Episode Book

EPISODE #6053

Köppen's 30 Boxes vs. a Changing Planet

PUBLISHED	17 October 2026 at 11:16 UTC
DURATION	20:11
LISTEN	myweirdprompts.com/episode/koppen-climate-classification-limits-84299/
HOSTS	Corn, Herman, Larry, Hilbert
SCRIPT MODEL	deepseek-flash
VOICES	chatterbox-regular (chatterbox-local)
PIPELINE	V5.9
SOURCES	11 cited by the research (listed at the end)
BOOK GENERATED	19 October 2026 at 17:43 UTC

SYNOPSIS

Every square kilometre has a climate nothing else quite shares, yet climatologists compress that vast list into a handful of archetypes. This episode digs into the two families of climate classification — genetic methods that sort by causes, and empiric methods like Köppen-Geiger that sort by effects — and asks whether the archetype is a real instrument or a convenient fiction. From Trewartha's fix for Köppen's fat mid-latitude group to Thornthwaite's soil water budget and the air-mass schemes that abandon averages entirely, we trace what each system throws away. Then we point the map at a changing climate: roughly 5% of global land has already moved to a different major Köppen class since 1901–1930, Hungary sits at 81% shifted, and the classification is structurally blind exactly where warming bites hardest. A taxonomy episode about what a class can and cannot tell you.

TRANSCRIPT



Corn

The atlas runs out of colours somewhere around the Caspian Sea, and you stop looking. One page, maybe two, the whole planet reduced to bands. That's the thing I keep chewing on.



Herman

Every square kilometre has a climate nothing else quite shares, and the map hands you eight colours and a legend.



Corn

That's the tension Daniel's poking at. He says every place has a slightly unique climate, the interaction of local landscape and global forces, and then climatologists take that vast list and stratify it into a few archetypes. He wants to know what the basic stratification actually is, and whether the compressing is a worthwhile exercise for people studying climate change and drafting policy.



Herman

Worthwhile how, though. That's the interesting half of the question.



Corn

Whether the archetype is a real instrument or a convenient fiction. And whether you can point it at a changing climate and then hand the result to a regulator.



Herman

The bit that gets me is that both halves of Daniel's prompt are testable. What's the map, and does it hold up under use.



Corn

Before we argue about whether the archetypes are worth having, somebody should say what they actually are.



Herman

Give me one clean sentence first, because the whole thing hangs on a distinction most people never hear. Climate classification splits into two families. Genetic methods sort places by causes. Air-mass frequency, where a place sits within the passing weather systems.



Corn

And the other family?



Herman

Empiric. You sort by effects. What grows there, how much water leaves the soil, which biome it resembles. Köppen is the second kind, and that's not a small footnote. It's the reason the system can serve as an ecological indicator later and the reason it has the blind spot it has.



Corn

The map in the atlas is a compression algorithm. It throws away nearly everything about a place to keep the one thing that lets you compare Hungary to Canada.



Herman

Roughly. The main characters are Köppen-Geiger, that's the dominant one, then Trewartha, Thornthwaite, Holdridge, and the air-mass schemes that try to classify by the weather itself rather than the average.



Corn

Two colours on a page, one argument underneath about what a class can even tell you.



Herman

Let's start with the system everyone has actually seen, the one on the wall of a geography classroom.



Corn

Köppen needs a person attached to it, because the man's job explains the design.



Herman

He was a botanist. That's the lot. His five major groups were drawn to line up with the major ecosystem types, so regions landing in the same class share broadly similar vegetation. He published in 1884, revised in 1918 and 1936, Geiger came in during the fifties and early sixties and left his name on it.



Corn

Five groups, A tropical, B dry, C temperate, D continental, E polar, and thirty sub-classes underneath.



Herman

The sub-classes are just letters stacked. Af is tropical rainforest, Cfb is oceanic with a warm summer, Dwb is semi-monsoonal continental with a warm summer. Two letters do a lot of work when you've only got thirty boxes for a planet.



Corn

Thirty boxes, and one of them is holding both London and New Orleans.



Herman

That's the flaw, and it's the reason Trewartha exists. Under plain Köppen the temperate C group is enormous. London and New York sit in group C alongside Brisbane and New Orleans, which is a category that's stopped discriminating.



