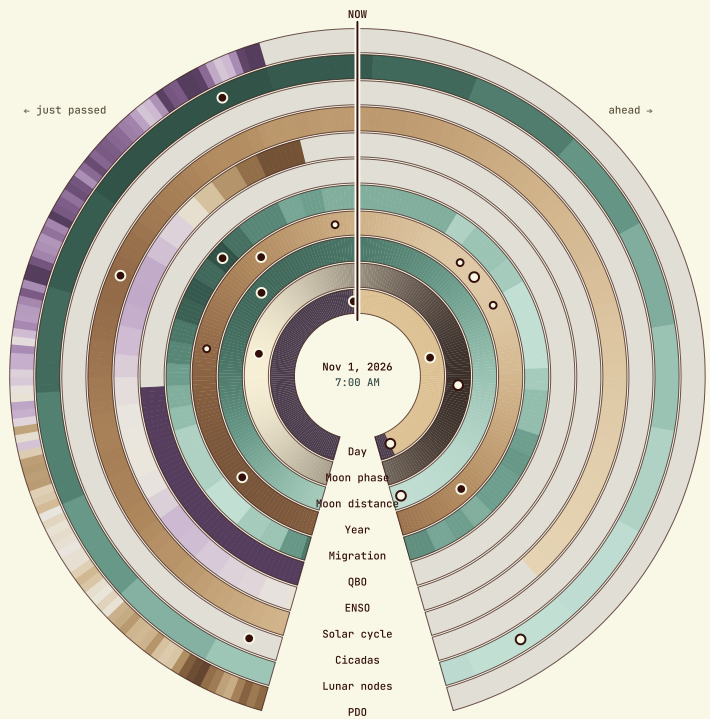


Natural Cycles Almanac

ZIP 15642 • Westmoreland County,
PA

Great Lakes & Eastern Woodlands
edition

November 2026 - October 2027



Printed for friends and family, not for sale. Built Oct 7, 2026 from public records; sources and nation credits are at the back. Moon names belong to the nations that publish them.

Contents and how to read this almanac

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Everything here is computed for Westmoreland County, PA, using the nearest weather station (Pittsburgh, PA, 47 km away). Times are local (New York time).

Sky and moon events are exact calculations. Dates marked = are expectations from past records, so nature may run early or late. Probabilities in the winter outlook come with each model's past track record, and every forecast here is logged before the season and scored afterwards.

On the Cycle Clock each ring is one cycle, drawn one full period wide, with the start of this edition at the top. Time runs clockwise. Filled dots are peaks (full moon, closest moon, solar maximum, emergence); hollow dots are troughs. Every chart carries its own key.

HOW FAR AHEAD CAN EACH CYCLE BE PREDICTED?

Exact Clockwork: astronomy and cicada brood years, calculable years ahead.	Shifts the odds A real driver (El Niño) or a steady habit (migration weeks). It tilts the dice without deciding.
Weak or debated A rhythm exists, but it's irregular or its effect here is small.	Not predictive Tested and no better than a coin flip, or forecastable only about two weeks out.

A correlation (r) says two records move together; squared, it says how much of the year-to-year swing one explains (r = 0.3 explains about 9%). A forecast also needs a lead (the driver changes first), a mechanism, and a test on years it wasn't fitted to. Long-term trends, such as shrinking ice, carry forward more reliably than cycles.

The cycles, one by one

What each rhythm is, what it touches, and how far ahead it can honestly be predicted, with figures for Westmoreland County, PA.

Day and season

24 hours · 365.24 days

Earth's spin and tilt set sunrise, sunset and day length. Air temperature lags the solstices by about a month, because land and lakes take time to warm and cool.

Day length triggers songbird migration, the deer rut and tree dormancy. Temperature, not day length, drives leaf-out and insects, which is where timing mismatches come from.

Exact: calculable years ahead

Sunrise, sunset and day length can be calculated centuries ahead for any place.

Today here: 10.5 h of daylight. December solstice in 50 d.

Moon phase

29.53 days (new moon to new moon)

How much of the moon's face is sunlit. Twelve lunations are 11 days shorter than a year, so full moons drift earlier each year; every 2-3 years a 13th fits in.

Moonlight changes night activity: nocturnal migrants, some fish spawning runs, predators. Nation moon calendars handle the 13th moon in their own ways.

Exact: calculable years ahead

Phases are exact astronomy, known to the minute decades ahead.

Next full moon Nov 24. This is a 13-full-moon year.

Moon distance

27.55 days (perigee to perigee)

The moon's orbit is an oval. When a full moon falls near the closest point (perigee) it looks a little bigger and brighter: a supermoon.

Closer moons raise ocean tides slightly. The Great Lakes have no real tides; their water sloshes (seiches) because of wind and pressure.

Exact: calculable years ahead

Perigee dates and distances are exact.

Next perigee Nov 25, 359,335 km.

Lunar nodes (standstills)

18.6 years

The tilt of the moon's orbit slowly wobbles, so the range of moonrise positions and the moon's height in the sky widen and narrow over 18.6 years.

A small effect on tides; famous for ancient monument alignments. The saying that standstill years run cold is in the claims register.

Exact: calculable years ahead

Exact. The rhythm is certain; its effect on our weather isn't supported by the records here.

Next minor standstill: 2034.

Solar cycle

about 11 years (9-14)

The sun's magnetic activity rises and falls; sunspot counts track it. Near and just after a peak, big eruptions are more common.

Solar storms → geomagnetic storms → aurora visible from the Great Lakes. The idea that solar lows bring cold winters didn't hold up in this app's test.

Shifts the odds: a real, partial signal

The rhythm is reliable enough to say roughly when the next peak comes (within a year or two); how strong it will be, and individual storms, are much harder.

Sunspots (13-month mean, Mar 2026): 95. NOAA SWPC forecast for Nov 2027: 63.

El Niño / La Niña (ENSO)

2-7 years, irregular

The tropical Pacific swings warm (El Niño) and cool (La Niña). That bends the jet stream, which steers storms and cold air across North America.

El Niño winters lean milder with less ice here; La Niña winters lean snowier. It's the strongest seasonal signal this region has, and it's still only a lean.

Shifts the odds: a real, partial signal

ENSO itself can be forecast 6-9 months ahead. Once it's known, it tilts the winter odds; it doesn't decide the winter.

Winter 2026-27: projected ONI +2.39 ± 0.47 °C, El Niño >99%. Lake Mendota averages 88 ice days in El Niño winters vs 97 in La Niña winters.

Tested here, ENSO vs Mendota ice days: $r = -0.32$ (explains 10% of the year-to-year swing), passes the chance test. ENSO vs Great Lakes ice: $r = -0.14$ (explains 2% of the year-to-year swing), not significant after the chance test.

The cycles, one by one (continued)

QBO (stratospheric winds)

about 28 months

High above the equator, the winds flip between easterly and westerly in a remarkably regular rhythm.

It may change how easily the polar vortex is disturbed, which can send cold air south. Researchers still debate how much this matters for our winters.

Weak or debated as a predictor

The QBO itself is predictable about a year ahead; its pull on Great Lakes weather is small and uncertain.

Pacific Decadal Oscillation (PDO)

decades, irregular

A long-lasting warm or cool pattern in the North Pacific: more like a slow background mood than a clock.

It can strengthen or weaken El Niño's effect on North America.

Weak or debated as a predictor

It persists for years, so this year's phase is a fair guess for next year's, but it has no fixed period to project.

Arctic & North Atlantic Oscillations (AO / NAO)

no fixed period: weeks to seasons

See-saws of air pressure between the Arctic and mid-latitudes. A negative AO lets Arctic air spill south.

Often matters more for a cold spell or a cold month than ENSO does.

Not predictive (or not beyond ~2 weeks)

Day-to-day it can be forecast about two weeks out; a whole season's AO can't yet be predicted with useful skill.

Tested here, winter AO vs winter temperature: $r = +0.32$ (explains 10% of the year-to-year swing), passes the chance test.

Bird migration

every year

Billions of birds move north in spring and south in fall. The eBird models here show the typical week-by-week presence of 36 species.

Many songbirds time their trips by day length; their insect food follows temperature. Warmer springs can open a gap between them.

Shifts the odds: a real, partial signal

The typical peak weeks repeat each year within a week or two. The exact nights depend on the weather (tailwinds, fronts), forecast only days ahead.

Typical peaks in PA: spring week of 05-03 (16 species), fall week of 09-13 (19).

Periodical cicadas

13 or 17 years

Broods spend 13 or 17 years underground, then emerge together in the same counties.

A brood feeds birds and other predators for a summer (nesting success rises), trims oak growth, and leaves a burst of nutrients in the soil.

Exact: calculable years ahead

The emergence year is known for every brood and county. The week depends on soil warming to about 18 °C at 20 cm, usually mid-May to early June.

Here: Brood VIII, next emerges 2036.

Acorns, mice and ticks

2-5 years, irregular

Oaks produce big acorn crops (mast years) in some years and few in others.

Big acorn fall → more white-footed mice the next year → more infected blacklegged tick nymphs about two years after the acorns → higher Lyme disease risk.

Shifts the odds: a real, partial signal

A lag is what makes prediction possible: a big acorn year gives about two years of warning for tick risk (Cary Institute studies). Mast years themselves are hard to forecast.

The cycles, one by one (continued)

Wolves and moose (Isle Royale)

irregular, decades

On an island in Lake Superior, predator and prey numbers have been counted every winter since 1959.

Moose numbers drive wolf numbers a few years later, and wolves push moose back down. Disease, hard winters and wolf reintroductions keep interrupting the loop.

Weak or debated as a predictor

The two drive each other, but the rhythm is too irregular to project. It shows why a real cycle isn't automatically a forecast.

Lake ice and winters

no cycle: a trend plus year-to-year swings

Lake Mendota's freeze-up and ice-out have been written down every winter since the 1850s.

Shorter ice seasons warm lakes earlier in summer, which affects fish, algae blooms and lake-effect snow.

Shifts the odds: a real, partial signal

Trends carry forward more reliably than cycles. The Projections section uses the long-term trend (and ENSO where it helps) for the expected freeze and ice-out dates.

Lake Mendota averaged 118 days of ice in 1856-1885 and 75 in 2016-2025.

Nation moon calendars

a year of named moons

Each nation's published calendar names moons for what happens on the land: sap running, berries, wild rice, freezing.

Comparing each named marker with observed timing (sap runs, ice, blooms) shows how the seasons are shifting against a long-kept record.

Traditional knowledge: a seasonal record

Not a forecast and not scored here; a record of when things happen, shown in each nation's own terms.

Weather sayings

—

Folk signs and popular ideas: a 13-moon year means a hard winter, an early frost means a hard winter, and so on.

Each is written down with a test and scored against the station records (Projections → Testable-claims register).

Not predictive (or not beyond ~2 weeks)

Chance alone gets about 50% right. A saying has to beat that, year after year, to count.

11 claims scored so far; 2 lean the claimed way; none pass the strict chance test.

