

Civilizational Costs

Nathan J. Richmond · Drafted September of 2026

Anthropogenic Planet

In March 2024, the institutions entrusted with maintaining the Geological Time Scale declined to place the Anthropocene on it. After fifteen years of formal investigation, the Subcommission on Quaternary Stratigraphy rejected a proposal for a new epoch beginning in 1952; the International Commission on Stratigraphy and International Union of Geological Sciences approved that rejection. Formally, we remain in the Meghalayan Age of the Holocene. The decision did not settle whether humans have transformed the planet. It settled the narrower question of whether one proposed transformation should begin a new unit of geological time at one exact horizon ^[160].

The proposed line was literally radioactive. In the annually layered sediment of Crawford Lake, Ontario, a dark lamina deposited in 1952 records a rapid rise in the combined concentration of plutonium-239 and plutonium-240. These artificial isotopes were dispersed by above-ground thermonuclear weapons tests; their appearance could be correlated with records far beyond one Canadian lake. The plutonium was not offered as the cause or total meaning of the Anthropocene. It was offered as its timestamp: an unusually sharp, persistent, and nearly synchronous mark made by humans in the accumulating body of the Earth ^[161].

What those geologists were trying to locate was a formal “we” in stone – a layer at which the effects of humans ceased to be only local, regional, or staggered and became legible around the planet. The plutonium upturn coincided with a wider mid-century rupture: fossil-fuel combustion, industrial chemistry, fertilizer use, sediment movement, species transfers, plastics, concrete, and rapidly changing carbon, nitrogen, and phosphorus cycles. The Great Acceleration is not one smooth curve, but its records show a pronounced post-1950 intensification across many socioeconomic and Earth-system measures ^[159].

Yet the Earth had been recording us for far longer. Shell middens, agricultural soils, earthworks, legacy sediments, and deliberately enriched earth appeared at different times in different places. Some anthropogenic shell-midden soils became widespread between roughly 12,000 and 6,000 years ago; Amazonian dark earth later preserved another durable record of people making soil rather than merely exhausting it. These are not weaker examples of human agency. They are older, plural, and asynchronous ones. That is precisely why some geologists argue that the Anthropocene is better understood

as an unfolding, intensifying event than as an epoch forced to begin everywhere at once [162][163].

The rejected boundary therefore opens the question rather than closing it. Nineteen fifty-two is not the birth of human influence, and a plutonium horizon is not the whole human story. It is the moment one proposed signal became planetary enough to draw a line. To understand the animal that eventually wrote itself into sediments across the Earth, we have to begin before one species stood alone: in a more diverse world, among megafauna and a bushy human genus in which humanity was born, met itself, and mixed more than once.

A History of Humans

A species within a lineage

We also did not emerge at the top of a clean, single-file ascent. The human family tree was bushy: multiple hominin lineages overlapped across changing Pleistocene landscapes, alongside animal communities far richer in large-bodied species than most people now encounter. *Homo sapiens* met and interbred with other humans. Genomes from roughly 45,000-year-old people place a major Neanderthal admixture event shared by the ancestors of living non-Africans around 45,000–49,000 years ago; most present-day non-African populations retain roughly 2–3% Neanderthal ancestry [156]. Denisovan evidence is even more fragmentary and expansive: a 2024 review found genomic evidence for at least three introgression events from distinct Denisovan populations, despite a fossil record still represented by only a small number of bones and teeth [157].

Assimilation was therefore not peripheral to the making of modern humanity. Genetic exchange preserved pieces of other human histories inside living populations, sometimes contributing variants later shaped by selection. We cannot calculate how much social knowledge, technology, language, care, conflict, or ecological adaptation also crossed between groups; archaeology and DNA can establish contact more readily than they can reconstruct its full human meaning. Nor can the disappearance of other hominins be assigned to one cause. Climate, small and isolated populations, competition, absorption, and other pressures interacted over immense spans of time.

The megafaunal world also diminished unevenly. Humans, climate change, and ecological transformation affected different species differently; a comparative ancient-DNA and radiocarbon study found no single explanation sufficient across mammoths, rhinoceroses, horses, bison, reindeer, and musk oxen [158]. The honest point is not that empire killed

the Pleistocene. Empire arrived much later. It is that the only surviving human lineage inherited a world already made through mixture and loss, then developed states, empires, and global property systems capable of imposing a new scale of simplification: absorbing peoples, enclosing shared land, suppressing languages, and replacing plural ecologies and institutions with forms legible to centralized power. A species produced by diversity became extraordinarily effective at destroying it.

How did most of us live?

The first problem is evidentiary. States leave walls, tax records, monuments, graves, armies, and authorized stories. Mobile people leave lighter traces, and oral knowledge can disappear with the people who carry it. Recent hunter-gatherers are not living fossils: colonial violence, land seizure, disease, trade, and displacement changed where and how they could live. Archaeology can recover tools, food remains, buildings, paths, bodies, and landscapes, but political relationships do not fossilize cleanly. Any answer to how most humans lived must therefore distinguish strong recurring patterns from certainty the record cannot provide.

For almost the whole history of Homo sapiens, there was no state to issue identity documents, record property, collect a standing tax, patrol a fixed border, or preserve an official account of events. Our species has existed for roughly 300,000 years; agriculture emerged within roughly the last 12,000, and the earliest state-organized societies within roughly the last 5,000. That does not make hierarchy new. Parents direct children, skilled people acquire prestige, coalitions prevail in disputes, and coercion is far older than writing. What is historically unusual is an authority that permanently claims a territory, monopolizes legitimate force within it, and is difficult for an ordinary person to refuse or leave ^{[6][7]}.

