The Iowa and Minnesota Hog-Belt Heat Signal, And Why Thirty-Day Severe Day Accumulation Still Precedes Supply Tightening

Why daily Temperature-Humidity Index severe-day counts across the US number-one and number-two hog states, accumulated on a thirty-day rolling window and tanh-bounded, deliver the a-priori bullish-LH direction the engine's physiology-based mechanism predicts, despite a polarity-INVERT tag that would flip the sign incorrectly.

David Stendahl · Market Lab Analytics · October 28, 2026

What this signal is

Hogs have no functional sweat glands. They rely on behavioral thermoregulation and panting for heat dissipation, which is why their SEVERE Temperature-Humidity Index stress threshold is lower than cattle. Iowa and Minnesota together house approximately forty percent of US hog inventory. When summer heat accumulates across the hog belt, hog average daily gain compresses by five to fifteen percent, feed intake falls, and breeding success can drop ten to twenty percent in high-THI windows. The compound effect is a thirty-to-sixty-day forward supply tightening in finished hogs.

This signal counts daily SEVERE or MODERATE stress days across the Iowa and Minnesota hog belt on a thirty-day rolling window, z-scores on a trailing five-year window, and bounds the result from minus one to plus one. When the composite climbs, stress accumulation is building. When it falls, cool conditions are letting the hog belt run near trend.

On July 1, 2024, as mid-summer severe heat accumulated across the hog belt and the composite entered sustained positive at plus 0.58, LH rose 16.2 percent over the next sixty trading days as August and September contracts priced the supply tightening. On June 22, 2022, as an early-summer heat spike hit Iowa and Minnesota and the composite registered plus 0.73, LH rose 16.2 percent over the next sixty trading days through late July and August. On May 15, 2023, as spring was running cool and the composite registered minus 0.58, LH rose 22.5 percent over the next sixty trading days driven by US-side supply tightening that overrode the heat signal.

Today the composite reads minus 0.42 as of October 27, 2026. The cool-side state has been running for 11 trading days as the Iowa and Minnesota hog belt has moved into the fall cool window. The thirty-day composite average sits at plus 0.06, meaning the signal was running near-neutral through most of October before falling into the mild-cool zone over the last two weeks.

Here is the honest finding. The engine's a-priori mechanism (severe heat → ADG compression + feed intake drop + breeding success down → thirty-to-sixty-day forward supply tightening → bullish LH) survives the thirty-six-year parquet. The EXTREME_POS state has delivered mean fwd 60-day LH returns of plus 1.64 percent, plus 1.38 percentage points above baseline. The Spearman information coefficient is positive at every horizon (plus 0.043 at h=20, plus 0.022 at h=60, plus 0.060 at h=125). The signal works as the engine's mechanism predicts. But the engine source carries a polarity INVERT tag that would flip the direction when consumed by downstream graders, a tag that is empirically incorrect and that this brief flags for a future engine refresh pass. Read on for three cases that frame how to read this signal with its correct empirical polarity, the state-conditional evidence, and the four caveats.

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How the inputs compose

The FEEDLOT_THI_DAILY source aggregates daily temperature and relative humidity observations across US hog-production monitoring stations. The Temperature-Humidity Index combines daily maximum temperature with daily relative humidity into a composite stress metric; days above approximately 84 THI are flagged SEVERE for hogs, with MODERATE conditions sitting in the 78 to 84 range.

The engine reads the daily indicator for SEVERE or MODERATE stress days across US_HOG_BELT_IA_MN, takes a 30-day rolling sum (so a reading of 30 means thirty consecutive days at or above moderate stress), z-scores on a trailing 1,260-trading-day window (approximately five years) with a 60-day minimum sample population (shortened from the standard 252-day minimum per cookbook convention for seasonally-concentrated signals), and bounds by tanh. No sign flip in the engine body: a high stress-day count prints positive.

The engine source carries a polarity annotation of composite_direction = "INVERT", which instructs downstream graders to flip the sign of the raw composite. This brief and the live page document that the INVERT tag is empirically incorrect; the raw composite's direction already matches the a-priori mechanism (positive composite = bullish LH on supply tightening).

The regime state machine maps the composite to five bands at the plus-or-minus 0.5 and plus-or-minus 0.2 thresholds. EXTREME_POS above plus 0.5 (24.5 percent of the sample). MODERATE_POS between plus 0.2 and plus 0.5 (4.3 percent). NORMAL between minus 0.2 and plus 0.2 (6.8 percent). MODERATE_NEG between minus 0.5 and minus 0.2 (9.9 percent). EXTREME_NEG below minus 0.5 (54.4 percent). The sample is heavily skewed to the cool-side because the hog belt has long cool-season stretches between summer heat peaks.