Where the cycles stand on Nov 1, 2026

Cycle	Now	Next
Day	10 h 27 min of daylight	Solar noon 12:02 PM (in 5 h)
Moon phase	Last quarter, 54% lit	New moon Nov 9, in 8 d
Moon distance	370,000 km away	Apogee Nov 13, in 12 d
Year	Day 305 · day length 10.5 h	Geminids peak Dec 13 · ZHR 150 · moon 22% lit, in 43 d
Migration	7 of 36 tracked species migrating: American Robin, Ruddy Duck, White-throated Sparrow...	Spring migration peak, PA: week of 05-03
QBO	-23.13 m/s, easterly (latest data Feb 2026)	Not a fixed-period cycle; future half of the ring stays empty
ENSO	+1.80 °C, El Niño range (latest data Jul 2026)	Not a fixed-period cycle; future half of the ring stays empty
Solar cycle	Cycle 25, 2.0 yr past maximum	Sep 2026: 60 sunspots · SWPC forecast Nov 2027: 63
Cicadas	Brood VIII (17-yr)	Brood VIII 2036
Lunar nodes	Moon's monthly swing reaches ±28.0°	Minor standstill 2034
PDO	-2.71, cool (negative) phase (latest data Aug 2025)	Not a fixed-period cycle; future half of the ring stays empty

RING KEY (INSIDE → OUT)

Day	daylight night
Moon phase	new full
Moon distance	far (apogee) close (perigee)
Year	8.5 h day 16 h day
Migration	none 19 species migrating
QBO	easterly westerly · pale = near zero · empty ahead = not calculable
ENSO	La Niña El Niño · pale = near zero · empty ahead = not calculable
Solar cycle	quiet sun 220 sunspots
Cicadas	marks only: emergence years (filled = this county)
Lunar nodes	minor standstill major
PDO	cool phase warm phase · pale = near zero · empty ahead = not calculable

November 2026

Average temperature: 43 °F (6.0 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 43 °F (6.0 °C).
Trend since 1950: warming, +0.27 °F per decade (about +2.1 °F over 75 years), small next to the year-to-year swings.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 † All Saints' Day 6:48-5:15	2 † All Souls' Day 6:49-5:14	3 6:51-5:13	4 6:52-5:12	5 6:53-5:11	6 6:54-5:10	7 6:55-5:09
8 6:56-5:08	9 6:58-5:07	10 6:59-5:06	11 7:00-5:05	12 7:01-5:04	13 7:02-5:03	14 7:03-5:02
15 7:05-5:01	16 7:06-5:00	17 7:07-5:00	18 7:08-4:59	19 7:09-4:58	20 7:10-4:58	21 7:11-4:57
22 7:13-4:56	23 7:14-4:56	24 7:15-4:55	25 7:16-4:55	26 7:17-4:54	27 7:18-4:54	28 7:19-4:54
29 † 1st Sunday of Advent 7:20-4:53	30 7:21-4:53					

☾ new moon 🌑 first quarter ☾ full moon 🌑 last quarter ❄ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Nov 17: Leonids meteor shower peak, up to ~15/hour under dark skies · moon 51% lit (washed out)
- Nov 24: Full moon

CHRISTIAN HOLIDAYS

Nov 1 All Saints' Day · Nov 2 All Souls' Day · Nov 29 1st Sunday of Advent

Day length goes from 10 h 27 min to 9 h 32 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

- Thunder: Haudenosaunee, Haudenosaunee Confederacy. Published timing: November
- Gashkadino-giizis (Ice is Forming Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Pākatāhkamekat-kēsoq (Freezing Moon): Menominee, lunation Oct 10-Nov 8 (placement assumed; see Calendars compared)
- Nīpātepaeh-kēsoq (Night Moon): Menominee, lunation Nov 9-Dec 8 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

American Robin, Sandhill Crane, Evening Grosbeak, Ruddy Duck, White-throated Sparrow, Dark-eyed Junco, Common Loon, Rough-legged Hawk

December 2026

Average temperature: 34 °F (1.0 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 35 °F (1.8 °C).
Trend since 1950: warming, +0.66 °F per decade (about +4.9 °F over 75 years), a clear trend.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 7:22-4:53	2 7:23-4:52	3 7:24-4:52	4 7:25-4:52	5 7:26-4:52
6 † 2nd Sunday of Advent † St. Nicholas Day 7:27-4:52	7 7:28-4:52	8 7:29-4:52	9 7:30-4:52	10 7:30-4:52	11 7:31-4:52	12 7:32-4:52
13 † 3rd Sunday of Advent 7:33-4:52 Geminids peak	14 7:33-4:53	15 7:34-4:53	16 7:35-4:53	17 7:35-4:54	18 7:36-4:54	19 7:37-4:54
20 † 4th Sunday of Advent 7:37-4:55	21 7:38-4:55 December solstice	22 7:38-4:56	23 7:39-4:56 Supermoon	24 † Christmas Eve 7:39-4:57 Closest moon	25 † Christmas Day 7:39-4:57	26 7:40-4:58
27 7:40-4:59	28 7:40-4:59	29 7:41-5:00	30 7:41-5:01	31 7:41-5:02		

☾ new moon 🌑 first quarter ☾ full moon 🌒 last quarter ❄ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Dec 13: Geminids meteor shower peak, up to ~150/hour under dark skies · moon 22% lit (good)
- Dec 21: December solstice, 3:50 PM
- Dec 23: Full moon · supermoon
- Dec 24: Closest moon of the year

CHRISTIAN HOLIDAYS

Dec 6 2nd Sunday of Advent · Dec 6 St. Nicholas Day · Dec 13 3rd Sunday of Advent · Dec 20 4th Sunday of Advent · Dec 24 Christmas Eve · Dec 25 Christmas Day

Day Length goes from 9 h 31 min to 9 h 21 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

- End of Seasons: Haudenosaunee, Haudenosaunee Confederacy. Published timing: December
- Manidoo-giizisoons (Little Spirit Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Nīpātepaeh-kēsoq (Night Moon): Menominee, lunation Nov 9-Dec 8 (placement assumed; see Calendars compared)
- Anāmaehkatwan-kēsoq (Handshaking Moon): Menominee, lunation Dec 9-Jan 6 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Sandhill Crane, Ruddy Duck, Snow Goose, Snow Bunting

January 2027

Average temperature: 29 °F (-1.7 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 29 °F (-1.4 °C).
Trend since 1950: warming, +0.11 °F per decade (about +0.8 °F over 76 years), small next to the year-to-year swings.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 7:41-5:03	2 7:41-5:03
3 7:41-5:04 Quadrantids peak	4 7:41-5:05	5 7:41-5:06	6 † Epiphany 7:41-5:07	7 † Orthodox Christmas 7:41-5:08	8 7:41-5:09	9 7:41-5:10
10 7:41-5:11	11 7:40-5:12	12 7:40-5:13	13 7:40-5:14	14 7:40-5:15	15 7:39-5:16	16 7:39-5:17
17 7:38-5:19	18 7:38-5:20	19 7:37-5:21	20 7:37-5:22	21 7:36-5:23	22 7:35-5:24 Supermoon	23 7:35-5:25
24 7:34-5:27	25 7:33-5:28	26 7:33-5:29	27 7:32-5:30	28 7:31-5:31	29 7:30-5:33	30 7:29-5:34
31 7:28-5:35						

☾ new moon 🌓 first quarter ☽ full moon 🌘 last quarter ❄ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Jan 3: Quadrantids meteor shower peak, up to ~110/hour under dark skies · moon 14% lit (good)
- Jan 22: Full moon · supermoon

EXPECTED (FROM PAST RECORDS)

- ≈ Jan 3: Lake Mendota freezes over. middle 50%: Dec 21 - Jan 11
- ≈ Jan 21: Sap season starts (Pittsburgh, PA). middle 50%: Jan 16 - Feb 1, El Niño winters

CHRISTIAN HOLIDAYS

Jan 6 Epiphany · Jan 7 Orthodox Christmas

Day length goes from 9 h 21 min to 10 h 7 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

- Midwinter: Haudenosaunee, Haudenosaunee Confederacy. Published timing: second week in January (about eight days)
- Gichi-manidoo-giizis (Great Spirit Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Anāmaehkatwan-kēsoq (Handshaking Moon): Menominee, lunation Dec 9-Jan 6 (placement assumed; see Calendars compared)
- Namaēpen-kēsoq (Sucker Moon): Menominee, lunation Jan 7-Feb 5 (placement assumed; see Calendars compared)

February 2027

Average temperature: 32 °F (-0.2 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 35 °F (1.6 °C).
Trend since 1950: warming, +0.40 °F per decade (about +3.0 °F over 76 years), small next to the year-to-year swings.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1 7:27-5:36	2 † Candlemas 7:26-5:38	3 7:25-5:39	4 7:24-5:40	5 7:23-5:41	6 7:22-5:42
7 7:21-5:44	8 7:20-5:45	9 † Shrove Tuesday 7:19-5:46	10 † Ash Wednesday 7:18-5:47	11 7:17-5:49	12 7:15-5:50	13 7:14-5:51
14 7:13-5:52	15 7:12-5:53	16 7:10-5:54	17 7:09-5:56	18 7:08-5:57	19 7:06-5:58	20 7:05-5:59 Lunar eclipse
21 7:03-6:00	22 7:02-6:01	23 7:01-6:03	24 6:59-6:04	25 6:58-6:05	26 6:56-6:06	27 6:55-6:07
28 6:53-6:08						

☾ new moon 🌓 first quarter ☽ full moon 🌘 last quarter ❄ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Feb 20: Lunar eclipse (penumbral) visible here, peak 6:12 PM, moon 2° up
- Feb 20: Full moon

CHRISTIAN HOLIDAYS

Feb 2 Candlemas · Feb 9 Shrove Tuesday · Feb 10 Ash Wednesday

Day length goes from 10 h 9 min to 11 h 15 min. Sunrise-sunset times are in each day's box.

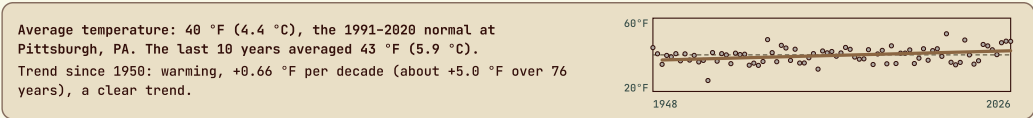
MOONS AND CEREMONIES NAMED FOR THIS TIME

- Maple Ceremony: Haudenosaunee, Haudenosaunee Confederacy. Published timing: second week in February (one day)
- Namebini-giizis (Sucker Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Namaēpen-kēsoq (Sucker Moon): Menominee, lunation Jan 7-Feb 5 (placement assumed; see Calendars compared)
- Wanaēw-kēsoq (Crusted Snow Moon): Menominee, lunation Feb 6-Mar 7 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Snow Goose, Red-winged Blackbird, Snow Bunting, Canvasback, Dark-eyed Junco, Rough-legged Hawk, Sandhill Crane, Tundra Swan, American Robin

March 2027



Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1 6:52-6:09	2 6:50-6:11	3 6:49-6:12	4 6:47-6:13	5 6:46-6:14	6 6:44-6:15
7 6:43-6:16	8 6:41-6:17	9 6:39-6:18	10 6:38-6:19	11 6:36-6:20	12 6:35-6:21	13 6:33-6:23
14 7:31-7:24	15 7:30-7:25	16 7:28-7:26	17 † St. Patrick's Day 7:26-7:27	18 7:25-7:28	19 7:23-7:29	20 7:22-7:30 March equinox
21 † Palm Sunday 7:20-7:31	22 7:18-7:32	23 7:17-7:33	24 7:15-7:34	25 † Annunciation † Maundy Thursday 7:13-7:35	26 † Good Friday 7:12-7:36	27 7:10-7:37
28 † Easter Sunday 7:08-7:38	29 7:07-7:39	30 7:05-7:40	31 7:04-7:41			

☾ new moon ☾ first quarter ☾ full moon ☾ last quarter ✳ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Mar 20: March equinox, 4:24 PM
- Mar 22: Full moon

EXPECTED (FROM PAST RECORDS)

- ≈ Mar 9: Sap season midpoint (Pittsburgh, PA). middle 50%: Feb 26 - Mar 17, El Niño winters
- ≈ Mar 25: Lake Mendota ice-out. middle 50%: Mar 14 - Apr 2

CHRISTIAN HOLIDAYS

Mar 17 St. Patrick's Day · Mar 21 Palm Sunday · Mar 25 Annunciation · Mar 25 Maundy Thursday · Mar 26 Good Friday · Mar 28 Easter Sunday

Day length goes from 11 h 18 min to 12 h 38 min. Sunrise-sunset times are in each day's box.