How early societies organized

There was no single original human society. The familiar image of prehistory as nothing but tiny, nomadic, uniformly egalitarian bands is now challenged by evidence of much wider variation. A synthesis covering 34 ethnographic regions and archaeological evidence from 27 Middle Stone Age sites found non-agricultural peoples ranging from highly mobile and egalitarian groups to sedentary, populous, unequal, politically stratified societies capable of storage, resource management, and large-scale cooperation. Its authors propose a "diverse histories" model: social arrangements varied with ecology, technology, demography, and historical circumstance long before agriculture ^[147].

Variation does not erase the recurring structure found among many mobile foragers. A comparative study of 5,067 adults in 32 hunter-gatherer societies found that either women or men might remain in or leave their natal group, adult brothers and sisters often lived together, and most people sharing a residential band were not close genetic relatives. The average experienced band contained about 28 adults, but residence linked those bands into much larger social networks. Cooperation was therefore not confined to one isolated biological family. Marriage, friendship, exchange, visiting, reputation, and the option to relocate joined multiple communities together ^[148].

Authority inside these societies was often real without being permanently bundled into one office. A respected hunter could lead a hunt without owning the camp. An elder could carry ritual or ecological knowledge without commanding every household. A persuasive speaker could coordinate a decision without acquiring a police force. Groups could recognize expertise, prestige, age, kin obligation, gendered work, or temporary leadership while resisting a single person's attempt to convert influence into durable domination. Ridicule, refusal, withdrawal, coalition, ostracism, and, at the extreme, expulsion or violence could operate as leveling mechanisms. This was not the absence of politics. It was politics conducted through relationships in which power remained dependent on other people's continuing participation.

The ecological logic matters. A comparative framework developed by Hillard Kaplan, Paul Hooper, and Michael Gurven connects many forager social patterns to production that is skill-intensive, risky, and difficult for one person to monopolize. Children require years of provisioning while learning; food arrives unevenly; different kinds of work complement one another; and cooperation with kin and non-kin reduces the danger of individual failure. Where vital resources are dispersed, mobile, or difficult to defend, maintaining trusted partners can be more productive than enforcing exclusive control. The same framework predicts more durable inequality where land, livestock, stored food, or other productive assets become defensible and inheritable ^[149].

This helps explain why food sharing, cooperative childcare, multigenerational provisioning, negotiated residence, and broad exchange networks recur without proving that early life was peaceful or equal in every dimension. Sex, age, physical force, specialist knowledge, and control of scarce resources could all produce asymmetry. Some non-agricultural societies maintained hereditary ranks or slavery; conflict occurred within and between groups. "Egalitarian" in the careful anthropological sense usually describes active limits on domination and accumulation, not identical lives, perfect fairness, or an absence of leadership. The useful contrast is therefore not hierarchy versus harmony. It is concentrated, self-reinforcing command versus authority that remains plural, conditional, and answerable to countervailing power.

Why plural authority persisted

Small-scale organization kept several forms of correction available at once. People could challenge a proposal face to face, withhold cooperation, appeal to kin or allies, shift allegiance, split a camp, or move between connected groups. Seasonal fission and fusion let a society operate at more than one scale: small residential groups could disperse when resources were thin, gather for exchange or ceremony, and form larger coalitions when a task required them. The structure was neither a collection of sealed households nor one undifferentiated commune. It was a network of overlapping obligations.

That network distributed information as well as power. No central administrator needed to possess every practical model of weather, plants, water, animals, birth, illness, conflict, tools, routes, and neighboring peoples. Knowledge lived in different people and could be recombined through movement and association. A failed decision did not necessarily capture every group at once; an effective practice could spread through observation, marriage, exchange, and teaching. The system could be conservative where memory mattered and experimental where conditions changed.

Carole Crumley's concept of heterarchy gives precise language to this arrangement: "the relation of elements to one another when they are unranked or when they possess the potential for being ranked in a number of different ways" ^[1]. Building on Warren McCulloch's 1945 neurological concept, Crumley argued that hierarchy and heterarchy coexist and that complex societies can move between ranked and unranked configurations. The concept has since been applied across Maya studies ^[2], Indus Valley archaeology ^{[3][4]}, and governance theory ^[5].

Heterarchy should not be mistaken for a claim that prehistoric people had the same values, institutions, or liberties we might choose now. It names a structural possibility visible across very different societies: several centers of authority can coexist; rank in one domain need not become rank in all domains; and coordination can emerge without one institution absorbing every function. That possibility matters because the historical story told by states often collapses "organized" into "governed from above."

From settlements to cities without one inevitable ladder

The surviving archaeological record no longer supports the assumption that population, technical specialization, or infrastructure requires one dominant center. Michael Heckenberger documented "garden cities" in the Upper Xingu River basin of Brazil – multi-centric settlements organized as "small independent polities within a regional

peer polity" with no single dominant center ^{[8][9]}. These settlements supported 30,000 to 50,000 people regionally, emerged around AD 1200, and operated through a "galactic" urban form – central plaza settlements with four cardinaly oriented satellites connected by roads. Heckenberger's full account appears in *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, A.D. 1000–2000* (Routledge, 2005). ^[10] The Kuikuro descendants of these city-builders continue to manage one of the world's largest contiguous tracts of protected tropical forest.