Corn

Coastal drizzle and subtropical swamp in one column.



Herman

Trewartha's fix was to split the mid-latitudes by how long the warm season lasts. Subtropical is eight or more months at ten degrees or above, temperate is four to seven months, boreal is one to three. Same idea, finer comb. Also, under Köppen, Washington and Oregon share zone Csb with parts of Southern California, which tells a farmer almost nothing useful.



Corn

So Trewartha patches the group that got too fat. What does Thornthwaite patch?



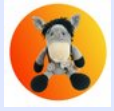
Herman

Water. Thornthwaite is 1948, and instead of asking what grows, it tracks the soil water budget through evapotranspiration. Humidity and aridity indices running from hyperhumid down to arid, thermal classes on top. Microthermal, mesothermal, megathermal.



Corn

Under that index, a third of the land is arid or semi-arid. Which is a more honest number than Köppen gives you.



Herman

Holdridge is the elegant one. Nineteen forty-seven, uses biotemperature, precipitation, latitude and altitude in a triangular chart. You can read a life zone off two axes and a position.



Corn

And the air-mass schemes give up on averages entirely.



Herman

The Bergeron family, and the Spatial Synoptic Classification as the modern version. Six categories. Dry Polar, Dry Moderate, Dry Tropical, Moist Polar, Moist Moderate, Moist Tropical. You classify a place by which air masses reach it and how often.



Corn

That's the genetic family. Sorting by the cause rather than the symptom.



Herman

Right, and it fixes the thing that bothers me about Köppen, which is that a monthly average is a number nobody experiences. You don't live in a July mean, you live in the days.



Corn

What turns a latitude band into a specific place, though? That's the half of Daniel's prompt that's landscape rather than taxonomy.



Herman

The criteria in Köppen are just monthly temperature and monthly precipitation. Nothing else. But the modern one-kilometre maps aren't built from station averages alone. They're built from climatologies that have been corrected for topography. Elevation, slope, the shape of the ground.



Corn

Which is how a one-kilometre grid catches a mountain valley a coarse map would smear across the whole region.



Herman

It also catches small islands. There are island climates that a two-hundred-kilometre grid simply erases, because the island falls between the cells.



Corn

Rain shadow is the clean example of a landscape manufacturing a climate out of a region's average.



Herman

Mountains block the path of moisture and precipitation. The windward side wrings the water out of the air, the lee side gets the left-over air, dry and warmed. That's how a good number of the world's deserts are made. They're not a latitude phenomenon, they're a rock phenomenon.



Corn

The global forces give you the latitude band. The rock decides what kind of place it turns into.



Herman

And this is where the honest weakness has to be said out loud, because it's structural, not a bug they'll patch. Classification puts a boundary between zones, and nature has a gradual transition instead. A line on a map is a decision, not a discovery.



Corn

Somebody drew it, and a mountain slope quietly ignores it.



Herman

There's a second-order version of that, too. Biome change doesn't have to follow class change. A place can move into a different Köppen class and its vegetation doesn't shift with it, because soil, CO2 fertilisation, fire, invasive species and land use are all sitting on top of the climate as separate variables.



Corn

The classification is a description of a climate. It's not a prophecy about a plant.



Herman

The map in the atlas isn't one thing either. It's the same answer, but it's not a fixed reference. Those one-kilometre maps get rebuilt for each thirty-year period, from corrected climatologies. It's not the plate in the textbook. It's a file that gets re-made.



Corn

Held still long enough to print and not one day longer.

L

Larry

Are you tired of climates that change every thirty years without asking permission? Introducing Climate Tier, the only monthly subscription box for people who want their local weather delivered. Tier One, Temperate Curious. You receive one leaf, seasonally appropriate, cancellation fee applies. Tier Two, Arid Enthusiast. A jar of dust, forty-page manual, no refunds ever. Tier Three, Continental Premium. Nineteen consecutive days of drizzle, delivered by courier. Cancel any time, meaning never, and we keep charging your card. Climate Tier. The climate you own, every month.



Herman

Temperate Curious. A leaf. Climate is a thirty-year average, not a leaf.



Corn

Let it go, Herman.



Herman

I cannot let it go, it said the climate changes every thirty years. The thirty years is the window you measure in, not the rate anything happens at.