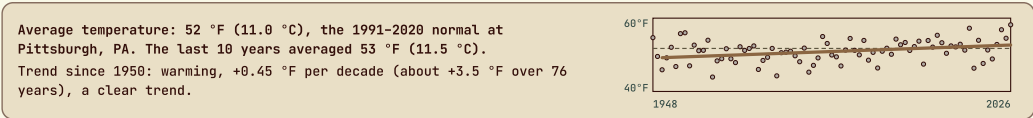
MOONS AND CEREMONIES NAMED FOR THIS TIME

- Onaabani-giizis (Hard Crust on the Snow Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Nnebne Gises (Sucker Fish Moon): Potawatomi, Citizen Potawatomi Nation
- Wanaēw-kēsoq (Crusted Snow Moon): Menominee, Lunation Feb 6-Mar 7 (placement assumed; see Calendars compared)
- Sūpomāhkwan-kēsoq (Sugaring Moon): Menominee, Lunation Mar 8-Apr 5 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Tundra Swan, Canvasback, American Woodcock, Eastern Phoebe, Snow Goose, American Robin, Common Loon, Snow Bunting, Ruddy Duck, Sandhill Crane, Dark-eyed Junco, Osprey

April 2027



Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 7:02-7:42	2 7:00-7:43	3 6:59-7:44
4 6:57-7:45	5 6:55-7:46	6 6:54-7:48	7 6:52-7:49	8 6:51-7:50	9 6:49-7:51	10 6:48-7:52
11 6:46-7:53	12 6:44-7:54	13 6:43-7:55	14 6:41-7:56	15 6:40-7:57	16 6:38-7:58	17 6:37-7:59
18 6:35-8:00	19 6:34-8:01	20 6:32-8:02	21 6:31-8:03	22 6:30-8:04	23 * = last frost 6:28-8:05	24 6:27-8:06
25 6:25-8:07	26 6:24-8:08	27 6:23-8:09	28 6:21-8:10	29 6:20-8:11	30 6:19-8:12	

☾ new moon 🌓 first quarter ☽ full moon 🌖 last quarter * typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Apr 20: Full moon
- Apr 22: Lyrids meteor shower peak, up to ~18/hour under dark skies · moon 96% lit (washed out)

EXPECTED (FROM PAST RECORDS)

- = Apr 17: Sap season ends (Pittsburgh, PA). middle 50%: Apr 12 – Apr 29, El Niño winters
- = Apr 23: Last spring freeze (Pittsburgh, PA). middle 50%: Apr 13 – Apr 30, El Niño winters

LAST SPRING FROST

Typically around Apr 23 at Pittsburgh, PA; in the middle half of years between Apr 13 and Apr 30, and in 8 years of 10 between Apr 8 and May 8. Adjusted for the long-term trend and the El Niño / La Niña forecast. Frost = a night at or below 0 °C (32 °F).

Day length goes from 12 h 40 min to 13 h 53 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

- Thunder Dance: Haudenosaunee, Haudenosaunee Confederacy. Published timing: first week in April
- Iskigamizige-giizis (Maple Sugar Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Zisbaktoke Gises (Maple Sugar Moon): Potawatomi, Citizen Potawatomi Nation
- Sūpomāhkwan-kēsoq (Sugaring Moon): Menominee, lunation Mar 8-Apr 5 (placement assumed; see Calendars compared)
- Pahkwan-kēsoq (Budding Moon): Menominee, lunation Apr 6-May 5 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Common Loon, Eastern Phoebe, Ruddy Duck, Tree Swallow, Osprey, American Robin, Lesser Yellowlegs, Broad-winged Hawk, Yellow-rumped Warbler, Dark-eyed Junco, American Woodcock, White-throated Sparrow

May 2027

Average temperature: 61 °F (16.4 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 62 °F (16.6 °C).
Trend since 1950: warming, +0.35 °F per decade (about +2.6 °F over 76 years), a clear trend.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 6:18-8:13
2 † Orthodox Easter 6:16-8:14	3 6:15-8:15	4 6:14-8:16	5 6:13-8:17	6 † Ascension Day 6:12-8:18 Eta Aquariids peak	7 6:10-8:19	8 6:09-8:20
9 6:08-8:21	10 6:07-8:22	11 6:06-8:23	12 6:05-8:24	13 6:04-8:25	14 6:03-8:26	15 6:02-8:27
16 † Pentecost 6:01-8:28	17 6:00-8:29	18 5:59-8:30	19 5:59-8:31	20 5:58-8:32	21 5:57-8:33	22 5:56-8:34
23 † Trinity Sunday 5:56-8:35	24 5:55-8:35	25 5:54-8:36	26 5:54-8:37	27 5:53-8:38	28 5:52-8:39	29 5:52-8:40
30 5:51-8:40	31 5:51-8:41					

☾ new moon

☾ first quarter

☾ full moon

☾ last quarter

✱ typical first / last frost (=)

† Christian holiday

SKY, MOON AND SEASON

- May 6: Eta Aquariids meteor shower peak, up to ~50/hour under dark skies · moon 0% lit (good)
- May 20: Full moon

EXPECTED (FROM PAST RECORDS)

- ≈ May 3: Spring migration peak (typical week, PA). 16 tracked species moving, e.g. Lesser Yellowlegs, Osprey, Wood Thrush, Rose-breasted Grosbeak

CHRISTIAN HOLIDAYS

May 2 Orthodox Easter · May 6 Ascension Day · May 16 Pentecost · May 23 Trinity Sunday

Day length goes from 13 h 56 min to 14 h 50 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

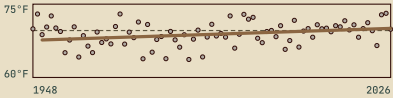
- Sun Dance: Haudenosaunee, Haudenosaunee Confederacy. Published timing: beginning of May
- Moon Dance: Haudenosaunee, Haudenosaunee Confederacy. Published timing: second week of May
- Seed Ceremony: Haudenosaunee, Haudenosaunee Confederacy. Published timing: middle of May (one day)
- Planting Ceremony: Haudenosaunee, Haudenosaunee Confederacy. Published timing: end of May
- Strawberry Ceremony: Haudenosaunee, Haudenosaunee Confederacy. Published timing: middle of May (one day)
- Waabigwanii-giizis (Flower Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Gtegan Gises (Planting Moon): Potawatomi, Citizen Potawatomi Nation
- Pahkwan-kēsoq (Budding Moon): Menominee, lunation Apr 6-May 5 (placement assumed; see Calendars compared)
- Atehemem-kēsoq (Strawberry Moon): Menominee, lunation May 6-Jun 3 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Lesser Yellowlegs, Osprey, Wood Thrush, Rose-breasted Grosbeak, Baltimore Oriole, Blackburnian Warbler, Scarlet Tanager, Blackpoll Warbler, Indigo Bunting, Semipalmated Sandpiper, Tree Swallow, Bobolink

June 2027

Average temperature: 70 °F (20.9 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 70 °F (21.2 °C).
Trend since 1950: warming, +0.31 °F per decade (about +2.4 °F over 76 years), a clear trend.



Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 5:51-8:42	2 5:50-8:43	3 5:50-8:43	4 5:49-8:44	5 5:49-8:45
6 5:49-8:45	7 5:49-8:46	8 5:48-8:46	9 5:48-8:47	10 5:48-8:48	11 5:48-8:48	12 5:48-8:49
13 5:48-8:49	14 5:48-8:49	15 5:48-8:50	16 5:48-8:50	17 5:48-8:51	18 5:48-8:51	19 5:48-8:51
20 5:48-8:51	21 5:49-8:52 June solstice	22 5:49-8:52	23 5:49-8:52	24 5:49-8:52	25 5:50-8:52	26 5:50-8:52
27 5:50-8:52	28 5:51-8:52	29 5:51-8:52	30 5:52-8:52			

new moon first quarter full moon last quarter typical first / last frost (=) Christian holiday

SKY, MOON AND SEASON

- Jun 18: Full moon
- Jun 21: June solstice, 10:10 AM

Day length goes from 14 h 51 min to 15 h 0 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

- Ode'imini-giizis (Time for Picking Strawberry Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Demen Gises (Strawberry Moon): Potawatomi, Citizen Potawatomi Nation
- Atehemem-kësoq (Strawberry Moon): Menominee, lunation May 6-Jun 3 (placement assumed; see Calendars compared)
- Āpahtaw-nēpen-kësoq (Half Summer Moon): Menominee, lunation Jun 4-Jul 3 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Tree Swallow, Blackburnian Warbler, Semipalmated Sandpiper, Rose-breasted Grosbeak, Purple Martin

July 2027

Average temperature: 73 °F (23.0 °C), the 1991-2020 normal at Pittsburgh, PA. The last 10 years averaged 75 °F (23.8 °C).
Trend since 1950: warming, +0.35 °F per decade (about +2.7 °F over 76 years), a clear trend.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 5:52-8:52	2 5:53-8:52	3 5:53-8:52
4 5:54-8:52	5 5:54-8:51	6 5:55-8:51	7 5:56-8:51	8 5:56-8:51	9 5:57-8:50	10 5:58-8:50
11 5:58-8:49	12 5:59-8:49	13 6:00-8:48	14 6:01-8:48	15 6:01-8:47	16 6:02-8:47	17 6:03-8:46
18 6:04-8:45	19 6:05-8:45	20 6:05-8:44	21 6:06-8:43	22 6:07-8:43	23 6:08-8:42	24 6:09-8:41
25 6:10-8:40	26 6:11-8:39	27 6:11-8:38	28 6:12-8:37 Southern Delta Aquariids peak	29 6:13-8:36	30 6:14-8:35	31 6:15-8:34

new moon first quarter full moon last quarter * typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Jul 18: Full moon
- Jul 18: Lunar eclipse (penumbral) (moon below the horizon here), peak 12:02 PM
- Jul 28: Southern Delta Aquariids meteor shower peak, up to ~25/hour under dark skies · moon 33% lit (good)

Day length goes from 14 h 60 min to 14 h 19 min. Sunrise-sunset times are in each day's box.

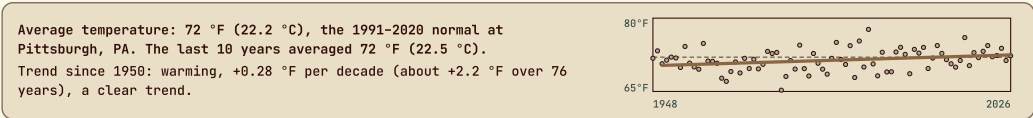
MOONS AND CEREMONIES NAMED FOR THIS TIME

- Aabita-niibino-giizis (Half Way Through the Summer Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Āpaehtaw-nēpen-kēsoq (Half Summer Moon): Menominee, lunation Jun 4-Jul 3 (placement assumed; see Calendars compared)
- Mēn-kēsoq (Blueberry Moon): Menominee, lunation Jul 4-Aug 1 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Osprey, Purple Martin, Tree Swallow, Wood Thrush, Semipalmated Sandpiper, American Robin, Chimney Swift

August 2027



Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 6:16-8:33	2 6:17-8:32	3 6:18-8:31	4 6:19-8:30	5 6:20-8:29	6 6:21-8:28	7 6:22-8:26
8 6:23-8:25	9 6:24-8:24	10 6:25-8:23	11 6:26-8:21	12 6:27-8:20	13 6:28-8:19	14 6:29-8:17
15 † Assumption of Mary 6:29-8:16	16 6:30-8:15	17 6:31-8:13 Lunar eclipse	18 6:32-8:12	19 6:33-8:11	20 6:34-8:09	21 6:35-8:08
22 6:36-8:06	23 6:37-8:05	24 6:38-8:03	25 6:39-8:02	26 6:40-8:00	27 6:41-7:59	28 6:42-7:57
29 6:43-7:56	30 6:44-7:54	31 6:45-7:52				

☾ new moon 🌓 first quarter ☽ full moon 🌘 last quarter ❄ typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Aug 12: Perseids meteor shower peak, up to ~100/hour under dark skies · moon 84% lit (washed out)
- Aug 17: Lunar eclipse (penumbral) visible here, peak 3:13 AM, moon 30° up
- Aug 17: Full moon

CHRISTIAN HOLIDAYS

Aug 15 Assumption of Mary
Day length goes from 14 h 17 min to 13 h 7 min. Sunrise-sunset times are in each day's box.