LIDAR technology has dramatically expanded the known scale of Amazonian urbanism. In January 2024, Stéphen Rostain and colleagues published the discovery of more than 6,000 earthen platforms connected by wide, straight roads in Ecuador's Upano Valley – a networked urban system occupied from approximately 500 BCE to 300–600 CE, making it at least 2,500 years old and over a millennium older than any previously known complex Amazonian society ^[11]. Population estimates reach at least 10,000 people across five large and ten smaller settlements. In Bolivia, Heiko Prümers revealed the Casarabe culture's four-tiered settlement system spanning 4,500 km², with sites featuring conical pyramids up to 22 meters tall and an estimated 570,000 cubic meters of earth moved at Cotoca alone ^[12]. Clark Erickson documented the broader Llanos de Mojos region, where pre-Hispanic peoples built permanent earthen fish weirs covering over 500 km² – the largest fish weir complex ever reported ^[13].

The governance models of these LIDAR-revealed cities remain under active investigation. Rostain compares the Upano layout to Maya urban systems; the Casarabe culture's monumental architecture and four-tier settlement classification suggest significant social complexity, but whether primary sites were hierarchical seats of power or heterarchical nodes has not been determined. What is clear is that these societies achieved massive coordinated infrastructure – roads, causeways, water management systems, and agricultural terracing. Their physical form demonstrates complexity; it does not by itself settle how authority was distributed.

Beyond the Americas, the pattern recurs. Çatalhöyük in Turkey (ca. 7500–5600 BCE) housed 8,000–10,000 people in what excavator Ian Hodder describes as an "aggressively egalitarian society" – no public buildings, no temples, no houses distinguishable by size or wealth, equal diets and workloads for men and women confirmed by skeletal analysis ^[14]. A 2025 DNA study published in *Science* ^[15] found intergenerational burial ties established predominantly through maternal lineage. The settlement persisted for nearly 1,500 years.

The Indus Valley/Harappan civilization (ca. 2600–1900 BCE) covered over one million km² – larger than Egypt and Mesopotamia combined – with uniform bricks, standardized

weights, and the world's earliest urban sanitation, yet no palaces, no monumental temples, no royal tombs, no depictions of rulers. Adam Green's landmark 2021 analysis argues that "urbanization, collective action, and technological innovation are not driven by the agendas of an exclusionary ruling class... and can occur in their total absence" ^{[16][17]}. Gregory Possehl proposed a stateless complex society model – integration through shared values rather than bureaucracy ^[4].

The Haudenosaunee Confederacy provides perhaps the best-documented example of sustained distributed governance at scale. Founded approximately 1142 CE according to calendar reconstructions, the Confederacy's Grand Council of 50 sachems required unanimous consensus for all decisions. Clan Mothers nominated and could remove chiefs; no majority-rule voting existed. The Great Law of Peace (Kaianere'kó:wa) contained 117 articles encoded in wampum belts. Benjamin Franklin, who attended Haudenosaunee councils as Pennsylvania's Indian commissioner, wrote in 1751 that "It would be a very strange Thing, if [the] Six Nations... should be capable of forming a Scheme for such an Union... and yet that a like Union should be impracticable for ten or a Dozen English Colonies." U.S. Congress formally acknowledged this influence in H.Con.Res.331 (1988), which passed 408–8. ^[18] Key academic treatments include Johansen ^[19] and Grinde & Johansen ^[20]. The Igbo of southeastern Nigeria likewise organized through village assemblies, age grades, lineage groups, and merit-based title societies constituting what Victor Uchendu called "an exercise in direct democracy" ^[21].

States and empires arrived late

Agriculture, permanent settlement, cities, states, and empires are related but not interchangeable stages. People settled before farming in some places; farmers lived without states for millennia; cities could be governed collectively; and states repeatedly formed, fragmented, or disappeared. Archaeologist Monica Smith describes the state as a territorial social form expressed through politics, violence, literacy, and borders, capable of building shared platforms for integration while also institutionalizing inequality and power ^[151]. The state was an invention, not the discovery of civilization's natural shape.

Its growth nevertheless had material conditions. Storable surplus could support specialists and buffer scarcity, but it could also be counted, seized, inherited, and used to maintain administrators and armed retainers. Fixed fields, livestock, irrigation works, roads, and dense settlements raised the value of territorial control. Warfare could increase the premium on defense while conquest delivered labor, tribute, and land. Religious and ceremonial institutions could build genuine common identity

while also legitimizing unequal claims. None of these mechanisms acts alone, and none makes concentrated rule unavoidable.

Household archaeology makes the long transition partially measurable. A comparative study using house-size distributions as a consistent proxy found that wealth inequality generally increased with plant and animal domestication and with sociopolitical scale. Post-Neolithic Eurasian cases became substantially more unequal than those in North America and Mesoamerica; the authors connect part of the divergence to large domesticated mammals, agricultural extensification, and mounted warrior elites, while emphasizing the geographic limits of their sample ^[150]. The result is not a law that farming creates tyranny. It is evidence that controllable, inheritable productive assets can let advantage accumulate across generations and domains.

Empires came later still, when some states acquired the administrative, military, and logistical capacity to extract from multiple peoples and territories. They expanded the scale of roads, standardization, trade, defense, and public works while also expanding the distance between decision and consequence. Their records dominate what is called history precisely because empires produced records, preserved official categories, and destroyed or absorbed alternatives. Most humans did not spend most of our species' existence inside that arrangement. Even after states appeared, state and non-state peoples remained contemporaries, trading, fighting, intermarrying, migrating, and learning from one another.

The deep-history question therefore does not yield one lost model to copy. It yields a wider design space. Humans have lived in mobile bands, seasonal aggregations, villages, confederacies, ranked societies, collective cities, states, and empires; many arrangements combined several forms at once. The important finding is that large-scale coordination did not originate with permanent centralized command, and complexity never belonged to it alone.

