Phenology (not Phrenology):

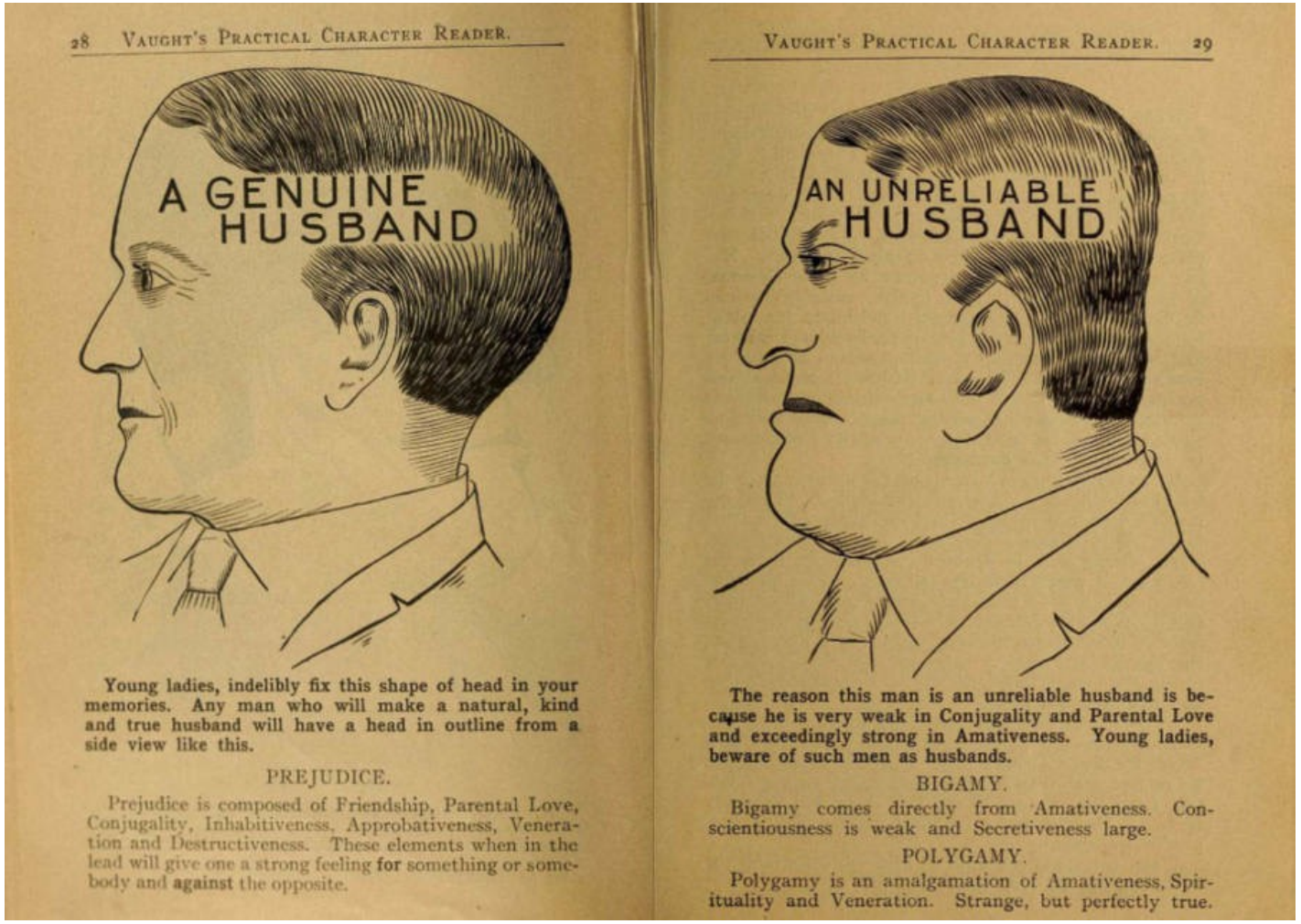
The science of climate-driven patterns in nature

DS2000: Introduction to Programming with Data

Northeastern University

John Rachlin

Not to be confused with *phrenology*



28 VAUGHT'S PRACTICAL CHARACTER READER.

A GENUINE HUSBAND

Young ladies, indelibly fix this shape of head in your memories. Any man who will make a natural, kind and true husband will have a head in outline from a side view like this.

PREJUDICE.

Prejudice is composed of Friendship, Parental Love, Conjugality, Inhabitiveness, Approbativeness, Veneration and Destructiveness. These elements when in the lead will give one a strong feeling for something or somebody and against the opposite.