Corn

The ad's wrong and the leaf is a leaf. Move.



Herman

Point taken.



Corn

The taxonomy's done. What happens when you point it at a changing climate and hand the result to a regulator?



Herman

This is where the archetype earns its keep, and the numbers are the argument. Between the period 1901 to 1930 and the period 1991 to 2020, about five percent of global land outside Antarctica moved to a different major Köppen class.



Corn

Five percent doesn't sound like much until you put a landmass next to it.



Herman

Two point six million square kilometres go from polar to cold under the middle scenario, which is roughly Argentina. Two point four million cold to temperate. One point one million cold to arid. Two point eight million temperate to tropical, that's the biggest single flow.



Corn

So the archetype is what lets somebody say a sentence like that at all.



Herman

Without the class you'd be talking about temperature deltas per pixel, which nobody can hold in their head, and no minister can act on. The class is the unit that makes the change sayable.



Corn

And the projections to the end of the century?



Herman

Five percent of land changes major class under the low scenario, eight under the middle, thirteen under the high. Under the middle one, land suitable for tropical vegetation grows eight percent, arid grows four. Temperate loses three, cold loses two, and polar loses a third.



Corn

A third of the polar class is one long, slow eviction.



Herman

Now the flaw, because there is one and it's beautiful. Köppen put deserts and the tropics near the top of the temperature scale. Which means the hottest places in the classification cannot change class. There's nowhere hotter to go. They only get hotter inside the box they already occupy.



Corn

So the tool that tells you how much land will change class is structurally blind in the places changing hardest.



Herman

The instrument shapes what change is visible. That's not a small philosophical point, that's a reporting gap at exactly the latitude where it hurts. And there's a second one. The maps are validated against more than a hundred and seventy thousand weather stations,



Herman (continued)

and they hit about seventy-nine percent to eighty-six percent on the thirty sub-classes.



Corn

Accuracy figures that high on thirty boxes is respectable. Where's the problem?



Herman

The accuracy for the recent period is lower than for the earliest one. Seventy-nine percent against eighty-six. The authors put it down to the climate moving under the labels. A single class is harder to pin a place to when the place is halfway between two.



Corn

The archetypes are getting blurrier exactly as we need them.



Herman

One of the explainer pieces around that dataset runs a line I keep thinking about. These maps were made for a climate that doesn't exist any more.



Corn

Give me a country, because a percentage of global land doesn't scare anybody.



Herman

Hungary. Eighty-one percent of the country has already shifted into a different, more temperate zone. The most of any nation in the dataset.



Corn

Eighty-one percent of a country whose building regulations were written against the old number.



Herman

Canada and Russia are at twenty-four percent already shifted, with another thirty-nine to forty percent to follow by the end of the century. Eastern Europe is the hotspot. Cold-winter continental becoming temperate with hot summers. South Africa, Eswatini and Lesotho, twenty-eight percent shifted with another forty-four to come. Australia, fourteen and thirteen.



Corn

Hungary's the case that matters for policy, because a building code is a promise that a zone is stable.



Herman

Which is exactly what the building literature means by a climate zone. A region where the climatic variables vary little, so you can apply uniform mandatory values across the whole area without arguing about every site. The United States assigns every county a zone through the energy code and the Department of Energy's programme, and that zone sets mandatory envelope requirements. Insulation, glazing, air tightness.



Corn

So the entire justification of the zoning is that the variation inside it is small.



Herman

And Hungary is the country where it stopped being small. The regulatory map is now describing a climate the country doesn't have. Whether anyone has redrawn it is a separate question, and I don't have a clean answer to that.



Corn

Agriculture does it too. Brazil's zoning,



Herman

ZARC, implemented in ninety-six. It delineates municipalities and planting windows by agroclimatic risk, and all of it sits underneath crop insurance and rural credit. If you plant outside your window you lose the cover.



Corn

Which is a much sharper instrument than a building code, because it fires the same season.



Herman

There's a fork in the road here that Daniel's prompt is really pointing at, and I don't think most people see it. There are two different kinds of stratification in play, and they answer different questions.



Corn

Go on.



Herman

Köppen stratifies by what the climate is like. Bioclimatic type. The IPCC doesn't use Köppen for its policy regions at all. It uses its own reference regions, forty-six land, fifteen ocean, three hybrid, drawn as shapes on the globe. That stratifies by where a place is. So one system tells you what a place can grow. The other tells you whose projections to go read.