Sustainable Cultures of Place

Ancient environmental management dwarfs modern sustainability efforts

The Amazonian civilizations that built these cities also engineered their environments with a sophistication modern agriculture has yet to match. Terra preta (Amazonian dark earth) – anthropogenic soil enriched with charcoal and organic wastes – contains on average 70 times more charcoal than surrounding soils, with approximately three times more organic matter, nitrogen, and phosphorus. These soils have remained fertile under

continuous agricultural use for centuries ^[22]. A 2023 study working with the Kuikuro people demonstrated that dark earth was intentionally created and that descendants continue making it today ^[23]. Published estimates place its known extent between roughly 6,000 and 18,000 km², while broader modeled estimates remain uncertain.

This technology was suppressed not by obsolescence but by genocide. Post-contact depopulation (up to 95% population loss) ended millennia of controlled burning, aquaculture, and agroforestry management. The consequences are still unfolding.

Practices That Consume Their Foundations

What destroyed knowledge systems cost in dollars and species

The erasure of indigenous knowledge is not merely a cultural tragedy – it carries quantifiable economic and ecological costs. The WHO reports that approximately 40% of pharmaceutical products draw from nature and traditional knowledge ^[24]. Newman and Cragg's definitive serial review found that ~33% of drugs approved between 1981 and 2019 were direct natural products, with an additional ~33% natural product-derived or inspired ^[25]. Of 122 plant-derived compounds in the global pharmacopoeia, 74% were discovered through ethnobotanical leads from indigenous peoples. The 1995 market value of pharmaceutical derivatives from traditional medicine was \$43 billion ^[26]. Landmark drugs traced directly to indigenous knowledge include quinine (Quechua cinchona bark), artemisinin (Tu Youyou's discovery from Chinese medical literature, Nobel Prize 2015), curare-derived muscle relaxants (Amazonian arrow poisons), and the Madagascar periwinkle's vincristine and vinblastine (childhood cancer treatments).

Each language death accelerates this loss. UNESCO's Atlas of the World's Languages in Danger lists 2,473 endangered languages, including 577 critically endangered and 230 already extinct since 1950. ^[27] A language dies approximately every 14 days. Of roughly 7,000 languages spoken today, 50–90% may disappear by 2100. K. David Harrison documented how languages encode irreplaceable ecological knowledge – the Tofa language of Siberia packs precise reindeer husbandry data into single morphemes; West Nggela fish names are 70% semantically transparent versus 45% for English, encoding ecological relationships directly in vocabulary ^[28].

The California fire crisis offers the starkest illustration of what suppression of Indigenous knowledge can cost. Pre-colonial Indigenous peoples burned 3–4 million acres annually in California, maintaining more open, fire-resistant landscapes ^[29]. In 1850, California passed the Act for the Government and Protection of Indians, effectively

outlawing intentional burning; Native people were "legally shot for burning as late as the 1930s" ^[30]. A 2022 UC Berkeley study found that Klamath Mountain forest biomass was approximately half of current levels historically, maintained by Karuk and Yurok cultural burning even during climate variability ^[31]. Against this multicausal background, California's insured wildfire losses from 2015–2020 exceeded \$50 billion, while suppression and wider social costs continued to rise. That damage cannot be assigned to one cause; it does show the scale of the burden created when climate stress, accumulated fuels, development, and the exclusion of working land practices reinforce one another.

The IPBES Global Assessment (2019) found that Indigenous peoples traditionally own, manage, use, or occupy at least a quarter of global land. ^[32] Their lands overlap roughly 35% of formally protected areas and roughly 35% of remaining terrestrial areas with very low human intervention; decline in nature has generally been slower there, although the evidence remains incomplete. The World Resources Institute found that 43% of Key Biodiversity Areas overlap Indigenous and local community lands. ^[33] Robert Costanza's landmark estimate valued global ecosystem services at \$125–145 trillion per year ^[34]; the World Economic Forum reported that over half of global GDP (~\$44 trillion) is moderately or highly dependent on nature ^[35].

Systematic Hierarchical Control

Laws that criminalize self-sufficiency

The modern state does not merely fail to protect alternative systems. In some jurisdictions it prohibits them; more often it makes them expensive, discretionary, or legally fragile. The architecture governing housing, food, water, and agriculture in the United States can foreclose sustainable, distributed living arrangements even when no single statute bans them outright.

Off-grid living faces a jurisdiction-specific web of utility-hookup ordinances, sanitation requirements, certificates of occupancy, and building codes. In 2014, Robin Speronis of Cape Coral, Florida, was declared "uninhabitable" for living on solar power and rainwater; Special Magistrate Harold Eskin ruled she could live without utility power but must hook up to the city's water system even without using it, citing the International Property Maintenance Code. ^[36] The point is not that disconnection is universally illegal. It is that nominal ownership does not guarantee a practical right to choose independent systems.

Alternative construction faces a proof burden that conventional construction usually avoids. IRC Section R104.11 explicitly allows alternative materials, designs, and methods, but requires the building official to find them equivalent in quality, strength, effectiveness, fire resistance, durability, and safety. ^[37] Cob, earthship, earthbag, and rammed-earth projects can therefore require additional testing, documentation, engineering, and local approval. The code does not categorically prohibit them; the cost and uncertainty of proving equivalence can still erase much of their affordability advantage.

Water reuse remains a state and local patchwork. EPA neither requires nor restricts particular reuse types at the federal level; states define their own sources, end uses, treatment standards, permits, and guidance. ^[38] Arizona pioneered permit-free residential greywater systems under 400 gallons per day ^[39], while other states and municipalities impose different conditions or provide no clear pathway. Composting toilets face the same problem: legality, approval, and whether a conventional septic or sewer connection remains mandatory vary by jurisdiction.