VAUGHT'S PRACTICAL CHARACTER READER. 29

AN UNRELIABLE HUSBAND

The reason this man is an unreliable husband is because he is very weak in Conjugality and Parental Love and exceedingly strong in Amativeness. Young ladies, beware of such men as husbands.

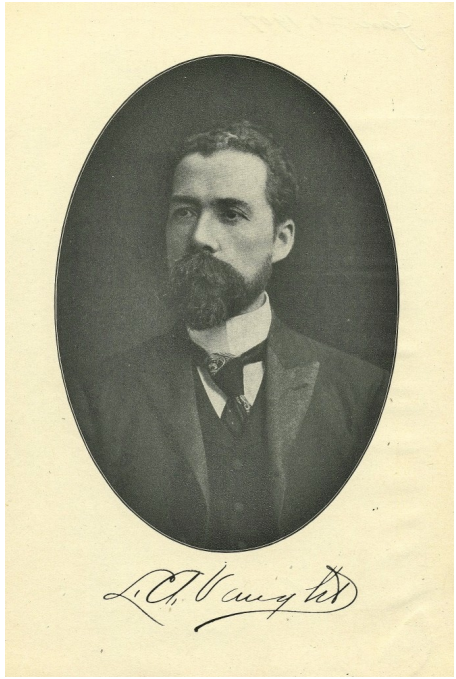
BIGAMY.

Bigamy comes directly from Amativeness. Conscientiousness is weak and Secretiveness large.

POLYGAMY.

Polygamy is an amalgamation of Amativeness, Spirituality and Veneration. Strange, but perfectly true.

Phrenology: The pseudo-scientific practice of predicting an individual's character based on bumps on their skull or other superficial traits.



From *Vaught's Practical Character Reader (1902).*

What is phenology?

phenology noun

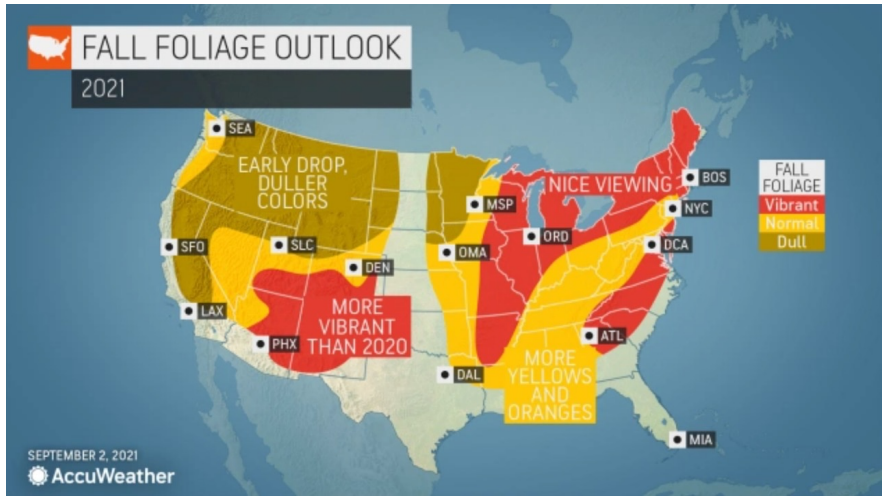
Save Word

phe·nol·o·gy | \ fi-ˈnä-lə-jē \

Definition of *phenology*

1 : a branch of science dealing with the relations between climate and periodic biological phenomena (such as bird migration or plant flowering)

2 : periodic biological phenomena that are correlated with climatic conditions



Examples:

- Date of emergence of leaves and flowers
- Date of egg-laying birds and amphibia
- Date of fall foliage
- Development cycle of honey bee colonies
- Animal migration patterns impacted by climate

Historical climate Data is readily available

NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Formerly the National Climatic Data Center (NCDC)... more about NCEI »