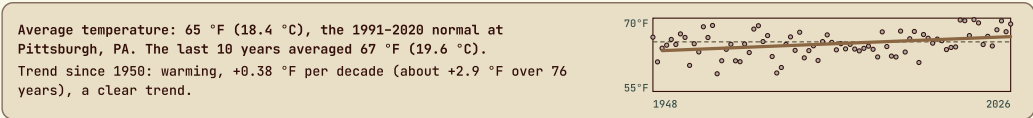
MOONS AND CEREMONIES NAMED FOR THIS TIME

- String Bean: Haudenosaunee, Haudenosaunee Confederacy. Published timing: first week in August (one day)
- Corn: Haudenosaunee, Haudenosaunee Confederacy. Published timing: middle of August
- Manoominike-giizis (Ricing Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Mën-kësoq (Blueberry Moon): Menominee, lunation Jul 4-Aug 1 (placement assumed; see Calendars compared)
- Pawāhān-kësoq (Threshing Moon): Menominee, lunation Aug 2-Aug 30 (placement assumed; see Calendars compared)
- Penipimakat-kësoq (Falling Leaves Moon): Menominee, lunation Aug 31-Sep 29 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Purple Martin, Semipalmated Sandpiper, Chimney Swift, Bobolink, Ruby-throated Hummingbird, Common Nighthawk, Osprey, Tree Swallow, Cape May Warbler, Indigo Bunting, Eastern Phoebe, Lesser Yellowlegs

September 2027



Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 6:46-7:51	2 6:47-7:49	3 6:48-7:48	4 6:49-7:46
5 6:50-7:44	6 6:51-7:43	7 6:52-7:41	8 6:53-7:39	9 6:54-7:38	10 6:54-7:36	11 6:55-7:35
12 6:56-7:33	13 6:57-7:31	14 6:58-7:30	15 6:59-7:28	16 7:00-7:26	17 7:01-7:24	18 7:02-7:23
19 7:03-7:21	20 7:04-7:19	21 7:05-7:18	22 7:06-7:16	23 7:07-7:14 September equinox	24 7:08-7:13	25 7:09-7:11
26 7:10-7:09	27 7:11-7:08	28 7:12-7:06	29 7:13-7:04	30 7:14-7:03		

new moon first quarter full moon last quarter * typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Sep 15: Full moon
- Sep 23: September equinox, 2:01 AM

EXPECTED (FROM PAST RECORDS)

- ≈ Sep 13: Fall migration peak (typical week, PA). 19 tracked species moving, e.g. Cape May Warbler, Semipalmated Sandpiper, Broad-winged Hawk, Chimney Swift

Day length goes from 13 h 5 min to 11 h 49 min. Sunrise-sunset times are in each day's box.

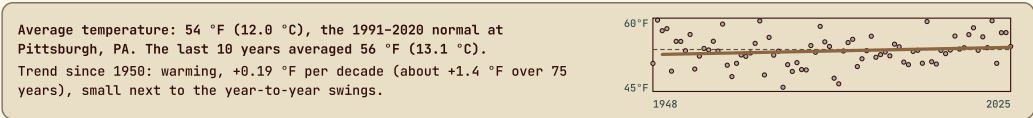
MOONS AND CEREMONIES NAMED FOR THIS TIME

- Waatebagaa-giizis (Leaves Changing Color Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- Penipimakat-kësoq (Falling Leaves Moon): Menominee, lunation Aug 31-Sep 29 (placement assumed; see Calendars compared)
- Păkatăhkamekat-kësoq (Freezing Moon): Menominee, lunation Sep 30-Oct 28 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Cape May Warbler, Broad-winged Hawk, Semipalmated Sandpiper, Ruby-throated Hummingbird, Chimney Swift, Eastern Phoebe, Palm Warbler, Tree Swallow, Common Nighthawk, Bobolink, Rose-breasted Grosbeak, Osprey

October 2027



Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 7:15-7:01	2 7:16-7:00
3 7:17-6:58	4 7:18-6:56	5 7:19-6:55	6 7:20-6:53	7 7:21-6:51	8 7:22-6:50	9 7:23-6:48
10 7:24-6:47	11 7:25-6:45	12 7:26-6:44	13 7:27-6:42	14 7:28-6:40	15 7:29-6:39	16 7:30-6:37
17 7:31-6:36	18 7:32-6:34	19 7:33-6:33	20 7:35-6:32	21 7:36-6:30	22 * = first frost 7:37-6:29	23 7:38-6:27
24 7:39-6:26	25 7:40-6:25	26 7:41-6:23	27 7:42-6:22	28 7:43-6:21	29 7:45-6:19	30 7:46-6:18
31 7:47-6:17						

☾ new moon 🌓 first quarter ☽ full moon 🌘 last quarter * typical first / last frost (=) † Christian holiday

SKY, MOON AND SEASON

- Oct 15: Full moon
- Oct 21: Orionids meteor shower peak, up to ~20/hour under dark skies · moon 62% lit (washed out)

FIRST FALL FROST

Typically around Oct 22 at Pittsburgh, PA; in the middle half of years between Oct 16 and Oct 31, and in 8 years of 10 between Oct 10 and Nov 5. Adjusted for the long-term trend. Frost = a night at or below 0 °C (32 °F).

Day length goes from 11 h 46 min to 10 h 30 min. Sunrise-sunset times are in each day's box.

MOONS AND CEREMONIES NAMED FOR THIS TIME

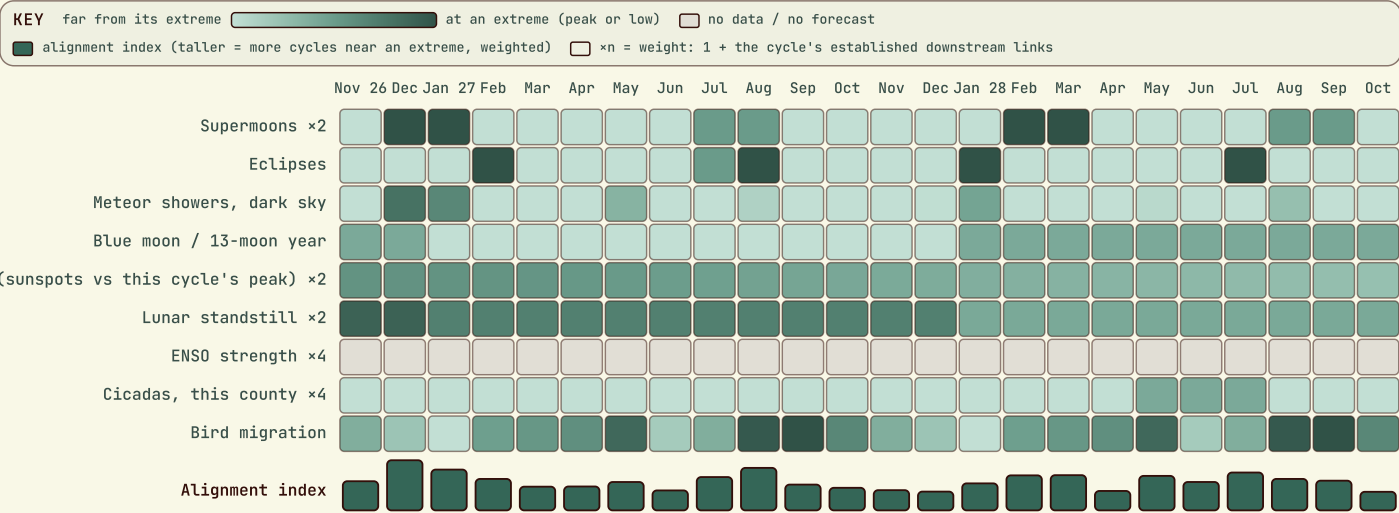
- **Harvest:** Haudenosaunee, Haudenosaunee Confederacy. Published timing: middle of October (four days)
- **Binaakwii-giizis** (Falling Leaves Moon): Ojibwe, Great Lakes Indian Fish & Wildlife Commission
- **Pākatāhkamekat-kēsoq** (Freezing Moon): Menominee, lunation Sep 30-Oct 28 (placement assumed; see Calendars compared)
- **Nīpātepaeh-kēsoq** (Night Moon): Menominee, lunation Oct 29-Nov 27 (placement assumed; see Calendars compared)

ON THE MOVE (PA, TYPICAL YEAR)

Palm Warbler, Yellow-rumped Warbler, White-throated Sparrow, American Robin, Tree Swallow, Sandhill Crane, Eastern Phoebe, Ruddy Duck, Dark-eyed Junco, Cape May Warbler, Blackpoll Warbler, Lesser Yellowlegs

Compounding: the year's overlaps

How close each cycle is to one of its extremes, month by month. The alignment index weights each cycle by how many established effects it has in the interaction graph. It describes overlap, not consequences.

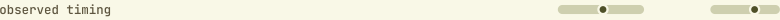
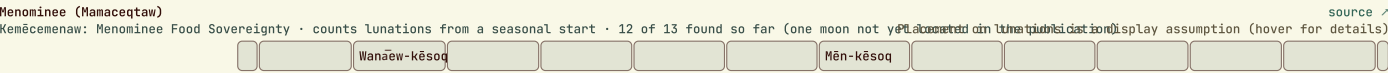
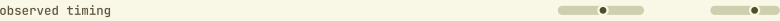
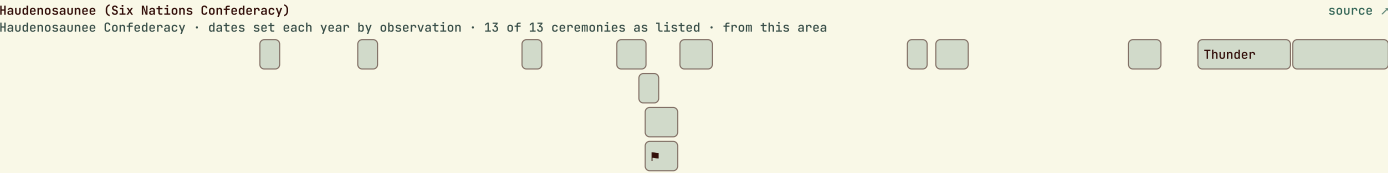


Darker = closer to an extreme. $\times n$ = weight from the interaction graph (1 + established downstream links).

- 1. December 2026: index 0.45, near extreme: Supermoons, Meteor showers, dark sky, Lunar standstill
- 2. August 2027: index 0.38, near extreme: Eclipses, Bird migration
- 3. January 2027: index 0.36, near extreme: Supermoons
- 4. July 2028: index 0.34, near extreme: Eclipses
- 5. March 2028: index 0.31, near extreme: Supermoons

Calendars compared, 2027

Each nation's published calendar in its own row, with the observed timing of the events its moons are named for underneath. These are comparisons, not judgements.