Seed sovereignty has been progressively eliminated. In *Bowman v. Monsanto Co.*, 569 U.S. 278 (2013), Justice Kagan's unanimous opinion established that patent exhaustion does not permit farmers to reproduce patented seeds by planting. ^[40] The Center for Food Safety documented 142 lawsuits by Monsanto against 410 farmers and 56 small businesses for seed-patent violations; Monsanto won all 11 that went to trial. ^[41] In Canada, *Monsanto Canada Inc v. Schmeiser* (2004 SCC 34) held 5-4 that growing patented genetic material constitutes infringement even without purchase. ^[42] The USDA reports that Corteva and Bayer now control 71.6% of U.S. corn seed sales and 93.5% of cotton seed sales ^[43]. The FAO estimates 75% of crop genetic diversity has been lost over the past century. ^[44] Since *J.E.M. Ag Supply v. Pioneer Hi-Bred*, 534 U.S. 124 (2001), plants can receive utility patents with no farmer saving exemption – overriding the Plant Variety Protection Act's original protections. ^[45]

Right-to-repair restrictions extend the pattern – but this is one place where the tide is turning. The FTC and five states sued Deere in January 2025, alleging that proprietary diagnostic restrictions monopolized repair services and increased farmers' costs and delays. ^[46] In July 2026 they secured a proposed settlement requiring Deere to make repair resources available through Operations Center PRO Service and other channels on terms comparable to those available to authorized dealers. ^[47] Enforcement and practical access still matter: a settlement does not reimburse years of downtime, expense, lost local skill, or consolidation pressure, and DMCA anti-trafficking rules can continue to constrain the tools independent repair requires. ^[48]

The tide can turn

Recognition does not erase the cost of delay; it proves reversal is possible.

-
- | | |
|------|---|
| 2022 | Firefighter exposure
IARC classifies occupational exposure as a firefighter as carcinogenic to humans. |
|------|---|
-
- | | |
|------|---|
| 2023 | Living soil knowledge
Research with Kuikuro communities confirms intentional creation of Amazonian dark earth. |
|------|---|
-
- | | |
|------|---|
| 2025 | Occupational cancer
The Honoring Our Fallen Heroes Act extends federal recognition and benefits. |
|------|---|
-
- | | |
|------|---|
| 2026 | Repair access
The FTC and five states secure a proposed settlement requiring broader Deere repair resources. |
|------|---|

Sources: IARC; Schmidt et al., Science Advances; FY2026 NDAA; FTC, July 2026.

Even growing food can trigger legal exposure. Julie Bass of Oak Park, Michigan was charged with a misdemeanor carrying 93 days in jail for planting a vegetable garden in her front yard (2011). ^[49] While charges were eventually dismissed under media pressure, the case illustrated how vague aesthetic zoning can criminalize food production. Village of Belle Terre v. Boraas, 416 U.S. 1 (1974) upheld one municipality's restriction on groups of unrelated people sharing a dwelling ^[50], providing constitutional room for similar definitions of "family" that can obstruct intentional communities.

The criminal justice pipeline: processing humans as throughput

The legal system through which the modern state enforces its prohibitions operates with documented inefficiency, structural bias, and minimal procedural safeguard for the vast majority of those it processes.

Indigent defense and the caseload crisis

The Sixth Amendment guarantees the right to counsel. In practice, 82% of state felony defendants rely on publicly financed attorneys ^[51]. In federal courts, nearly 90% of defendants receive court-appointed counsel under the Criminal Justice Act.

The 2023 RAND National Public Defense Workload Study – commissioned by ABA SCLAID and NCSC, and representing the first update to caseload standards in fifty years – established evidence-based benchmarks finding that a single "Felony-Low" case requires approximately 35 attorney hours, meaning a public defender can responsibly handle roughly 59 felonies per year ^[52].

The prior standard, set by the 1973 National Advisory Commission on Criminal Justice Standards and Goals (Standard 13.12), permitted 150 felonies per attorney ^[53] – already 2.5 times the updated recommendation. In practice, many jurisdictions far exceed even the outdated limit: Oklahoma public defenders carried nearly four times the recommended caseload; rural Missouri offices handled 350 felonies per lawyer per year. The ABA summarized the national finding as: public defenders work three times too many cases ^[54].

Plea bargaining as the default

The U.S. Sentencing Commission's Annual Report for FY 2023, covering 64,124 cases, reports that 97.2% of sentenced individuals pleaded guilty – no jury, no trial ^[55].

The ABA Plea Bargain Task Force Report (February 22, 2023) places the national figure at nearly 98% of convictions from guilty pleas. ^[56] At the state level, conviction-by-plea ranges from approximately 94% to 97%. Pew Research Center analysis (June 14, 2023) found that fewer than 1% of federal criminal defendants were acquitted in 2022. ^[57] The Vera Institute of Justice's review ^[58] documented systematic coercion in plea negotiations, including threats of substantially longer sentences at trial – the so-called "trial penalty." The ABA's 2024 analysis noted that only 2.5% of convictions at the federal level resulted from trials ^[59].

Pretrial detention and cash bail

At midyear 2024, 69% of local jail inmates – approximately 450,600 people – were unconvicted and awaiting court action ^[60].

At midyear 2023, the figure was 70% (467,600 people). ^[61] Between 2013 and 2023, the unconvicted jail population increased by 3% while the convicted population decreased by 29% – meaning pretrial detention is the primary driver of jail population growth.