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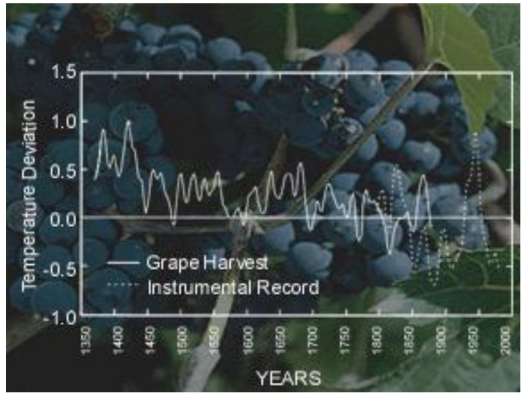
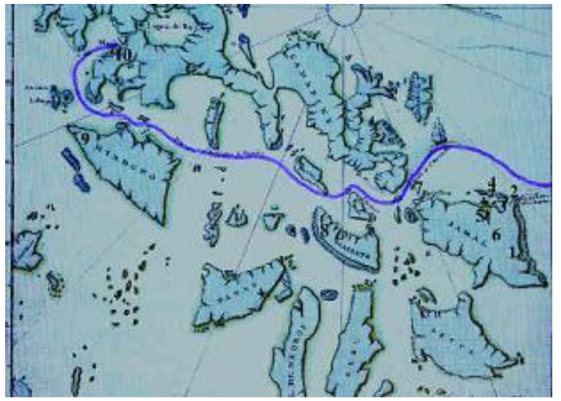
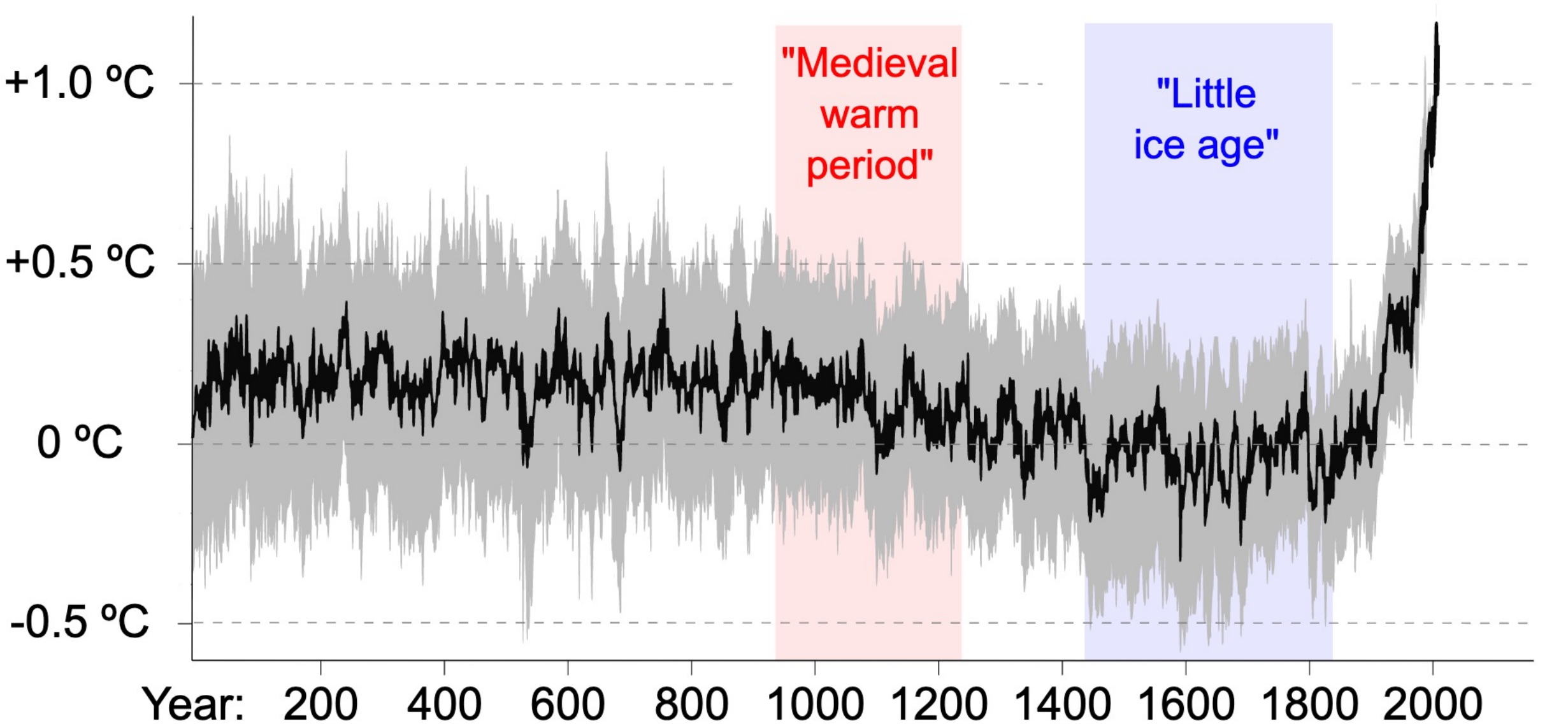




