The Ecological Survey of the Big Bend Area (ESBBA) plots provide a permanent quantitative and photographic record of vegetation dynamics in Big Bend NP covering more than a half century – a long-term record of vegetation dynamics unique in the arid southwestern United States.

**History:** Big Bend National Park began a long-term monitoring program in 1955 to document changes in park vegetation through time. The Park’s motivation was two-fold: (1) the Park lands were severely over grazed when acquired. The monitoring program was designed to document changes following Park establishment and protection from grazing; and (2) the 1950’s drought was causing die back of trees throughout the Chisos Mountains and the Park personnel asked that this problem be considered in the monitoring program.

**The Permanent Plots:** Between 1955-1957 a total of 77 permanently marked vegetation plots were established in the Park, including the desert grassland areas on the piedmont slopes below the Chisos Mountain and in both the Paint Gap and Grapevine Hills; in the woodland-transition zone in Green Gulch; and in the woodlands and forests of the high Chisos. Most of these plots were established near Park roads or along trails in the Chisos Mountains. Some plots have been lost or severely damaged by Park activities – the plots are discretely marked with rebar – and there is continued risk of further damage or destruction.

**Remeasurements:** The original ESBBA scientists measured the plots in 1955, 1961, and 1967. After 1968 the plots fell into disuse. The plots were rediscovered and remeasured by Dr. S. Wondzell, Dr. J. Ludwig, and Dr. E. Muldavin in 1981, 1996, and 2007.
Results: The time period of measurement spans changes in policy and management questions relevant to the Park. Initial focus on recovery from grazing and drought effects on forest die back has been replaced by concerns over climate change, invasive species, fuel accumulation and uncharacteristic wildfire risks. The long-term records provide many insights to these questions.

Recovery from grazing and the 1950’s drought: The data show a clear increase in total grass cover and substantial increases in biodiversity over time. But the 1950’s drought also caused die-back of many desert shrubs and these have also regrown over time. Overall, there is much more vegetation cover in the desert grasslands today than there was in the mid-20th Century.

Invasives: Few non-native species were recorded on the permanent plots from 1955 through 1981. In 1996 Lehman’s Lovegrass was first recorded on the plots and had increased in cover by 2007. While Lehman’s Lovegrass cover on the permanent plots is currently low, observations suggest that substantial increases in cover are likely in the future. The plots are well positioned to monitor the effects of this non-native species on the desert grasslands of the Park. Most of the desert grassland plots are at too high an elevation (and therefore too cold) for Buffle Grass, however, one transect located on Tornillo Flats now has substantial cover of this species.

Forest die-off: Overall, forest die-off was not substantial throughout the Chisos Mountains in the 1950’s drought – notable exceptions were Gray and Graves Oaks at lower elevations in Green Gulch, Juniper Canyon, and Pine Canyon (75% dead); and moderate die-off (averaging 40% dead) of Arizona Cypress in Boot Canyon and of Ponderosa Pine in Pine Canyon.

Wildfire Risks: There are only 11 permanent plots located in the Chisos Mountains and these are poorly matched replicates making it difficult to draw conclusions. However, the plots show little to no change in tree density from 1955 to 2008. These observations run counter to the prevailing paradigm that decades of fire suppression have significantly changed forest structure resulting in increased wildfire risk. Perhaps the long period of protection from grazing (starting with initial efforts to remove livestock from the Chisos Mountains in the mid-1930’s) has allowed recovery of herbaceous vegetation resulting in strong competitive suppression of tree regeneration.

Effects of global change: This 55-year long study spans multi-year periods of below and above average rainfall and, despite the long intervals between remeasurements, the data show that the desert grassland vegetation responds rapidly to variations in precipitation. For example, grass cover peaked in 1981 following a period of much wetter than average summers – when summer rains favored the growth of the native warm-season perennial bunch grasses of Big Bend. Drier years since then has seen reductions in grass cover accompanied by continued growth of dominant shrubs. These data suggest that the desert grassland vegetation will be highly responsive to climate change – with increased summer rainfall supporting perennial bunch grasses whereas drier conditions or increased winter rainfall more likely to favor desert shrubs. Our data from the woodland plots are too sparse to speculate on potential climate change impacts of the forests in the Chisos Mountains.

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