The U.S. Commission on Civil Rights reported in January 2022 that more than 60% of defendants are detained pretrial because they cannot afford to post bail ^[62]. The Brennan Center for Justice estimates that most of the roughly two-thirds of jail inmates awaiting case resolution simply cannot afford bail ^[63]. The most methodologically rigorous figure, from BJS's 2009 data analyzed by the Prison Policy Initiative, found 34% of defendants were detained specifically for inability to post money bail ^[64].

The criminalization of homelessness after *Grants Pass*

In *City of Grants Pass v. Johnson*, 144 S. Ct. 2202 (2024), decided June 28, 2024 in a 6–3 ruling, the Supreme Court held that enforcing public camping bans does not violate the Eighth Amendment's prohibition on cruel and unusual punishment ^[65], even when no shelter beds are available – overturning the Ninth Circuit's *Martin v. Boise* (2018) precedent ^[66] that had protected homeless individuals from criminal penalties for sleeping outside when shelters were full.

The National Homelessness Law Center's *Housing Not Handcuffs 2021* had already documented that 48 states had at least one law criminalizing homelessness-related behavior. ^[67] After *Grants Pass*, the pace accelerated dramatically: by January 2025, approximately 150 cities in 32 states had passed or strengthened camping and sleeping ban ordinances ^[68]. By the one-year anniversary of the decision, 260 new laws criminalizing homelessness had been enacted across the country, and 57 state-level bills were introduced in 17 states ^[69].

Extraneous factors in judicial decisions

The original study by Danziger, Levav, and Avnaim-Pesso ^[70], edited by Daniel Kahneman, analyzed 1,112 rulings by Israeli parole boards and found favorable decision rates dropped from approximately 65% at the start of each session to nearly 0% by the end, resetting to approximately 65% after food breaks.

However, subsequent analysis by Glöckner ^[71] demonstrated via simulation that the pattern could be a statistical artifact of case scheduling: favorable rulings take longer (approximately 7.4 minutes) than unfavorable ones (approximately 5.2 minutes), so judges rationally avoid starting complex cases before scheduled breaks.

The broader literature on judicial decision-making does confirm that extralegal factors – including time of day, local weather, recent football outcomes, and judge fatigue – measurably influence sentencing outcomes across multiple jurisdictions and study designs.

Civilizational Costs and Comparative Scale

A trillion-dollar annual drain on human potential

The economic systems built atop this legal architecture generate waste on a staggering scale.

The United States incarcerates nearly 2 million people across federal, state, and local facilities ^[72].

That broad count should not be confused with a single prison census. The Bureau of Justice Statistics counted 1,254,200 people under state or federal prison jurisdiction at year-end 2023; the broader total also includes people in local jails, territorial and tribal systems, youth confinement, immigration detention, and other forms of custody ^[132]. Private prisons are part of this machinery, but not its whole structure: 28 states used private prisons in 2023, and those facilities held 7.1% of state and federal prisoners ^[133].

The median state cost per prisoner is \$60,989/year, ranging from \$19,806 in Mississippi to \$284,976 in Massachusetts. But direct corrections spending – \$63.6 billion annually – captures only a fraction of the true cost. ^[121]

A Washington University in St. Louis study led by Michael McLaughlin found the aggregate annual burden reaches \$1.014 trillion – nearly 6% of GDP and 11 times direct spending – once lost wages, adverse health effects, family damage, and intergenerational effects are included ^[73].

The Brennan Center calculated \$370 billion per year in lost earnings for the 70+ million Americans with criminal records; prison causes a 52% reduction in annual earnings ^[74].

The digital economy exhibits a parallel structure of extraction.

A 2024 Harvard Business School study estimated the demand-side replacement value of open source software at \$8.8 trillion: what firms would have to spend if the packages they rely on did not exist and each firm had to recreate them independently. That is not a wage bill or cash value, but it reveals the extraordinary dependence of commercial systems on a shared software commons ^[75].

Yet 60% of open source maintainers remain unpaid ^[76].

The XZ Utils backdoor (CVE-2024-3094) – a near-catastrophic security breach that could have compromised millions of Linux servers – exploited this ^[77]: the utility was maintained by a single unpaid developer.

Some 96% of commercial codebases contain open source components; 25% of OSS projects have only one developer contributing code ^{[78][79]}.

Medical debt functions as a direct tax on economic participation.

The landmark study by Himmelstein et al. estimated that 66.5% of U.S. bankruptcies were tied to medical issues – respondents cited medical expenses, illness-related work loss, or both as contributors – equivalent to approximately 530,000 families annually ^[80].

Three-quarters of medical bankrupts had health insurance.

Total medical debt stands at approximately \$220 billion ^[81]; a 2022 KFF survey found 41% of adults carry some form of health care debt.

Student debt – now \$1.83 trillion across 43 million borrowers – has precluded approximately 400,000 young adults from homeownership ^[82]. A Philadelphia Federal Reserve study found that a ~3% increase in student debt produced a 14.4% decrease in small firm formation (2015). ^[83]

Globally, 262 million young people (1 in 4) are classified as NEET – not in education, employment, or training ^[84].

The "Talent Disrupted" report ^[85] found that 52% of bachelor's degree graduates are underemployed one year after graduation, and 73% who start underemployed remain so a decade later.

Meanwhile, 77% of employers report difficulty finding workers with needed skills ^[86].

Japan's hikikomori population has reached 1.46 million working-age people ^[87], while South Korea's male NEET rate among university graduates reached 23% ^[88].

The paradox – simultaneous labor shortage and youth exclusion – reflects not a skills gap but a structural failure to connect human capacity with meaningful work.

Squandering humanity

The population curve below offers us an empty forgiveness as a species. At exactly the moment humanity is blooming into billions, many of the world's richest nations are

squandering the world's most valuable resource: humanity itself.