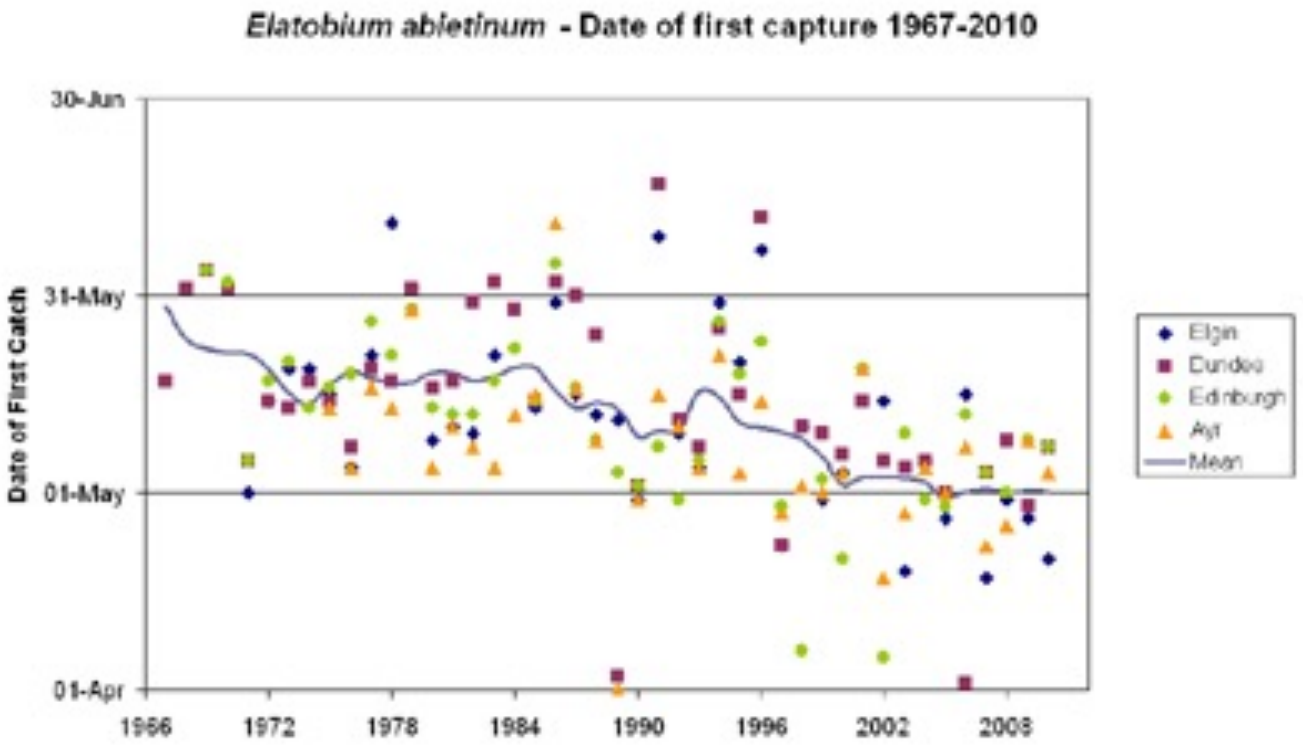
The NOAA Paleoclimatology Program distributes archives of paleoclimatology indicators derived from historical references and documentary evidence, such as church records, harvest dates, harbor ice free dates, and ship logs.

Global Average Temperature Change



From graphic by Ed Hawkins. Data: from PAGES2k (and HadCRUT 4.6 for 2001-). Reference period: 1850-1900.