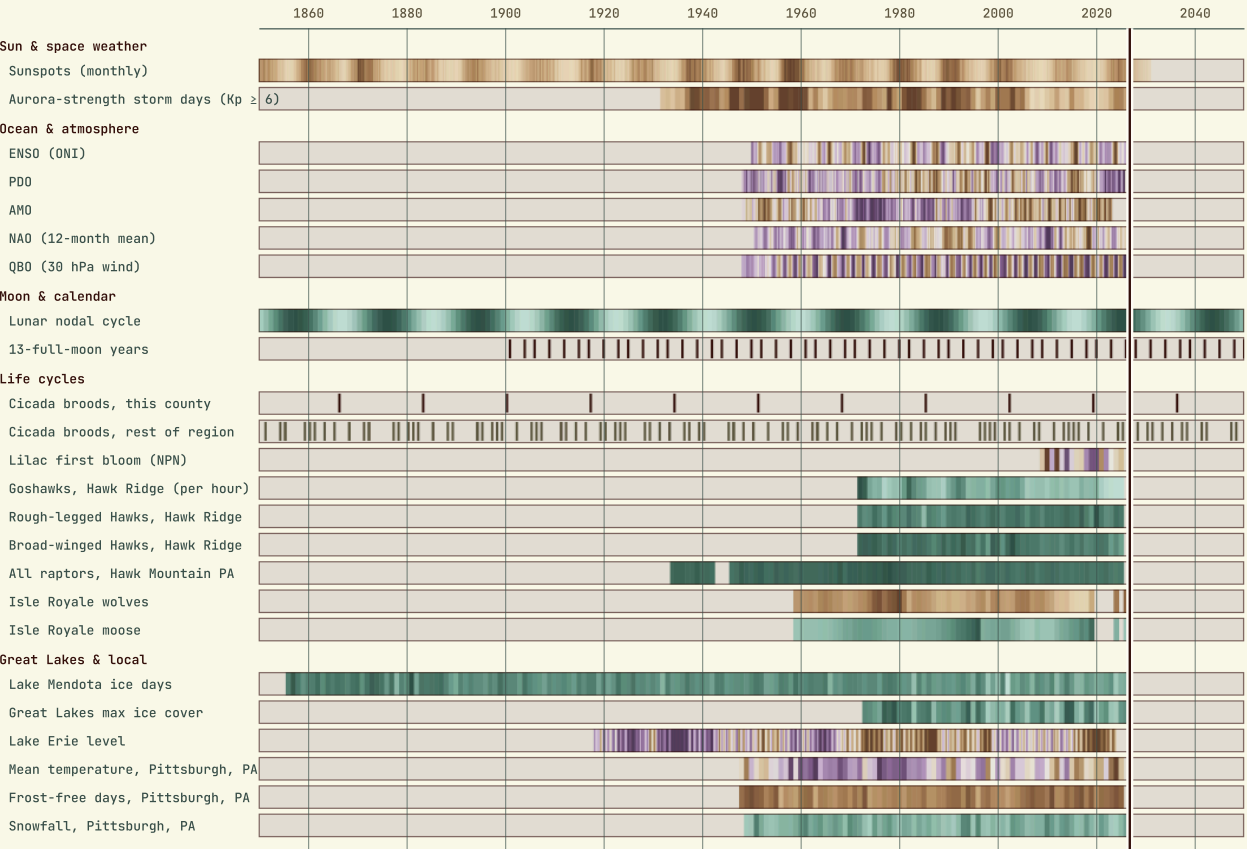
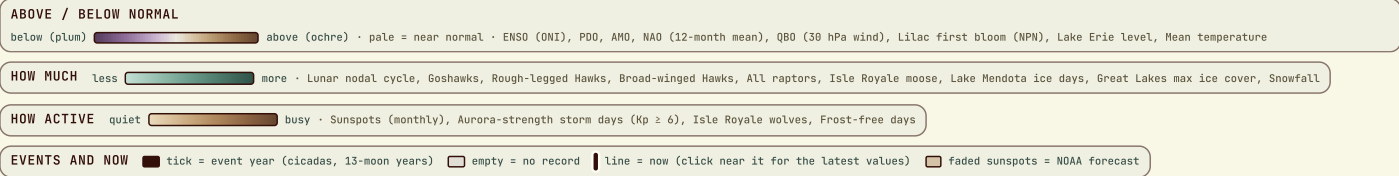
Calendar from the selected area Calendar from elsewhere in the region Observed range Observed typical date Observed in this year flagged 1

January	February	March	April	May	June	July	August	September	October	November	December
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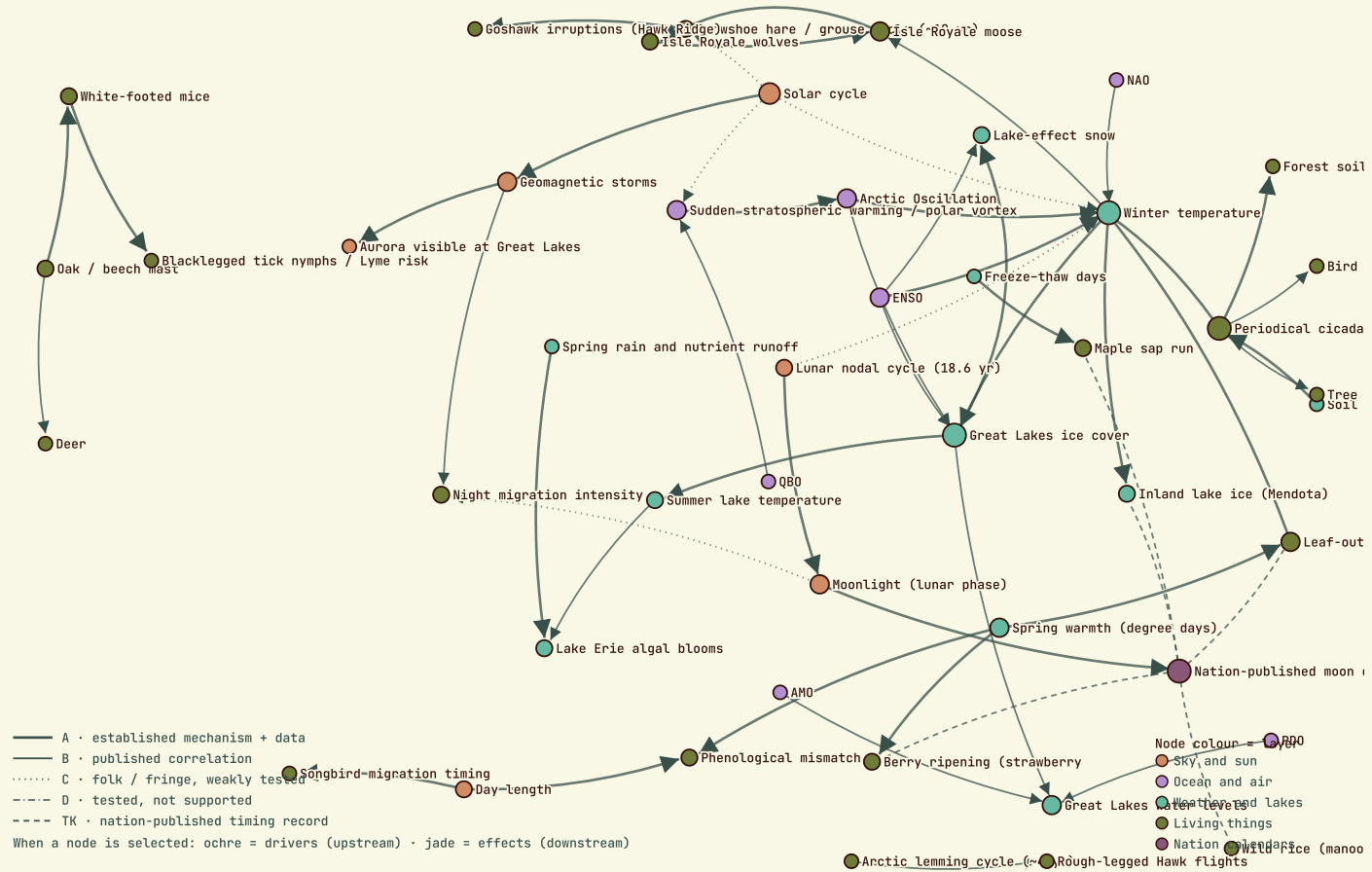
Weekly relative abundance in a typical year, each species scaled to its own peak (darker = more). Sorted by spring peak.

The long records

Each band is one record coloured by its own value: plum/ochre for below/above normal, darker for more. The dark line marks this edition's start.