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Three cases that frame how to read this signal

Case 1: July 2024. Mid-summer heat accumulation into supply tightening. The dominant pattern.

Firing date: July 1, 2024 at composite plus 0.5792. Forward 60-day LH return from entry: plus 16.2 percent.

Context: summer 2024 saw sustained SEVERE and MODERATE stress day accumulation across Iowa and Minnesota through late June and early July. The composite entered sustained positive on the thirty-day rolling count exceeding trailing five-year trend. US hog ADG compressed through the second half of July; packer kill-weights began to decline on the pipeline; breeding herd efficiency metrics (per NASS Quarterly Hogs and Pigs) showed modest tightening into Q3.

LH August and October 2024 contracts rallied through late July, August, and September as the market priced the supply-side tightening the signal had foreshadowed. The 2024 case is a clean confirming example of the signal's a-priori mechanism working: heat accumulation drives physiological stress, physiology compresses production, production compression feeds forward into LH futures.

Case 2: June 2022. Early-summer heat spike. The timing-leading case.

Firing date: June 22, 2022 at composite plus 0.7297. Forward 60-day LH return from entry: plus 16.2 percent.

Context: a sharp early-summer heat spike hit Iowa and Minnesota in mid-June 2022, driving sustained SEVERE stress days. The composite jumped to deep positive within the thirty-day rolling window. The signal fired early in the summer cycle, giving an unusually long forward signal before the peak heat window.

LH July, August, and October 2022 contracts rallied through late June, July, and August on the forward supply tightening the signal foreshadowed. The 2022 case teaches that early-season heat spikes can be more informative than late-summer accumulation because the forward 60-day window captures a longer stretch of the subsequent production response.

Case 3: May 2023. Cool spring, LH rallies anyway. The US-supply override.

Firing date: May 15, 2023 at composite minus 0.5767. Forward 60-day LH return from entry: plus 22.5 percent.

Context: spring 2023 was running cool across Iowa and Minnesota; the composite registered deep cool. The signal's physiology-based mechanism would call this bearish LH on comfortable production conditions.

Instead, LH rallied 22.5 percent through late May, June, and July 2023. The driver was US-side supply tightening unrelated to the heat signal: sow slaughter was running above year-ago through Q2 2023, the breeding herd was contracting, and packer margins were under pressure from elevated feed costs. The heat signal registered cool conditions correctly; the LH price was driven by variables the signal cannot see.

The 2023 case teaches that this signal reads physiology-driven production constraints only. When US-side structural supply dynamics (sow slaughter, breeding herd, feed costs) dominate, the heat signal can miss.

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What the state-conditional returns have actually done

The SPY forward-60-day return baseline (unconditional) is mean plus 2.31 percent, median plus 3.13 percent. Standard deviation 7.23 percent. Percent negative 29.8 percent. State-conditional means below are expressed as edges relative to this baseline.

> **Reference baseline (8,986 LH-aligned trading days from November 1990 through roughly July 2026)**
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> LH forward-60-day return baseline (unconditional): mean plus 0.26 percent, median minus 0.24 percent. Standard deviation 10.9 percent. Percent negative 51.7 percent. Phase 0 source: Z4774 engine parquet joined with LH back-adjusted continuous closes.

The signal's EXTREME_POS state (composite above plus 0.5), 2,204 trading days, delivered a mean forward 60-day LH return of plus 1.64 percent. That is plus 1.38 percentage points above baseline. The state is the strongest constructive-forward-LH regime in the sample on the physiology-based supply-tightening mechanism.

The MODERATE_POS state (composite between plus 0.2 and plus 0.5), 390 days, delivered mean plus 0.25 percent, near-baseline. Small-n, mild positive.

The NORMAL state (composite between minus 0.2 and plus 0.2), 607 days, delivered mean plus 1.06 percent, plus 0.80 pp above baseline. Mid-range composite values deliver above-baseline returns.

The MODERATE_NEG state (composite between minus 0.5 and minus 0.2), 893 days, delivered mean minus 0.12 percent, minus 0.38 pp below baseline. The signal's cool-side bearish prior starts to show.

The EXTREME_NEG state (composite below minus 0.5), 4,892 days, delivered mean minus 0.39 percent, minus 0.65 pp below baseline. The modal state in the sample (54 percent) at the cool side, consistent with hog-belt winter and shoulder-season patterns.

The spread between EXTREME_POS and EXTREME_NEG forward returns is plus 2.03 percentage points at 60 days. Spearman information coefficient of the composite against LH forward 60-day returns is plus 0.0223 (p = 0.035, n = 8,986), mildly significant. At h=20 IC is plus 0.043 (strongly significant). At h=125 IC is plus 0.060 (strongly significant). The IC is positive across all horizons, consistent with the a-priori direction.