Aphids are sensitive to climate change



Aphid Phenology in Scotland

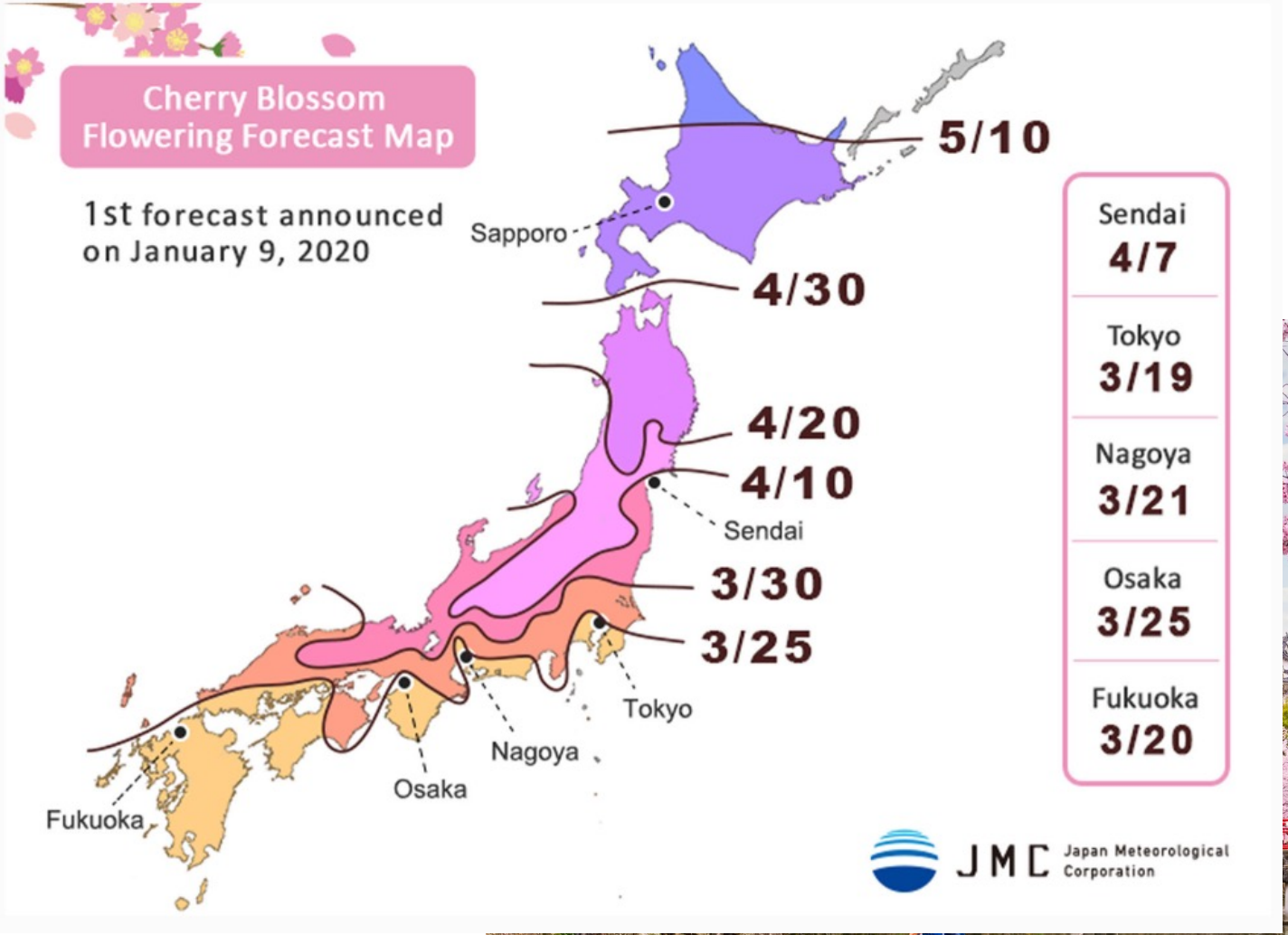
Many aphid species are specialist herbivores and major pests of agriculture, forestry and horticulture. They have short generation times and rapid growth rates making them one of the invertebrate groups that are most sensitive to climate change.

SASA monitors aphids caught in four 12.2m suction traps operated continuously at Dundee (since 1967), Edinburgh (1969), Elgin (1970) and Ayr (1974). Daily records of abundance of aphid species are available from the main aphid flight season and weekly records from other times.