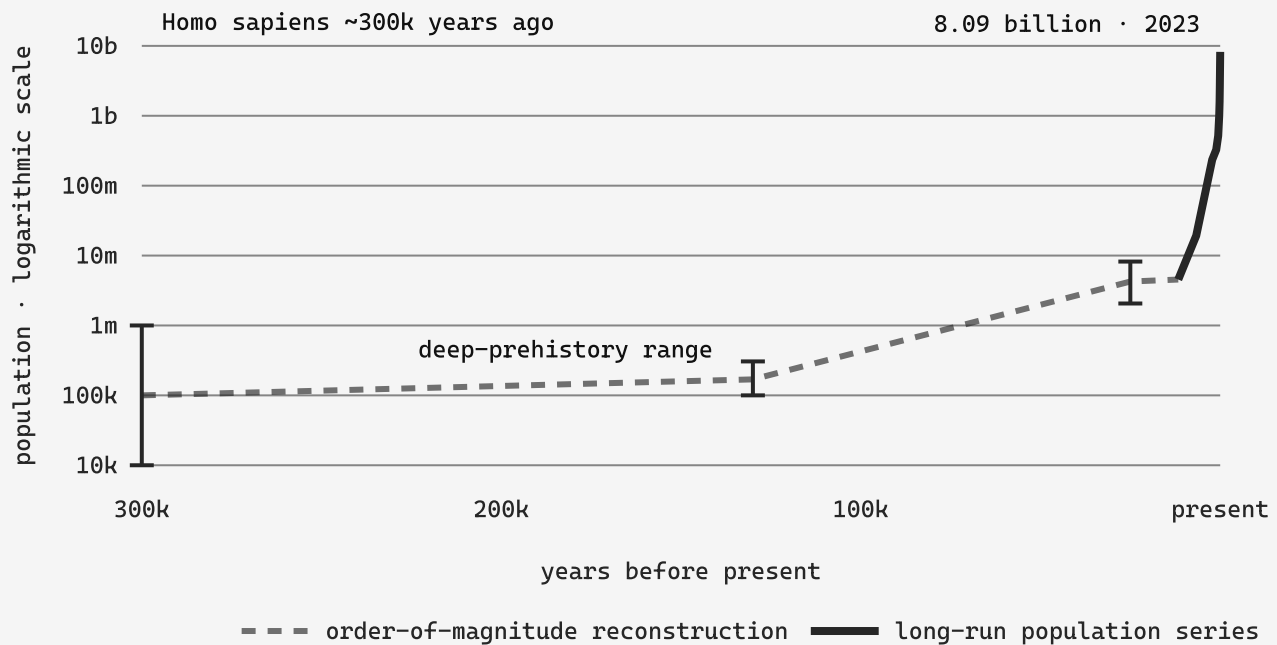
Nowhere is this contradiction clearer than in Africa. Sub-Saharan Africa remains the world's lowest-income major region at approximately \$1,577 GDP per person in 2024, yet the United Nations projects its population to grow 79% by 2054, reaching 2.2 billion, and then to reach approximately 3.3 billion by 2100. Nine countries – including Angola, the Democratic Republic of the Congo, Niger, and Tanzania – are expected to double in population between 2024 and 2054 ^{[89][90]}.

This growth is occurring with a fraction of the material glut consumed elsewhere. The UN Environment Programme's International Resource Panel estimated Africa's material footprint below three tonnes per person, compared with approximately 20 tonnes in Europe and 25 tonnes in North America. Material footprint is not a complete measure of sustainability, and poverty should not be romanticized; the same report describes the disparity as evidence of unequal material living standards. But the contrast demonstrates that material excess is not a prerequisite for human continuity ^[91].

Africa's growth reflects a much younger age structure, higher fertility, and improving survival, not one isolated cause. Even so, the comparison exposes a failure of allocation in wealthier societies. They consume many times more material per person while making housing, care, time, and family formation increasingly difficult to secure. They have accumulated extraordinary wealth without organizing it around the continuation and growth of humanity itself.

Human population at the scale of our species

Logarithmic population scale across the approximate 300,000-year history of Homo sapiens.



Sources: Smithsonian Human Origins Program; Takahata (1993) and Sjödin et al. (2012) for genetic and inferred early-population ranges; Tallavaara et al. (2015) for the Last Glacial Maximum; HYDE 3.3, Gapminder v7, and UN World Population Prospects 2024 via Our World in Data for the long-run series. Dashed values and range bars are order-of-magnitude reconstructions, not census counts; later historical values are estimates, not measurements of equal precision.

Declining birth rates signal systemic failure, not progress

The demographic data is unambiguous: the world's wealthiest societies are failing to reproduce.

South Korea's TFR hit 0.75 in 2024 ^[92]. Japan stands at 1.15 ^[93], the U.S. at a record-low 1.599 ^[94].

More than half of all countries are now below the replacement rate of 2.1.

The UN's 2024 World Population Prospects projects a global peak of approximately 10.3 billion in the mid-2080s, about 700 million lower than projected a decade earlier.

The standard demographic transition model posited stabilization near replacement. This has not occurred.

Fertility continues to plummet far below replacement across culturally diverse societies – secular Europe, Confucian East Asia, liberal North America, Catholic Southern Europe.

This convergence across different political systems, religions, and cultural traditions suggests structural rather than purely cultural drivers.

Recent research identifies housing costs as a primary mechanism.

Benjamin Couillard ^[95] found rising housing costs since 1990 are responsible for 11% fewer children and 51% of the TFR decline between the 2000s and 2010s in the United States.

Li et al. ^[96] corroborated this globally using house price data from 1870–2012.