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How to use the signal today

This is a seasonal-cycle regime lens with strongest signal in summer months.

Three best uses.

First, as a confirming lens on US LH summer-month exposure. The signal is most informative between June and August when Iowa and Minnesota heat variability is highest. Allocators adjusting LH exposure around the summer expiries (July, August, October contracts) can use the signal to confirm or push back on supply-side-driven moves.

Second, as a leading indicator for August-October LH. The thirty-day rolling input + 60-day forward return mapping means the signal typically fires in mid-June through late August and captures the subsequent 60-day production response. The 2024 and 2022 cases both fit this pattern.

Third, as a divergence check against US-side structural supply signals. When this signal reads EXTREME_POS (summer heat) and NASS sow slaughter is also running elevated (US supply tight-

ening), the two signals compound and the forward LH response is likely strong. When this signal reads EXTREME_NEG (cool conditions) but sow slaughter is still elevated, the US-side signal dominates (May 2023 counter-case).

Important polarity note: the engine source carries a composite_direction = “INVERT” tag that is empirically incorrect per the state-conditional analysis. Parent LH composites that respect the INVERT tag will apply a sign flip that reverses the direction of a signal already correctly oriented. The brief recommends treating the engine output as AS_IS (positive composite = bullish LH); the INVERT tag should be removed in a future engine refresh pass.

Today’s reading at minus 0.42, 11 trading days in MODERATE_NEG, places the signal in the mild-cool zone as the hog belt moves into fall cool-down. The historical pattern of fall cool entries has been mild downside bias (-0.38 pp below baseline).

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Methodology notes

The signal’s historical Spearman information coefficient against LH forward 60-day returns is plus 0.0223 (n = 8,986, p = 0.035). The sign is positive across all practical horizons: plus 0.043 at h=20 (strongly significant), plus 0.022 at h=60 (mildly significant), plus 0.060 at h=125 (strongly significant). The signal’s a-priori direction is empirically supported.

Polarity INVERT tag flagged as empirically incorrect: the engine source carries `polarity.composite_direction = "INVERT"` at line 56. Per the state-conditional analysis (EXTREME_POS delivers +1.38 pp above baseline, EXTREME_NEG delivers –0.65 pp below), the raw composite is correctly oriented. The INVERT tag would flip the direction when consumed by downstream graders, which would be incorrect. The recommended patch is to change the tag to “AS_IS” in a future engine refresh pass. The brief and page document the correct empirical direction.

The regime state machine uses the plus-or-minus 0.5 and plus-or-minus 0.2 composite thresholds. Sample distribution is heavily cool-side skewed: 54.4 percent in EXTREME_NEG, 24.5 percent in EXTREME_POS, 21.0 percent in the middle three bands combined.

Four complete sample episodes anchor the EXTREME_POS calibration: the 2009 summer heat window, the 2012 summer during the Midwest drought (compound shock), the 2022 early-summer spike, and the 2024 mid-summer sustained accumulation.

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What this signal does not cover

Four caveats on the signal’s reach, each stated plainly.

First, the engine source carries a polarity INVERT tag that is empirically incorrect. Parent composites must not apply the sign flip; the raw composite is correctly oriented.

Second, the signal reads physiology-driven production constraints only. US-side structural supply dynamics (sow slaughter, breeding herd, feed costs, packer capacity) are not reflected. When these dominate (May 2023 counter-case), the signal can miss direction.

Third, the signal uses SEVERE OR MODERATE combined stress-day count. Finer separation (SEVERE-only vs MODERATE-only) could sharpen the signal in a future refresh. The current construction may include mid-level stress days that are not biologically-driving.

Fourth, this is a moderate-moving signal. Half-life approximately 30 to 45 trading days given the 30-day rolling input and 1,260-day z-window. The signal responds to multi-week stress accumulation, not to daily heat events.

Not investment advice. The analysis in this brief is informational and educational. The engine source carries a polarity INVERT tag that is empirically incorrect; this brief and the live page document the correct empirical direction. Signal readings, historical case figures, and empirical statistics are derived from publicly available data (CME CBOT Lean Hog settlement prices for 1990 to 2026 via vendor archive; USDA National Agricultural Statistics Service Quarterly Hogs and Pigs; feedlot-stress Temperature-Humidity Index observations across the Iowa and Minnesota hog belt) and are provided without warranty. Hypothetical performance results have inherent limitations. Readers should consult their own financial advisor before making any investment decision. (c) 2026 David Stendahl.