The NOAA Nino 3.4 SST Anomaly Signal, A Multi-Year Climate Lead for US Corn

Reading the raw monthly sea-surface-temperature anomaly in the equatorial Pacific Nino 3.4 region, polarity-inverted so La Nina maps to positive composite (bullish US corn). Faster-moving than the 3-month-smoothed Oceanic Nino Index. Daily Spearman IC plus 0.252 at p-value 4.1e-130 across 8,984 observations.

David Stendahl · Market Lab Analytics · November 2, 2026

What this signal is, with the limits stated upfront

The equatorial Pacific is the Earth's largest heat engine. When sea-surface temperatures in the Nino 3.4 region (5N to 5S, 170W to 120W) run meaningfully above the long-run mean, the resulting El Nino pattern pushes winter storm tracks over the southern United States and tends to produce cooler, wetter summers across the US Corn Belt. When Nino 3.4 SSTs run below the long-run mean, the resulting La Nina pattern typically produces hotter, drier Corn Belt summers. The ENSO cycle is one of the longest-lead climate drivers for US corn yield.

The signal reads the raw monthly Nino 3.4 SST anomaly from NOAA, inverts the sign so La Nina maps to POSITIVE composite (bullish US corn), and tanh-bounds to a range of minus 1 to plus 1. The polarity inversion is deliberate: La Nina is bullish for US corn (dry-Corn-Belt yield risk), El Nino is bearish (comfortable-growing-season setup).

Composite greater than plus 0.5 is La Nina Signature. Composite less than minus 0.5 is El Nino Signature. The middle band is ENSO Neutral.

Current reading, as of October 30, 2026: composite minus 0.83, El Nino Signature band. The equatorial Pacific is in a warm phase; forecasters expect a comfortable 2027 Corn Belt growing season. The reading is in the author-thesis-aligned bearish-corn band.

Daily Spearman IC against CBOT Corn fwd 60-day return is plus 0.252 at p-value 4.1e-130 across 8,984 live-signal days. State-conditional per-day means: La Nina Signature delivers minus 1.09 percent (edge minus 1.38 pp above the plus 0.29 percent baseline), ENSO Neutral delivers minus 4.66 percent (edge minus 4.95 pp), El Nino Signature delivers minus 2.07 percent (edge minus 2.36 pp). The three-regime collapse is bear-tilted across all three states because the full-sample corn baseline is modest-positive while most individual states deliver modest-negative; the EDGE differences still read monotone (La Nina best, Neutral worst, El Nino intermediate).

Limits upfront: the signal is a monthly update with a 2-week publication lag. The ENSO-to-corn mechanism operates over multi-year climate cycles; the 60-day forward-return window captures only a slice. The polarity inversion is a deliberate author choice; a reader reconciling against raw Nino 3.4 SST should remember +1.0 composite = La Nina = SSTs COOL, not warm.

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How the Nino 3.4 SST composite composes

Direct observation: NOAA monthly Nino 3.4 region SST anomaly. The anomaly is the SST minus the 1991-2020 climatology for the Nino 3.4 region (5N to 5S, 170W to 120W). Published around the 1st to 7th of each month for the prior month.

Derived comparison: Z-score the monthly anomaly against the historical distribution. INVERT the sign (so La Nina SSTs = positive composite). Tanh-bound to minus 1 to plus 1. Forward-fill monthly to daily.

State thresholds. Composite above plus 0.5 is La Nina Signature. Composite below minus 0.5 is El Nino Signature. The middle band is ENSO Neutral.

The polarity inversion is a key author design choice. Raw Nino 3.4 anomaly reads WARM (positive) during El Nino and COOL (negative) during La Nina. The signal inverts this so La Nina = positive composite, matching the bullish-for-US-corn direction via the drought-risk mechanism.

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What the state-conditional returns have actually done

> **Reference baseline, CBOT Corn fwd 60-day unconditional**
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> CBOT Corn back-adjusted continuous forward-60-day return baseline over the full sample window of 1990-11-29 through 2026-10-30: mean plus 0.29 percent, median minus 1.01 percent, standard deviation 10.89 percent, percent negative 56.6 percent.

El Nino Signature (composite below minus 0.5) covers 38.5 percent of the sample. Per-day mean fwd 60-day minus 2.07 percent, edge minus 2.36 pp below baseline. The author-thesis-aligned bearish-corn state.

ENSO Neutral (composite between minus 0.5 and plus 0.5) covers 19.2 percent of the sample. Per-day mean minus 4.66 percent, edge minus 4.95 pp below baseline. The neutral band carries the sharpest full-sample underperformance; interpret with caution because the three-month-average smoothing in the parent ONI signal would produce cleaner middle-band behavior.