Corn

The same word, region, doing two unrelated jobs.



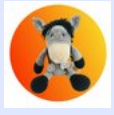
Herman

And policy needs both. The building code needs the type, because the type tells you what the envelope has to do. The IPCC needs the place, because a projection is only meaningful over a defined footprint. Nobody has to choose between them and it'd be a mistake to think one replaced the other.



Corn

There's a last layer underneath all of it, which is that every number we've said comes out of a model.



Herman

Sixty-seven models get evaluated for this work. Eighteen of them have all the sensitivity metrics inside the likely ranges. The rest get dropped, and forty-two are retained overall.



Corn

Which is a polite way of saying the ensemble is not a democracy.



Herman

The line in the paper is that using the full set uncritically can mislead you, and shouldn't guide real decisions. So the archetype is only as good as the projections being poured into it. A clean instrument fed a bad ensemble gives you a confident wrong map.



Corn

Sixteen years of my life went into believing the atlas was a reference. That's not the paper's fault.



Hilbert

They were right, mostly.



Corn

Mostly.



Hilbert

The compression works. I'd go further than either of you, though. The most consequential climate classification in an ordinary person's life isn't Köppen. It's the number on the back of a seed packet.



Herman

The hardiness zone.



Hilbert

Zone six. That's what it said when I bought the place, and it says zone seven now, on the newer packets, for the same garden. Nobody surveyed the garden. The number came down from a county extension office that reclassifies in bulk, and the packet printer absorbed the change a year or two later and nobody told the people planting.



Corn

And you checked.



Hilbert

I checked. I rang the extension office in the spring and asked which map they were using, and the woman said she'd have to get back to me. That was four years ago. She hasn't got back to me and I haven't stopped asking.



Herman

Four years of phone calls.



Hilbert

Two calls a year, mostly, plus the letters. I wrote to the state office twice. Second letter I enclosed a photocopy of the old packet and the new packet side by side, circled the number, and wrote underneath, which one is true. No reply. I keep the copies in a shoebox, sorted by year, and I've got a shoebox and a half.



Corn

A shoebox and a half of seed packets.



Hilbert

This level's a bit hot on the second one, Herman, bring it down a touch on the next pass.



Herman

Noted.



Hilbert

The part I object to is that a grower picks a variety by that number. You buy a tree that's rated for zone six and the winter takes it, you've lost five years before your first crop. The number decides what gets planted. Nobody audits it. The whole of Köppen gets its thirty-year revision and its hundred and seventy thousand weather stations, and the packet gets a number that was assigned to a county before the grower was born.



Herman

The reclassification does come from the same kind of data, just at a coarser scale, county by county, lowest winter temperature averaged over a window. It's the same instrument, badly lagged.



Corn

Which is why the letters.



Hilbert

I planted a zone seven pear anyway. It came through four winters and then died in the fifth, and I know exactly which winter it was.



Corn

How much did the pear cost?



Hilbert

Forty-one dollars, bare root, postage included. I've still got the invoice.



Corn

I'll take the pear over the whole atlas.



Herman

A seed packet is a policy document that fits in a pocket. The zone is a mandatory value applied uniformly across an area, same definition as the building code, except it's enforced by the plant dying.



Corn

And the woman on the phone is the regulator.



Herman

Which sets up the question we can't answer on air, which is what happens when the map gets coarser because the ground underneath it moved.



Corn

If the instrument blurs as the climate shifts, do we build a sharper instrument or just accept a map that lies by the decade?



Herman

And the structural point sits underneath it. The hottest zones can't change class, they only intensify, so the map will always under-report change in the places changing hardest. An instrument that under-reads its own loudest signal.



Corn

Which is the thing to leave people with. Also, Hilbert's pear died in a winter nobody at the extension office ever asked about.



Herman

Producing today by Hilbert Flumingtop, who is owed a phone call from a county office. If you want more of this, try episode four, If Your Voice Ages, Does Your Fine-Tune Become Useless; episode twenty, Architectural AI; and episode eleven, How Does Fine Tuning Work Anyway. This has been My Weird Prompts.



Corn

Reviews help more than the leaf does. See you soon.

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