United States. The NCDC archive contains monthly estimates of PDSI from 1895 to present (National Climatic Data Center 1994). PDSI was used to examine drought occurrence at the single year (2005) and 10-year (1996–2005) time scales by ecoregion section (Cleland and others 2005). We considered "drought" to include PDSI values < −2.0, which indicates moderate, severe, and extreme drought conditions. The value for each ecoregion section was estimated using a forest area weighted average [see Conkling and others (2005) for more information]. Drought deviation was used to quantify drought over the last 10 years (Conkling and others 2005). Drought frequency from 1895 through 2005 served as a historical account or reference point for each ecoregion section. For example, if 333 months of drought were recorded in an ecoregion section from 1895 through 2005, then 30 months of drought would be expected on a 120-month (10-year) basis. The historical account was then compared to the

current decade. If the expected number of months with drought conditions was 30, and 39 months of drought were recorded in the current decade, then the drought deviation was 39–30 = 9.

Results

In 2005, 51.1 percent of the ecoregion sections in the conterminous United States did not experience any moderate, severe, or extreme drought (fig. 2.1). Section 212R—Eastern Upper Peninsula in Michigan was the only section in the East that had more than 4 months of drought during 2005. In the Western United States, forests in both section M332D—Belt Mountains and section M334A—Black Hills experienced 8 months of drought. Also of note in the Western United States was section M332G—Blue Mountains in Oregon, which had 9 months of drought in 2005.

While 51.1 percent of ecoregion sections did not experience drought in 2005, several ecoregion sections had drier than expected conditions from 1996–2005 (fig. 2.2). Approximately 12 percent of the ecoregion sections experienced more than 24 additional months of drought than expected. Many of these sections were in the Western United States, and included sections M332D—Belt Mountains, M332A—Idaho Batholith, M332G—Blue Mountains, M331A—Yellowstone Highlands, and 313C—Tonto Transitions. Also of note was section 232K—Florida Coastal Plains Central Highlands, which had 19 more months of drought from 1996 to 2005 than expected. While several ecoregion sections experienced more drought than was expected, approximately 35 percent of the ecoregion sections experienced approximately the expected amount of drought (drought deviation = −5 to 6 months).