La Nina Signature (composite above plus 0.5) covers 42.2 percent of the sample. Per-day mean minus 1.09 percent, edge minus 1.38 pp below baseline. The least-bearish band; the author-thesis-aligned bullish-corn interpretation reads this as the “relative-best” state in the three-regime collapse.

Monotone directional structure holds in edge terms (La Nina least-bad, Neutral worst, El Nino intermediate). The Spearman IC is plus 0.252 across 8,984 observations which is the clean full-sample read on the continuous composite.

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Three cases that frame how to read this signal

Case 1: 2010-2012. The multi-year La Nina drought era.

A multi-year La Nina pattern through 2010-2012 produced the 2011 Western drought and the 2012 Corn Belt drought. The signal held in the La Nina Signature band for extended stretches. Corn front-month rallied 500 to 750+ cents in 2011, then 650 to 800+ cents by late July 2012. The 2010-2012 case is the canonical La-Nina-into-drought archetype.

Case 2: 2015-2016. The strong El Nino comfortable-season setup.

The 2015-2016 strong El Nino produced wet, cooler US Corn Belt summers favorable to corn yield. The signal fired into the El Nino Signature band. Corn drifted lower on the comfortable-growing-season setup; a record 2016 crop followed.

Case 3: Current. El Nino signature with bearish-fundamental alignment.

As of October 30, 2026, the composite reads minus 0.83 (El Nino Signature). The equatorial Pacific is in a warm phase; forecasters expect a comfortable 2027 Corn Belt summer. The reading aligns with the parallel Z4393 Stocks Loosening (abundant 2025 supply) for a bearish-corn setup. CBOT Corn front-month trades near 448 cents per bushel.

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How to use the signal today

As of November 2, 2026, the composite reads minus 0.83 and the state is El Nino Signature. The reading supports the author-thesis-aligned bearish-corn interpretation.

Pair with three confirming reads:

- **Z4545 NOAA Oceanic Nino Index (Inverted, Publication-Shifted).** The companion ONI signal with 3-month smoothing. ONI confirms ENSO persistence; this Nino 3.4 signal moves faster.
- **Z4381 Corn Silking Pace.** The downstream pollination-vulnerability signal. La Nina Corn Belt summers typically increase silking-heat risk; ENSO is a lead for the pace signal.
- **Z4393 US Corn Ending Stocks YoY.** The supply-balance read. ENSO signatures ultimately drive the growing-season yield that feeds the ending-stocks balance.

ENSO is a lead; pace and ending-stocks are the downstream realization.

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Methodology notes

Data sources. (A) NOAA monthly Nino 3.4 region SST anomaly. Published around the 1st to 7th of each month for the prior month.

Signal construction. Z-score the monthly SST anomaly against the historical distribution. Invert the sign (La Nina SSTs = positive composite). Tanh-bound to minus 1 to plus 1. Forward-fill monthly to daily. State thresholds plus or minus 0.5 extreme and plus or minus 0.2 moderate. Target: CBOT Corn back-adjusted continuous.

Validation statistics. Daily Spearman IC against CBOT Corn fwd 60-day return is plus 0.252 at p-value 4.1e-130 across 8,984 live-signal days. Three-regime per-day means: La Nina Signature minus 1.09 percent (edge minus 1.38 pp vs plus 0.29 percent baseline), ENSO Neutral minus 4.66 percent (edge minus 4.95 pp), El Nino Signature minus 2.07 percent (edge minus 2.36 pp). Baseline median minus 1.01 percent and standard deviation 10.89 percent.

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What this signal does not cover

First, the signal reads Nino 3.4 SST only. Other ENSO indicators (SOI, MEI, ONI) have slightly different timing and smoothing. The sibling Z4545 ONI signal covers the smoothed version.

Second, the ENSO-to-corn mechanism operates over multi-year climate cycles. The 60-day forward-return window captures only a slice; the signal is strongest as a multi-year lead.

Third, the polarity inversion is a deliberate author choice. A reader reconciling against raw Nino 3.4 SST should remember +1.0 composite = La Nina = SSTs COOL.

Fourth, non-ENSO climate drivers (Atlantic Multi-Decadal Oscillation, PDO, Indian Ocean Dipole) are not captured and can shift the growing-season outlook independently.

This research brief is for informational purposes only and does not constitute investment advice. Data sources: NOAA monthly Nino 3.4 region SST anomaly, CBOT Corn back-adjusted continuous target. State-conditional statistics computed through 2026-10-30.