Source: https://www.sasa.gov.uk/wildlife-environment/phenology

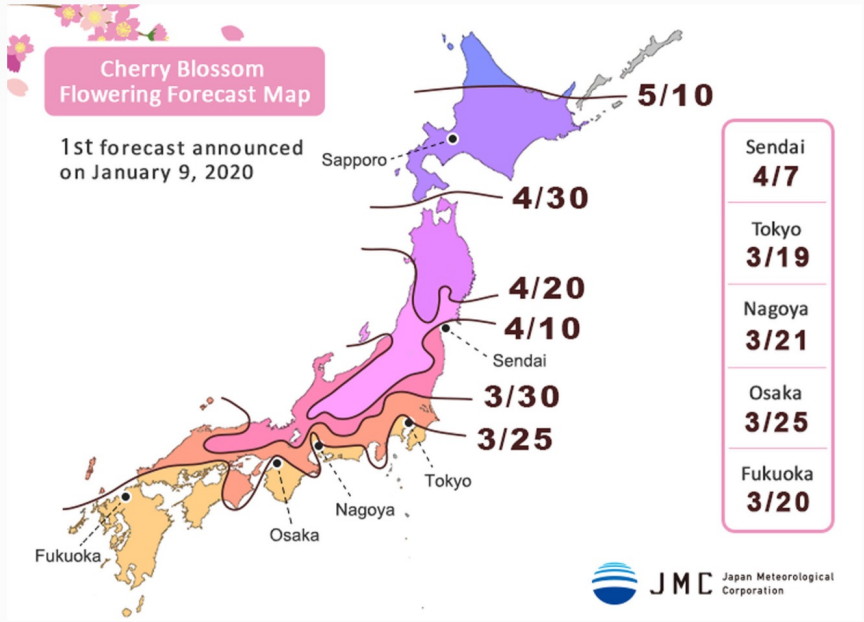
Cherry Blossoms in Japan

Japan's famed cherry blossom season to arrive earlier than usual



Forecasting when cherry blossoms come to full bloom

Japan's famed cherry blossom season to arrive earlier than usual



BY MAGDALENA OSUMI
STAFF WRITER

SHARE Jan 10, 2020

Cherry blossom season is expected to arrive in Tokyo a week earlier than usual this year, with full bloom expected on March 27, according to a forecast released Friday by Japan Meteorological Corp., an Osaka-based weather-forecasting company.

The firm said Tokyo and Kochi prefectures will be the first to observe the start of the iconic bloom on March 19, also earlier than last year.

According to the Meteorological Agency, the blossoms began blooming in Tokyo on March 21 last year.

The company said the early arrival of the flowers is related to high temperatures in autumn and winter, as well as projected warm and sunny spring weather. The warming trend has been observed in the capital since 2013.

What impact would we expect from climate change?

Kyoto cherry blossom data goes back 1200 years!

1	Full-flowering dates of Japanese cherry (Prunus jamasakura) at Kyoto, Japan. (Latest version, Jun. 12, 2012)
2	This phenological data was acquired by following studies.
3	
4	Column A; A.D.
5	Column B; Full-flowering date (day of year).
6	Column C; Full-flowering date (calender date, e.g. 402 --> April 2).
7	Column D; Source code
8	1; Reported by Taguchi (1939), *J. Marine Meteorol. Soc.* (*Umi to Sora*), **19**, 217-227
9	2; Added by Sekiguchi (1969), *Tokyo Geography Papers*, **13**, 175-190.
10	3; Added by Aono and Omoto (1994), *J. Agric. Meteorol.*, **49**, 263-272.
11	4; Added by Aono and Kazui (2008), *Int. J. Climatol.*, **28**, 905-914 (doi: 10.1002/joc.1594).
12	5: Cherry phenological data, Added by Aono and Saito (2010), *Int. J. Biometeorol.*, **54**, 211-219.
13	6: Added by Aono (2011), *Time Studies*, **4**, 17-29. (in Japanese with English abstract)
14	7: Added by Aono (2012), *Chikyu Kankyo*, **17**, 21-29. (in Japanese)
15	8: Found after the last publication of articles.
16	Column E; Data type code
17	0 : data from modern times (full-bloom date since 1880s)
18	1 : from diary description about full-bloom
19	2 : from diary description about cherry blossom viewing party
20	3 : from diary description about presents of cherry twigs from party participants
21	4 : title in Japanese poety
22	8 : Deduced from wisteria phenology, using the relation proposed by Aono and Saito (2010)
23	9 : Deduced from Japanese kerria phenology, using the relation proposed by Aono (2011)
24	Column F; Names of old documents

AD	flowering date (DOY)
1757	112
1758	101
1759	109
1760	103
1761	89
1762	106
1763	112
1764	98
1765	106
1766	113
1767	101
1768	117
1769	105

Source: https://www.ncei.noaa.gov/pub/data/paleo/historical/phenology/japan/LatestVersion/KyotoFullFlower7.xls

Cherry blossoms are peaking earlier

The cherry blossom season, Japan's traditional sign of spring, has peaked at the earliest date since records began 1,200 years ago, research shows.

The 2021 season in the city of Kyoto peaked on 26 March, **according to data collected by Osaka University**.