Cherry Blossom Bloom Dates in Washington, D.C.

Identification

1. Description

This regional feature highlights the peak bloom date (PBD) for the most common species of cherry tree planted around the Tidal Basin in Washington, D.C., from 1921 to 2022. The PBD provides insight into how shifting climate patterns may be affecting the timing of cherry blossom blooming in one particular area, as an example of an event associated with the onset of spring. Shifts in phenological events such as bloom dates can have important implications for ecosystem processes and could have economic and cultural consequences. For reference, this feature also shows the start and end dates of the National Cherry Blossom Festival, which is planned to coincide with the predicted PBD each year.

2. Revision History

May 2014:	Feature published.
June 2015:	Updated feature with data through 2015.
April 2016:	Updated feature with data through 2016.
April 2021:	Updated feature with data through 2021.
July 2022:	Updated feature with data through 2022.

Data Sources

3. Data Sources

Data were provided by the National Park Service (NPS) within the U.S. Department of the Interior, which cares for the cherry trees around Washington's Tidal Basin. The NPS has continuously monitored PBD since 1921 for the cherry trees around the Tidal Basin.

The NPS also records the dates for the National Cherry Blossom Festival, with data spanning 1934–2022. There was a five-year gap from 1942 to 1946 when the festival was canceled due to World War II.

4. Data Availability

All cherry blossom PBD data, as well as National Cherry Blossom Festival dates, are maintained by the NPS. PBD data back to the 2000s can be found on the National Cherry Blossom Festival and NPS websites at: https://nationalcherryblossomfestival.org/bloom-watch and: www.nps.gov/subjects/cherryblossom/bloom-watch.htm. Festival dates for 2012–2022 were provided by the organizers of the festival; the most recent dates are available at: https://nationalcherryblossomfestival.org. The archive of previous PBDs and festival dates is not presently available online, but those dates were posted on an older version of the NPS website that EPA accessed in the past. EPA now collects the most recent year to add to the data set for the purposes of this feature.

Methodology

5. Data Collection

NPS horticulturalists carefully monitor approximately 3,700 cherry trees around the Tidal Basin. The most prevalent species—and the one covered by this feature—is Yoshino (*Prunus x yedoensis*), which constitutes about 70 percent of Washington's cherry trees. NPS staff have also monitored another species, Kwanzan (*Prunus serrulata 'Kwanzan'*), representing about 13 percent of the trees present, but the Kwanzan data are missing several years (including all years since 2012), so they were not included in this regional feature.

NPS horticulturalists examine a specific set of Yoshino trees daily and evaluate them with respect to five stages of cherry blossom development: green buds, florets visible, extension of florets, peduncle elongation, and puffy white. They use this approach to determine the official PBD, which is defined as the day when 70 percent of the Yoshino cherry tree blossoms are open in full bloom. A pictorial description of the phases of cherry blossom development, as well as other general information about blooming periods, is available at: www.nps.gov/subjects/cherryblossom/index.htm.

In 2017, roughly half of the Yoshino blossoms were lost during a vulnerable stage of bud development due to a late frost in mid-March. NPS horticulturalists based the 2017 PBD on when 70 percent of surviving blossoms reached peak bloom stage. This approach ensured consistency with other years for comparison.

6. Derivation

Figure 1 plots the annual PBD for the Yoshino trees from 1921 to 2022, along with the annual start and end dates of the National Cherry Blossom Festival.

For consistency, EPA converted bloom and festival dates into Julian days to support graphing and calculations. By this method, January 1 = day 1, etc. The method also accounts for leap years, such that March 31 = day 90 in a non-leap year and day 91 in a leap year, for example. Figure 1 plots Julian dates, but the corresponding non-leap year calendar dates have been added to the y-axis to provide a more familiar frame of reference. This means that a PBD of March 31 in a leap year will be plotted at the same level as April 1 from a non-leap year, for example, and it will appear to be plotted at April 1 with respect to the y-axis.

7. Quality Assurance and Quality Control

By monitoring the five different stages of cherry blossom bud development, NPS horticulturalists are able to forecast, and ultimately pinpoint, PBD with minimal uncertainty.

Analysis

8. Comparability Over Time and Space

The NPS has recorded PBD annually for Yoshino cherry trees since 1921, using a consistent definition of PBD, examining the same group of Yoshino cherry trees, and using the same set of bud break criteria throughout the period of record. These consistent practices allow for comparability over time.

Start and end dates for the National Cherry Blossom Festival have been provided for reference only. While these dates add an interesting cultural and economic element to this regional feature, they fundamentally reflect human decisions based on economic and social factors that have changed over time. In particular, the festival has evolved from a single day or weekend to a multi-week event.

This regional feature is limited to a small geographic area. Methods have been applied consistently within this area.

9. Data Limitations

Factors that may impact the confidence, application, or conclusions drawn from this feature are as follows:

1. The timing of PBD for cherry trees can be affected by a variety of weather and climate factors. This feature does not necessarily pinpoint a single main cause of the observed trends, although winter and early spring temperatures are believed to play a key role.

2. The PBD does not provide information on non-climate factors that may affect cherry tree phenology (the timing of key developmental events) or health.

10. Sources of Uncertainty

Because PBD is clearly defined, and NPS horticulturalists have used a single, consistent definition over time, there is little uncertainty in either the definition or identification of PBD. Uncertainty in the measurements has not been explicitly quantified, however.

11. Sources of Variability

Because PBD is highly sensitive to changes in temperature, natural variations in seasonal temperatures contribute to year-to-year variations in PBD. Although the PBD for these cherry trees is primarily affected by temperature, other aspects of changing climate could also affect the annual blooming date. Extended growing periods or warmer autumns may indirectly affect PBD by altering other stages of cherry tree development (Chung et al., 2011).

12. Statistical/Trend Analysis

EPA calculated the long-term trend in PBD for Yoshino cherry trees by ordinary least-squares linear regression to support a statement in the “Key Points” text. The 1921–2022 trend had a slope of -0.0704 days/year, with $p = 0.004$. Thus, the trend is significant to a 95-percent level.

References

Chung, U., L. Mack, J.I. Yun, and S. Kim. 2011. Predicting the timing of cherry blossoms in Washington, D.C. and Mid-Atlantic states in response to climate change. PLOS ONE 6(11):e27439.