How the cycles connect



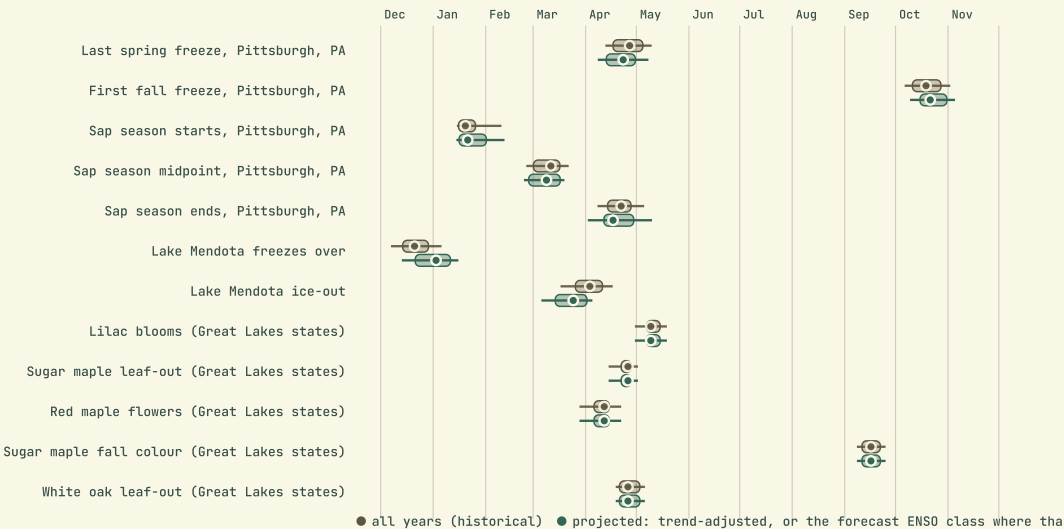
Every link, with its evidence

From	To	Grade	Lag	Mechanism	Tested here
Arctic Oscillation	Winter temperature	A	same winter	Negative AO lets Arctic air spill south over the Great Lakes. (Thompson & Wallace (1998) GRL 25:1297-1300)	ao_djf → t_winter, lag 0: r = +0.32 (n 76, q 0.024) ✓ survives FDR; ao_djf → mendota_days, lag 0: r = -0.17 (n 76, q 0.310) · not significant after FDR
Day length	Songbird migration timing	A	seasonal	Day length triggers migratory restlessness in many songbirds, so timing shifts less than temperature does. (Gwinner (1996) J. Exp. Biol. 199:39-48)	—
Day length	Phenological mismatch	A	seasonal	Day-length-cued arrivals vs temperature-cued leaf-out and insects can drift apart as springs warm. (Both & Visser (2001) Nature 411:296-298; Mayor et al. (2017) Sci. Rep. 7:1902)	—
ENSO	Winter temperature	A	same winter	El Niño shifts the Pacific jet and storm track; northern-tier winters tend to be milder. (Ropelewski & Halpert (1986) Mon. Wea. Rev. 114:2352-2362)	oni_djf → t_winter, lag 0: r = +0.26 (n 76, q 0.069) · not significant after FDR; oni_djf → mendota_days, lag 0: r = -0.32 (n 76, q 0.024) ✓ survives FDR
Freeze-thaw days	Maple sap run	A	days	Freezing nights and thawing days build stem pressure that drives sap flow. (Tyree (1983) Plant Physiol.)	—
Geomagnetic storms	Aurora visible at Great Lakes	A	hours	Aurora reaches 42-47°N roughly when Kp is 6-7 or higher. (NOAA SWPC aurora dashboard)	—
Great Lakes ice cover	Lake-effect snow	A	same winter	Ice cover shuts off heat and moisture from open water, so lake-effect snow drops when lakes freeze. (Laird & Kristovich (2004) J. Appl. Meteor. 43)	—
Great Lakes ice cover	Summer lake temperature	A	following summer	Less ice means earlier stratification and warmer summer surface water (Lake Superior warms faster than the air). (Austin & Colman (2007) GRL 34:L06604)	—
Isle Royale moose	Isle Royale wolves	A	1-3 yr	Prey supply (especially old moose) limits wolf numbers. (Vucetich & Peterson (2004) Proc. R. Soc. B 271:183)	—
Isle Royale wolves	Isle Royale moose	A	1-3 yr	Predation; the island system cycles with wolves lagging moose. (Peterson et al. (1998) Ecology; Vucetich & Peterson annual reports)	—
Leaf-out and bloom	Winter temperature	A	—	Phenology records past warmth; it marks the season and doesn't drive the weather. (—)	—
Lunar nodal cycle (18.6 yr)	Moonlight (lunar phase)	A	—	Sets how high and low the moon rides each month (standstills). (Meeus, Astronomical Algorithms)	—
Moonlight (lunar phase)	Nation-published moon calendars	A	—	Lunations set the moons; 12 vs 13 full moons a year makes moon names drift against the seasons. (astronomy (this project))	—
Oak / beech mast	White-footed mice	A	1 yr	Acorn crops boost overwinter survival and breeding of white-footed mice. (Ostfeld et al. (2006) PLoS Biol. 4:e145)	—
Periodical cicadas	Forest soil nutrient pulse	A	weeks	Dead adults are a nitrogen pulse to forest soils. (Yang (2004) Science 306:1565-1567)	—
Periodical cicadas	Winter temperature	A	—	Cicadas mark soil temperature and don't drive weather. (—)	—
Snowshoe hare / grouse cycle (~10 yr)	Goshawk irruptions (Hawk Ridge)	A	0-1 yr	Goshawks leave the boreal forest when hare and grouse crash; flights at Hawk Ridge peak about every 10 years. (Mueller, Berger & Allee (1977) Auk 94:652; Doyle & Smith (1994))	—
Soil temperature	Periodical cicadas	A	days	Emergence starts when soil at ~20 cm reaches ~18 °C. (Heath (1968) Am. Midl. Nat. 79:151)	—
Solar cycle	Geomagnetic storms	A	0-2 yr (storms peak after maximum)	Coronal mass ejections near maximum and high-speed streams on the declining phase cause geomagnetic storms. (Hathaway (2015) Living Rev. Solar Phys. 12:4)	ssn → kp6, lag 0: r = +0.56 (n 94, q 0.010) ✓ survives FDR; ssn → kp6, lag 1: r = +0.65 (n 94, q 0.001) ✓ survives FDR
Spring rain and nutrient runoff	Lake Erie algal blooms	A	same summer	Spring phosphorus loading from the Maumee River sets bloom size.	—

From	To	Grade	Lag	Mechanism	Tested here
				(Stumpf et al. (2012) PLoS ONE 7:e42444)	
Spring warmth (degree days)	Leaf-out and bloom	A	weeks	Leaf-out and bloom track accumulated warmth (growing degree days). (Schwartz et al. (2013) Int. J. Climatol.)	–
Spring warmth (degree days)	Phenological mismatch	A	seasonal	Warmer springs move food peaks earlier than photoperiod-cued migrants arrive. (Mayor et al. (2017) Sci. Rep. 7:1902)	–
Spring warmth (degree days)	Berry ripening (strawberry)	A	weeks	Ripening follows accumulated warmth. (USA-NPN)	–
Sudden stratospheric warming / polar vortex	Arctic Oscillation	A	1-8 weeks	Vortex breakdown propagates down, giving weeks of negative A0 and cold-air outbreaks. (Baldwin & Dunkerton (2001) Science 294:581-584)	–
White-footed mice	Blacklegged tick nymphs / Lyme risk	A	1 yr	More mice feed more larval ticks, giving more infected nymphs the next year (=2 yr after the mast). (Ostfeld et al. (2006) PLoS Biol. 4:e145)	–
Winter temperature	Great Lakes ice cover	A	same winter	Ice extent tracks accumulated freezing degree days. (Assel (2005) J. Great Lakes Res.)	–
Winter temperature	Inland lake ice (Mendota)	A	same winter	Ice duration on Lake Mendota tracks winter air temperature; the 170-year record shows about a month's loss. (Magnuson et al. (2000) Science 289:1743-1746)	–
AMO	Great Lakes water levels	B	0-3 yr	Multidecadal Atlantic temperature shifts affect basin precipitation. (Hanrahan, Kravtsov & Roebber (2010) GRL 37:L01701)	amo → level_michigan, lag 0: r = -0.27 (n 75, q 0.430) · not significant after FDR; amo → level_michigan, lag 2: r = -0.38 (n 74, q 0.259) · not significant after FDR
Arctic lemming cycle (~4 yr)	Rough-legged Hawk flights	B	0-1 yr	Breeding success follows the ~4-year lemming cycle, changing autumn numbers. (Potapov (1997) J. Raptor Res.)	–
Arctic Oscillation	Great Lakes ice cover	B	same winter	Negative A0 winters bring more Arctic air and more ice. (Bai et al. (2012) J. Geophys. Res. 117:C03002)	ao_djf → gl_ice, lag 0: r = -0.16 (n 54, q 0.430) · not significant after FDR
ENSO	Great Lakes ice cover	B	same winter	Strong El Niño gives low ice; the effect is nonlinear and interacts with the A0/NAO. (Bai et al. (2012) J. Geophys. Res. 117:C03002)	oni_djf → gl_ice, lag 0: r = -0.14 (n 54, q 0.436) · not significant after FDR
ENSO	Lake-effect snow	B	same winter	La Niña winters favour more Great Lakes snow; El Niño less. (Kluver & Leathers (2015) Int. J. Climatol. 35:4374)	oni_djf → snow, lag 0: r = -0.34 (n 76, q 0.019) ✓ survives FDR
Geomagnetic storms	Night migration intensity	B	same night	Fewer migrants fly, and more drift, during strong geomagnetic disturbance. (Gulson-Castillo et al. (2023) PNAS 120:e220224120)	–
Great Lakes ice cover	Great Lakes water levels	B	0-1 yr	Open winter water evaporates more, lowering levels. (Spence et al. (2011) J. Hydrometeor. 12:1170)	–
NAO	Winter temperature	B	same winter	The region sits at the western edge of the NAO pattern; the effect is weaker than in the east. (Hurrell (1995) Science 269:676-679)	nao_djf → t_winter, lag 0: r = +0.31 (n 76, q 0.030) ✓ survives FDR
Oak / beech mast	Deer	B	0-1 yr	Fall acorns affect body condition and next spring's young. (McShea (2000) Ecology 81:228-238)	–
PDO	Great Lakes water levels	B	0-3 yr	Decadal precipitation shifts in the upper Midwest line up with Pacific decadal variability. (Watras et al. (2014) GRL 41:456-462)	pdo → level_michigan, lag 0: r = +0.24 (n 76, q 0.430) · not significant after FDR; pdo → level_superior, lag 1: r = +0.18 (n 75, q 0.436) · not significant after FDR
Periodical cicadas	Bird nesting success	B	same year and later	Predator satiation and a food glut change bird populations in emergence years. (Koenig & Liebhold (2005) Am. Nat. 165:452; Koenig et al. (2011))	–
Periodical cicadas	Tree growth	B	0-2 yr	Egg-laying damage and root feeding reduce growth of host trees. (Koenig & Liebhold (2003) Ecology 84:2479)	–
QBO	Sudden stratospheric warming / polar vortex	B	same winter	Easterly QBO weakens the polar vortex and makes sudden warmings more likely (Holton-Tan effect). (Holton & Tan (1980) J. Atmos. Sci. 37:2200-2208)	qbo_win → t_winter, lag 0: r = +0.04 (n 77, q 0.782) · not significant after FDR

From	To	Grade	Lag	Mechanism	Tested here
Summer lake temperature	Lake Erie algal blooms	B	same summer	Warm, calm water favours cyanobacteria. (Michalak et al. (2013) PNAS 110:6448)	–
Winter temperature	Isle Royale moose	B	1-2 yr	Warm winters raise heat stress and winter-tick loads. (Vucetich & Peterson annual reports)	–
Lunar nodal cycle (18.6 yr)	Winter temperature	C	0	Proposed 18.6-year Lunar-nodal rhythm in Midwest drought and temperature; weak or absent in later tests. (Currie (1984) J. Climate Appl. Meteor. 23:1281)	nodal → t_annual, lag 0: r = +0.15 (n 86, q 0.430) · not significant after FDR; nodal → t_winter, lag 0: r = +0.12 (n 87, q 0.436) · not significant after FDR
Moonlight (lunar phase)	Night migration intensity	C	same night	Moonlight is sometimes said to boost or orient night migration; radar studies find little effect. (Pyle et al. (1993) Condor 95:343; BirdCast radar analyses)	–
Solar cycle	Sudden stratospheric warming / polar vortex	C	same winter	Solar UV changes stratospheric ozone heating; proposed to modulate the QBO's effect on the polar vortex. (Labitzke & van Loon (1988) J. Atmos. Terr. Phys. 50:197-206)	–
Solar cycle	Winter temperature	C	0-1 yr	Top-down UV pathway projecting onto the NAO/AO; small in observations. (Ineson et al. (2011) Nature Geoscience 4:753-757)	ssn → t_winter, lag 0: r = -0.01 (n 86, q 0.914) · not significant after FDR; ssn → t_winter, lag 1: r = +0.02 (n 87, q 0.914) · not significant after FDR
Solar cycle	Snowshoe hare / grouse cycle (~10 yr)	C	0-2 yr	Proposed from tree rings and fur records; later work finds no consistent link. (Sinclair et al. (1993) Am. Nat. 141:173-198; Krebs et al. (2014) Oecologia)	ssn → goshawk_hr, lag 0: r = +0.09 (n 54, q 0.782) · not significant after FDR; ssn → goshawk_hr, lag 2: r = +0.49 (n 54, q 0.069) · not significant after FDR
Nation-published moon calendars	Maple sap run	TK	–	Sugar / sap moons (Ojibwe Iskigamizige-giizis; Potawatomi Zisbaktoké Gises; Menominee Súpomähkwan-kěsoq). (see Calendar Strip sources)	–
Nation-published moon calendars	Berry ripening (strawberry)	TK	–	Strawberry and blueberry moons; Haudenosaunee Strawberry Ceremony. (see Calendar Strip sources)	–
Nation-published moon calendars	Wild rice (manoomin) ripening	TK	–	Ricing / threshing moons (Ojibwe Manoominike-giizis; Menominee Pawähän-kěsoq). (see Calendar Strip sources)	–
Nation-published moon calendars	Inland lake ice (Mendota)	TK	–	Freezing and ice moons (e.g., GLIFWC Ojibwe Gashkadino-giizis, Ice is Forming Moon). (see Calendar Strip sources)	–
Nation-published moon calendars	Leaf-out and bloom	TK	–	Budding, flower and falling-leaves moons. (see Calendar Strip sources)	–

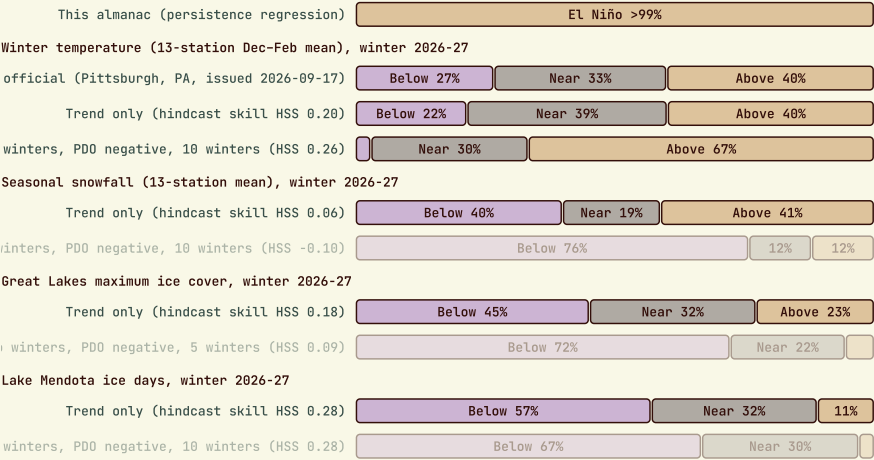
Expected dates and the winter outlook



KEY below normal / La Niña near normal / neutral above normal / El Niño a fair three-sided die = 33% each; wider = more likely

ENSO for winter 2026-27: projected Dec-Feb ONI +2.39 ± 0.47 °C (from 2026-07 ONI 1.8; regression r = 0.88, 76 winters).