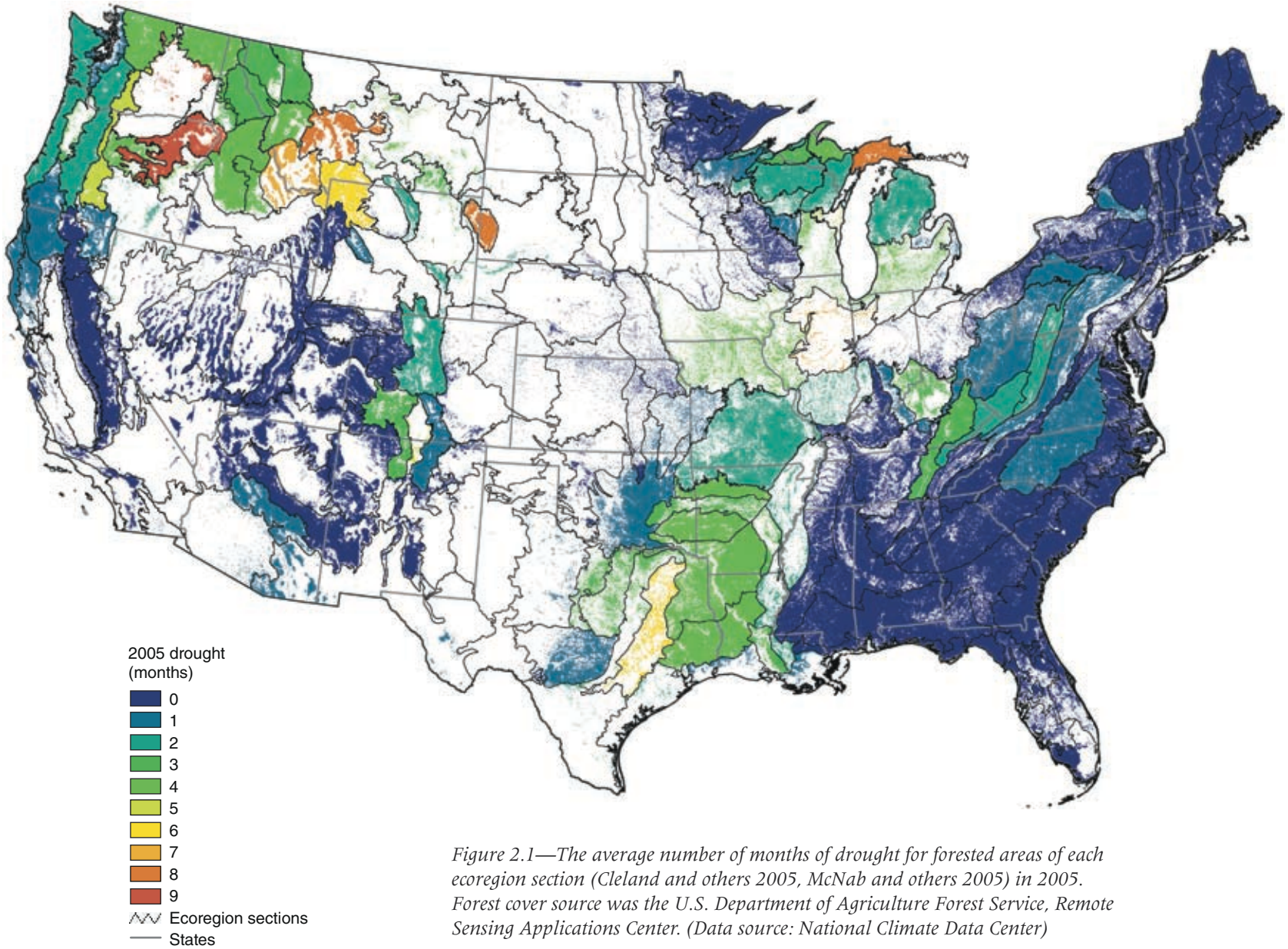

Figure 2.1—The average number of months of drought for forested areas of each ecoregion section (Cleland and others 2005, McNab and others 2005) in 2005. Forest cover source was the U.S. Department of Agriculture Forest Service, Remote Sensing Applications Center. (Data source: National Climate Data Center)

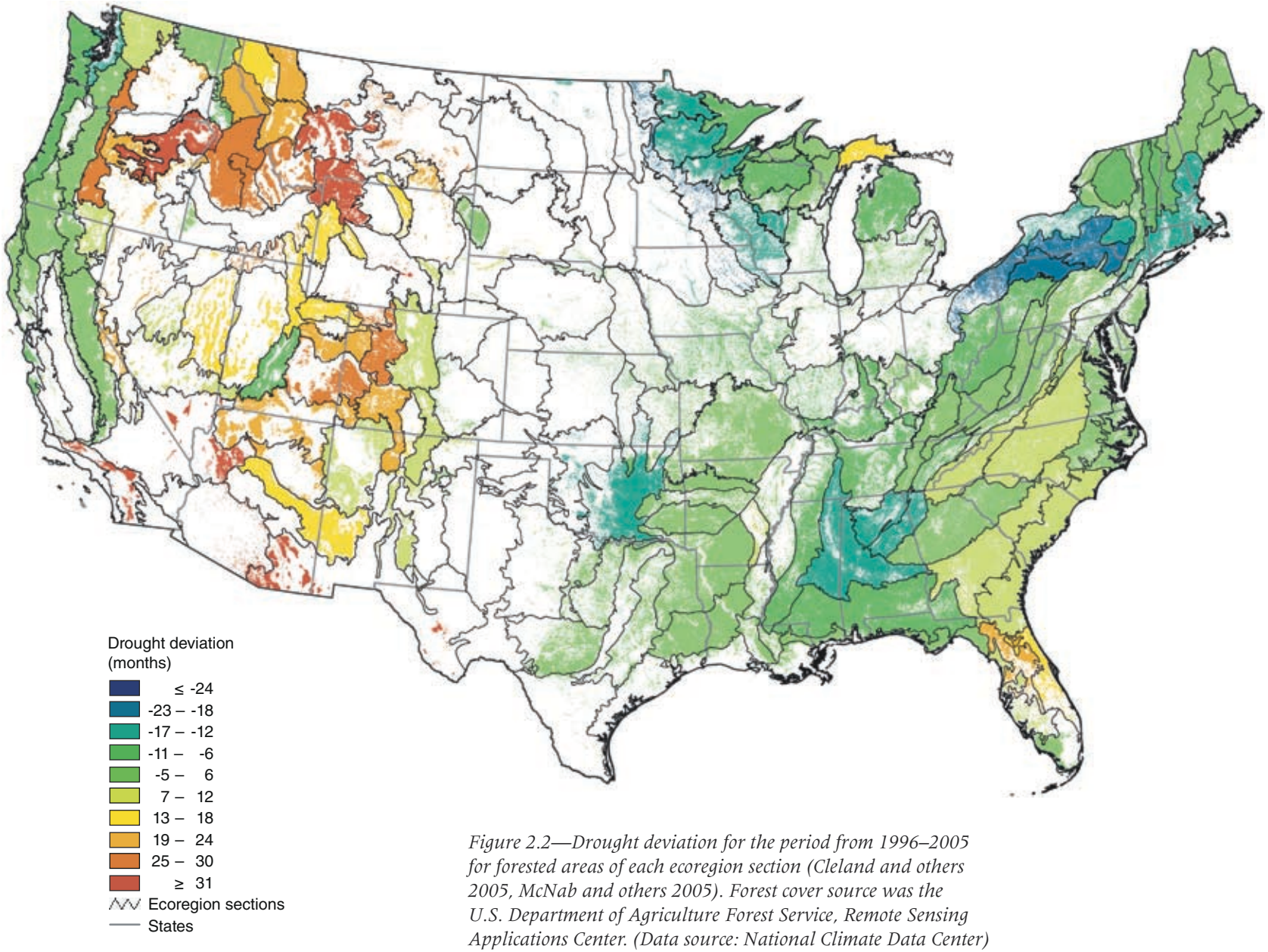

Figure 2.2—Drought deviation for the period from 1996–2005 for forested areas of each ecoregion section (Cleland and others 2005, McNab and others 2005). Forest cover source was the U.S. Department of Agriculture Forest Service, Remote Sensing Applications Center. (Data source: National Climate Data Center)

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