ENSO class (Dec-Feb)



Below / near / above the 1991-2020 normal (terciles). Faded = shown for

Claims on the record

Claim	Origin	Cases	Went the claimed way	q (FDR)	Verdict
El Niño winters are mild around the Great Lakes.	science	26	14 of 26 (54%)	0.55	not supported
La Niña winters are snowy around the Great Lakes.	science	26	17 of 26 (65%)	0.55	leans the claimed way, not significant
La Niña winters bring more Great Lakes ice.	science	19	9 of 19 (47%)	0.6762	not supported
A negative Arctic Oscillation winter is a cold winter here.	science	31	18 of 31 (58%)	0.55	not supported
Winters around solar minimum are colder.	fringe	24	13 of 24 (54%)	0.55	not supported
A year with 13 full moons brings a hard winter.	folk	32	18 of 32 (56%)	0.55	not supported
Major Lunar standstill years run cold.	fringe	15	9 of 15 (60%)	0.55	leans the claimed way, not significant
An early first fall freeze means a hard winter.	folk	29	15 of 29 (52%)	0.55	not supported
A snowy winter is followed by a late last frost.	folk	25	14 of 25 (56%)	0.55	not supported
Lots of Great Lakes ice means a late spring.	folk	18	10 of 18 (56%)	0.55	not supported
A big goshawk flight in fall foretells a hard winter.	folk	11	6 of 11 (55%)	0.55	not supported

Waiting for data

- A heavy acorn crop means a hard winter. (folk): Oak mast survey series (state DNR reports) not yet entered.
- If Punxsutawney Phil sees his shadow on February 2, six more weeks of winter. (folk): A machine-readable record of Phil's yearly calls was not found; not hand-entered from memory.
- Wider brown bands on woolly bear caterpillars mean a milder winter. (folk): No systematic caterpillar-band record exists for the region.

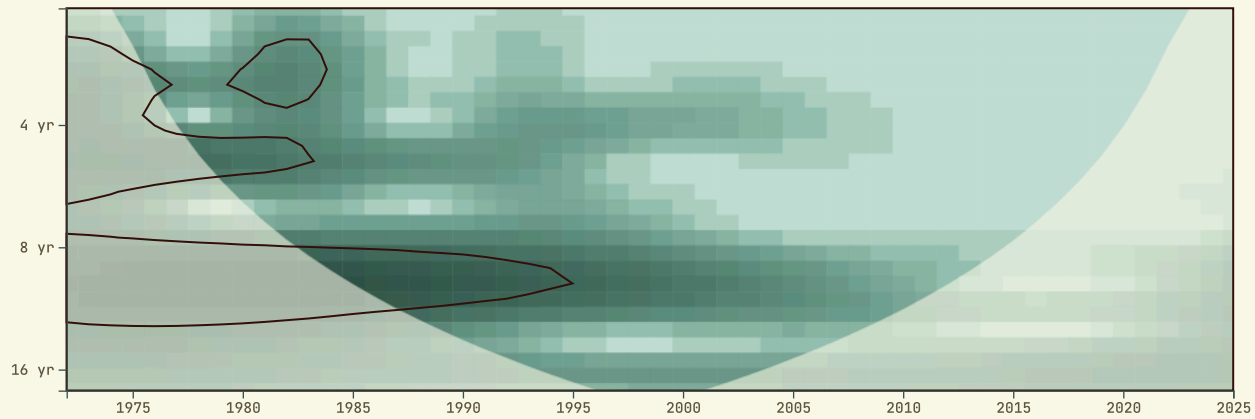
Forecasts on the record (logged before the season, scored after)

Forecast	Made	Probabilities	Status
ENSO class for winter 2026-27 (Dec-Feb ONI)	2026-10-03	La Niña <1% · neutral <1% · El Niño >99%	pending
Winter temperature (13-station Dec-Feb mean), winter 2026-27: analog model	2026-10-03	below 3% · near 30% · above 67%	pending
Seasonal snowfall (13-station mean), winter 2026-27: trend-only model	2026-10-03	below 40% · near 19% · above 41%	pending
Great Lakes maximum ice cover, winter 2026-27: trend-only model	2026-10-03	below 45% · near 32% · above 23%	pending
Lake Mendota ice days, winter 2026-27: trend-only model	2026-10-03	below 57% · near 32% · above 11%	pending
NOAA CPC Dec-Feb temperature outlook, averaged over the 13 stations (DJF 2026-2027)	2026-09-17	below 18% · near 33% · above 49%	pending

What the records show: cycles inside the counts

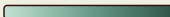
Northern Goshawks per hour, Hawk Ridge (log scale) · 1972-2025 · darker = more power · outline = significant at 95% vs red noise (AR1 0.53) · pale wash = edge-affected · significant periods: 9.8 yr

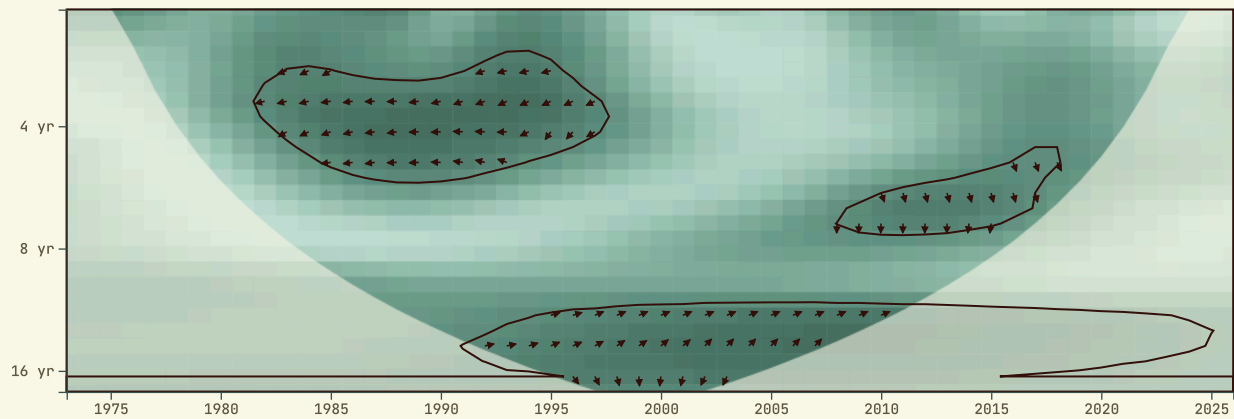
KEY weak rhythm  strong rhythm at that period  outline = significant at 95%  washed-out corners = edge-affected, read with care



23% of the reliable (non-edge) area is significant; significant parts are mostly opposite (one high when the other is low). Expect about 5% by chance alone. $n = 54$ years from 1973.

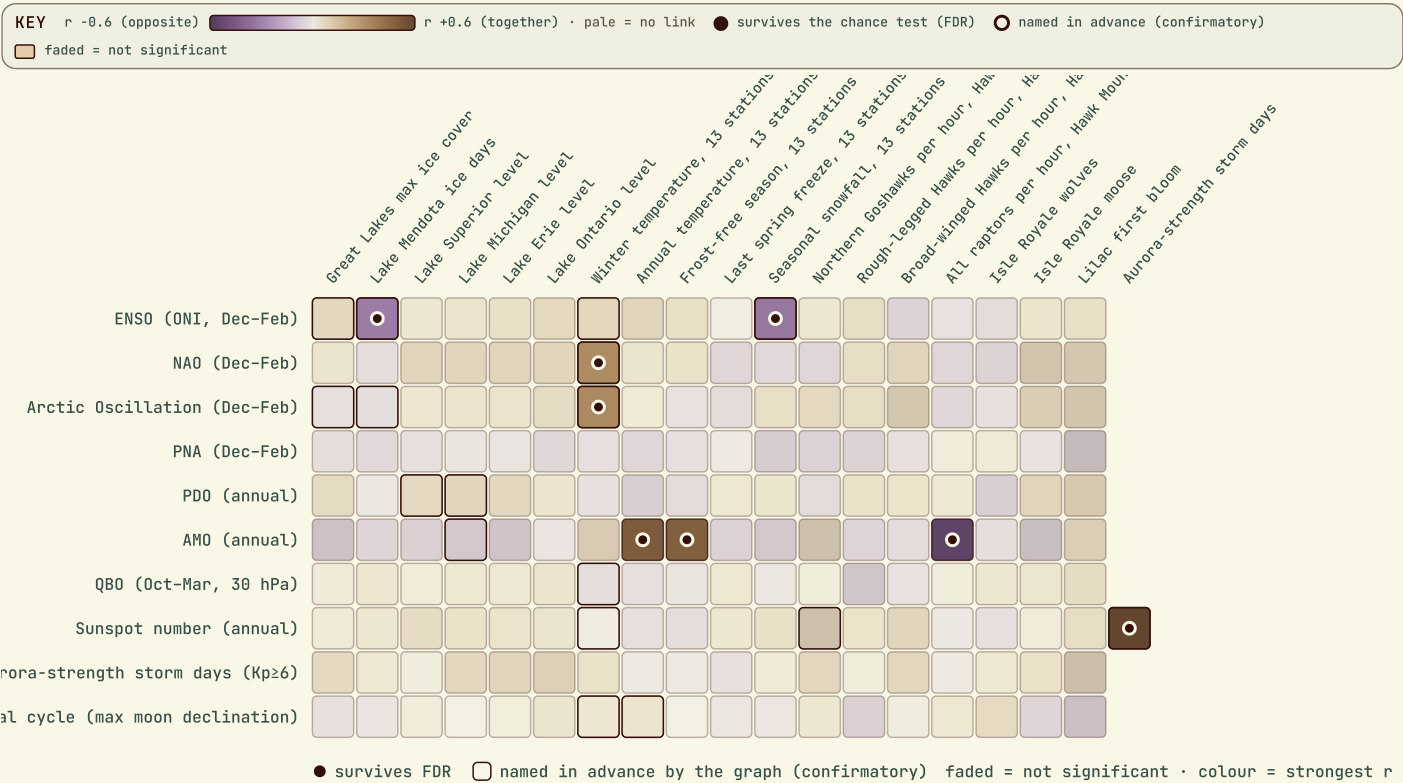
Coherence 0-1 (darker = the two records vary together at that period) · outline = significant at 95% · arrows: → in phase, ← opposite, ↑ ENSO leads by a quarter cycle

KEY 0 unrelated  1 vary together  outline = significant at 95%  washed-out corners = edge-affected, read with care
arrows: → move together · ← opposite · ↑ first record leads



What the records show: every driver against every response

721 tests. 51 had $p < 0.05$, about 36 would by chance; 9 survive the false-discovery-rate guard.



Essays

READING THE OVERLAP

Every place sits inside many cycles at once: the turning day, the lunar month, the year, and slower rhythms in the ocean, the sun and living things. This almanac doesn't try to explain one cycle with another. It shows where each one stands, which ones line up, and what the evidence says about how they're connected.

Some links are firm, like the solar cycle driving geomagnetic storms and El Niño easing Great Lakes winters. Some are published correlations. Some are sayings that have never been tested well. Each link is graded, and sayings get scored against the records in the claims register at the back.

TWELVE MOONS OR THIRTEEN

A lunar month (new moon to new moon) averages 29.53 days, so twelve of them fall about eleven days short of a solar year. Most years have twelve full moons; roughly every two and a half to three years has thirteen. Over nineteen years the two cycles nearly realign (the Metonic cycle).

Calendars that tie moon names to Gregorian months absorb the extra moon quietly. Calendars that count actual lunations from a seasonal start gain one, and their names drift a little against the seasons from year to year. The Calendar Comparison Strip shows both kinds side by side.

NATIONS' OWN CALENDARS

The moon names here are the published calendars of the Ojibwe (as published by GLIFWC for its member bands), the Citizen Potawatomi Nation, the Menominee (Kemēcemenaw), and the Haudenosaunee Confederacy's ceremonial cycle. Each is shown as its own calendar and never merged into a general "Native" list, because names, spellings and timing differ from community to community.

Where a source reserves its rights, only names and timing appear, with a link back. Many moon names describe events you can watch for: sap running, suckers spawning, strawberries ripening, wild rice, leaves changing, ice forming. Under each calendar the almanac sets out when those events have actually happened in recent decades, as a comparison and not as a judgement. Some sources are still being found (other Potawatomi nations, the Ho-Chunk Nation, Odawa), and they'll be added as their own nations publish them.

EL NIÑO AND THE LAKES

El Niño and La Niña are swings in Pacific Ocean temperatures every two to seven years. They shift the jet stream across North America. Around the Great Lakes, El Niño winters tend to be milder with less ice and less snow; La Niña winters lean colder and snowier. The records here show those tendencies, though not every winter follows them.

Winter 2026–27 opens with a strong El Niño. The winter outlook gives the official NOAA probabilities next to this almanac's own models, each with its past skill.

THE SUN'S ELEVEN YEARS AND THE AURORA

Sunspots rise and fall over roughly eleven years. Cycle 25 peaked in late 2024. Big geomagnetic storms come mostly near and after the peak, which is why aurora chances stay elevated for a few years after maximum. At Great Lakes latitudes the aurora usually needs a Kp index of about 6 to 7.

Claims that the solar cycle sets our winters are much weaker. They're graded C in the interaction graph and don't hold up in the claims register.

ICE ON LAKE MENDOTA

Lake Mendota in Madison has a freeze and thaw record going back to the winter of 1852–53, one of the longest lake-ice records anywhere. The lake now spends about a month less under ice than it did in the 1800s. Year to year it swings with El Niño and the Arctic Oscillation, and the long-term decline runs through all of it.

The Great Lakes' own ice record, by satellite since 1973, shows big swings too: almost total cover in 1979 and 2014, and very little in several recent El Niño winters.

PERIODICAL CICADAS

Periodical cicadas spend 13 or 17 years underground, then emerge together in late spring when soil about 20 cm down reaches roughly 18 °C. Each synchronised population is a brood. Brood XIII covers northern Illinois and parts of Wisconsin, Indiana, Michigan and Iowa. It last emerged in 2024 and is next due in 2041.

An emergence feeds every predator in the woods for weeks, then sends a pulse of nitrogen into the soil as the adults die. Cicadas mark soil temperature; they don't make the weather.

MIGRATION ON A SCHEDULE

Many songbirds time migration by day length, which doesn't change from year to year, while leaf-out and insects follow temperature, which does. As springs warm, the two can drift apart. That drift is the phenological mismatch shown in the interaction graph.

The migration ring and the bird rows come from eBird Status & Trends. That's a model of a typical year built from millions of checklists, so it shows when to expect each species, not exactly when they came in any one year.

GOSHAWKS, HARES AND LEMMINGS

At Hawk Ridge above Duluth, counters have tallied migrating raptors every fall since 1972. Northern Goshawk numbers spike about every ten years (1972, 1982, 1992). That's the boreal snowshoe hare and grouse cycle: when prey crashes in the north, goshawks move south. Rough-legged Hawks show a shorter, roughly four-year rhythm tied to Arctic lemmings. The wavelet analysis finds both periods in the counts.

WOLVES AND MOOSE ON ISLE ROYALE

On Isle Royale in Lake Superior, wolves and moose have been counted every winter since 1959. It's the longest-running study of its kind. The two populations rise and fall with wolves trailing moose, broken by disease, inbreeding, winters, ticks and, since 2018, wolves brought over to restore the predator.

SUGAR SEASON

Maple sap runs when nights freeze and days thaw. Sugarmakers' rule of thumb is nights below 32 °F and days above 40 °F. The almanac counts those days at each weather station; around the southern lakes the season now usually runs from February into April. Every nation calendar here has a sugar or sap moon. The strip shows where the counted sap season falls under each one.

Sources and credits

Moon names and ceremonies are reproduced as each nation or its institutions publish them, with attribution. Where a source reserves its rights, only names and timing appear. Corrections from the nations themselves take precedence over anything here.

- Haudenosaunee (Six Nations Confederacy), published by Haudenosaunee Confederacy. <https://www.haudenosauneeconfederacy.com/ceremonies/> (retrieved 2026-10-03). Terms: (c) Haudenosaunee Confederacy, All Rights Reserved. Names and timing only, linked back; nothing reproduced.
- Menominee (Mamaceqtaw), published by Kemëcemenaw: Menominee Food Sovereignty (Menominee community food sovereignty publication, via eXtension). <https://publications.extension.org/view/135506231/29/> (retrieved 2026-10-03). Terms: Names reproduced with attribution; descriptions summarised. Diacritics as printed (FlippingBook text layer, check against the PDF).
- Ojibwe (Anishinaabe), published by Great Lakes Indian Fish & Wildlife Commission (GLIFWC), on behalf of eleven Ojibwe member bands. <https://glifwc.org/sites/default/files/uploads/documents/2024-12/25%20calendar.pdf> (retrieved 2026-10-03). Terms: GLIFWC publication; names and translations reproduced with attribution. Other years' calendars are on glifwc.org.
- Potawatomi (Bodéwadmī), published by Citizen Potawatomi Nation. <https://www.potawatomi.org/blog/2022/03/21/mnokme-spring-months-named-for-bountiful-changes/> (retrieved 2026-10-03). Terms: (c) Citizen Potawatomi Nation. Names reproduced with attribution; descriptions summarised, not quoted.
- Atlantic Multidecadal Oscillation (unsmoothed): NOAA Physical Sciences Laboratory climate indices
- Arctic Oscillation: NOAA Physical Sciences Laboratory climate indices
- Periodical cicada broods (13- and 17-year): USDA Forest Service Northern Research Station – Periodical Cicada Broods
- Cicada broods by county: USDA Forest Service Northern Research Station – Periodical Cicada Broods
- Testable-claims register: Claims register, this project
- Day length by latitude: NOAA Global Monitoring Lab solar calculation (declination series)
- Bird migration timing, Great Lakes states (eBird Status & Trends): eBird Status and Trends, 2025 release (Cornell Lab of Ornithology)
- Solar and lunar eclipses: Astronomy Engine (Don Cross), computed locally
- El Niño and La Niña episodes: Derived from NOAA PSL/CPC ONI
- Superposed epoch analysis around key events: Computed in this project
- Geomagnetic activity and aurora-possible days: GFZ Helmholtz Centre – Kp, Ap, F10.7 since 1932
- Great Lakes anchor weather stations: NOAA NCEI GHCN-Daily
- Great Lakes annual maximum ice cover: NOAA GLERL Great Lakes Ice Cover Database
- Great Lakes monthly water level, ice concentration, surface temperature: GLISA / GLOS ERDDAP – GLERL Great Lakes Dashboard monthly statistics
- Nation-published moon and ceremonial calendars: Haudenosaunee (Six Nations Confederacy) – Haudenosaunee Confederacy; Menominee (Mamaceqtaw) – Kemëcemenaw: Menominee Food Sovereignty (Menominee community food sovereignty publication, via eXtension); Ojibwe (Anishinaabe) – Great Lakes Indian Fish & Wildlife Commission (GLIFWC), on behalf of eleven Ojibwe member bands; Potawatomi (Bodéwadmī) – Citizen Potawatomi Nation
- How the cycles affect each other (interaction graph): Curated in this project from the cited literature; local tests computed here
- Isle Royale wolves and moose (winter counts): Wolves and Moose of Isle Royale project (Michigan Tech). Data_wolves_moose_Isle_Royale_June2019.csv via R package dsem
- Lagged correlations between drivers and responses (FDR-guarded): Computed in this project
- Lunar perigee and apogee: Astronomy Engine (Don Cross), computed locally
- Lunar nodal cycle (18.6 yr) / Lunar standstills: Meeus, Astronomical Algorithms (2nd ed.), mean node formula
- Lunisolar alignment: 13-moon years and blue moons: Astronomy Engine (Don Cross), computed locally
- Lake Mendota ice-on / ice-off (1852-): Wisconsin State Climatology Office – Lake Mendota ice history
- Major meteor shower peaks: Astronomy Engine (Don Cross), computed locally; IMO Meteor Shower Calendar (peak solar longitudes, ZHR)
- New and full moons: Astronomy Engine (Don Cross), computed locally
- North Atlantic Oscillation: NOAA Physical Sciences Laboratory climate indices
- Niño-3.4 SST anomaly: NOAA Physical Sciences Laboratory climate indices
- Observed phenology onsets, Great Lakes states (USA-NPN): USA National Phenology Network – Nature's Notebook summarized data
- ENSO – Oceanic Niño Index: NOAA Physical Sciences Laboratory climate indices
- Pacific Decadal Oscillation: NOAA Physical Sciences Laboratory climate indices
- Pacific-North American pattern: NOAA Physical Sciences Laboratory climate indices
- Projections: ENSO, winter outlooks, expected dates: NOAA Climate Prediction Center seasonal outlooks (map service); Computed in this project from the datasets above
- Quasi-Biennial Oscillation (30 hPa zonal wind): NOAA Physical Sciences Laboratory climate indices
- Hawkwatch season totals, Great Lakes (HMANA HawkCount): Hawk Migration Association of North America – HawkCount
- Equinoxes and solstices: Astronomy Engine (Don Cross), computed locally
- Solar cycle minima and maxima: WDC-SILSO, Royal Observatory of Belgium – International Sunspot Number v2
- Solar cycle forecast (NOAA SWPC): NOAA SWPC predicted solar cycle
- Frost dates, frost-free season, growing degree days, annual mean temperature: NOAA NCEI GHCN-Daily
- Monthly mean temperature by station: NOAA NCEI GHCN-Daily
- Seasonal snowfall (lake-effect included): NOAA NCEI GHCN-Daily
- Sunspot number (monthly, 1749-): WDC-SILSO, Royal Observatory of Belgium – International Sunspot Number v2
- Wavelet coherence between cycle pairs: Computed in this project with pycwt (Torrence & Compo 1998; Grinsted, Moore & Jevrejeva 2004)
- Wavelet power of long records: Computed in this project with pycwt (Torrence & Compo 1998; Grinsted, Moore & Jevrejeva 2004)

Non-commercial edition. Sunspot numbers: SILSO, Royal Observatory of Belgium (CC BY-NC 4.0). Bird data: eBird Status and Trends, Cornell Lab of Ornithology (non-commercial use). Hawk counts: HMANA HawkCount and the named hawkwatches. Weather: NOAA NCEI GHCN-Daily. Outlooks: NOAA Climate Prediction Center. Phenology: USA National Phenology Network. Cicadas: USDA Forest Service. Lake ice: NOAA GLERL and the Wisconsin State Climatology Office. Isle Royale: Wolves and Moose of Isle Royale project, Michigan Tech.