Van Doornik et al. ^[97] provided causal evidence from a Brazilian housing credit lottery.

In South Korea, median families spend 63% of household income on mortgage repayment ^[98].

The competitive "parental rat race" – social comparison motives that drive intensive investment in fewer children – further amplifies the effect ^[99].

Biological factors may also contribute: Levine et al.'s 2023 meta-analysis documented accelerating global declines in sperm counts ^{[100][101]}.

Pro-natalist policies have not produced a sustained return to replacement-level fertility in an advanced economy.

South Korea has spent over \$280 billion since 2006 on birth bonuses, childcare subsidies, fertility treatments, and housing incentives ^[122]; TFR continued declining from 1.08 to 0.75.

Hungary raised family spending from 3.5% to 6.2% of GDP – among the highest in the OECD – and TFR rose modestly to ~1.55 before declining again, still far below its 2.1 target ^[102].

A Lancet study (2025) found Japan's current cash benefit policies have only a 12% likelihood of reversing fertility decline by 2030. ^[103]

Kim (2020) found that 94% of South Korean births receiving baby bonuses were infra-marginal – they would have occurred regardless. ^[104]

No advanced economy has successfully sustained a return to replacement-level fertility.

The economic consequences are already materializing.

Japan has 9 million vacant homes (13.8% of all residential properties), projected to reach 23 million by 2038 ^[105].

South Korea has permanently closed 4,008 schools since 1982; first-time elementary enrollment is expected to fall below 300,000 in 2026 against university capacity of 450,000–500,000. ^{[123][124]}

China's population declined by 3.39 million in 2025, with only 7.92 million births – less than half the 2017 level ^[125]; the Shanghai Academy of Social Sciences projects a population of just 525 million by 2100. ^[126]

Germany's worker-to-retiree ratio has collapsed from 6:1 in the 1960s to 2:1 today. ^[127]

Multiple studies link fertility decline to social trust and systemic wellbeing beyond economics.

Ferretti et al. ^[106] found that worsening social climate and growing uncertainty correlate with lower birth intentions independent of economic uncertainty.

Liu et al. ^[107] showed social trust reduces perceived cost of childbearing.

The Milbank Memorial Fund (2022) explicitly framed declining births as "a warning sign regarding the social and economic factors that are the fundamental drivers of all population dynamics." ^[108]

Sojung Lim ^[109] describes South Korea's crisis as "an extreme manifestation of social problems that many societies share."

Working for Failed Institutions

The pattern of institutional betrayal extends to the people institutions most publicly praise. Firefighters, healthcare workers, social workers, construction workers, and police perform different kinds of labor and hold very different kinds of power. They should not be collapsed into one moral category. They do share a structural position: each is expected to absorb risk, scarcity, trauma, and organizational contradiction so that an essential system can continue appearing functional.

When the worker compensates successfully, the shortage stays hidden. A nurse skips rest, a social worker carries another case, a construction crew accepts another dangerous deadline, a firefighter reuses contaminated equipment, or an officer is sent to a behavioral-health call that should have had another responder. The immediate task may get done. The institution then records output without recording the borrowed human capacity that made it possible.

This is why burnout language can obscure more than it reveals. Exhaustion, injury, moral distress, turnover, addiction, and suicide are not interchangeable outcomes, and none has one cause. But repeatedly treating them as defects in individual resilience protects the design of work from scrutiny. The relevant questions are material: how much work exists, who is available to do it, what control they possess, what hazards are engineered out, what support follows exposure, and whether the public receives the service the institution claims to provide.

Firefighters: honored in public, abandoned in practice

Firefighters are the clearest case because the cultural praise is so strong and the occupational bargain is so visible. The work requires entering environments everyone else is told to escape, then trusting equipment, staffing, medical surveillance, and compensation systems to limit the damage afterward.

The International Agency for Research on Cancer classified firefighting as Group 1 – Carcinogenic to Humans in July 2022 ^[110].

The NIOSH pooled cohort study of 29,993 career firefighters found a 9% higher cancer diagnosis rate and 14% higher cancer mortality rate versus the general population, including a twofold increase in mesothelioma ^[111].

The IARC meta-analysis identified statistically significant elevated risks for mesothelioma (58% increase), testicular cancer (37%), melanoma (36%), thyroid cancer (28%), prostate cancer (21%), colon cancer (19%), bladder cancer (16%), and non-Hodgkin lymphoma (12%) ^[112].

Cancer now causes nearly 80% of career firefighter line-of-duty deaths ^[113].

The carcinogenic exposures are both inherent and manufactured.

NIST identified 26 different PFAS compounds in turnout gear textiles, with highest concentrations in the outer layers designed to protect firefighters from flame ^[114].

Modern fires burn hotter and produce more toxic combustion byproducts from synthetic materials – polyurethane foam, nylon, PVC, engineered wood.

A Harvard study detected benzene in 181 of 197 samples at fire scenes, with half of measured levels exceeding 10 times the OSHA limit. ^[115]

Dermal absorption is the primary exposure route even with respiratory protection, as contamination occurs at interface regions – jawline, neck, hands, groin.

In December 2025, Duke University and NC State found brominated flame retardants in gear marketed as "PFAS-free," potentially introducing new hazards ^[116].

Despite this, systemic protection has lagged decades behind the science.

Federal recognition of occupational cancer as a line-of-duty death came only in December 2025 with the Honoring Our Fallen Heroes Act, passed as part of the NDAA. ^[117] The delay imposed real costs, but the law also demonstrates that an entrenched failure can be named and reversed.

While 48 states and DC now have cancer presumption laws, a Public Health Watch/Mother Jones investigation (2023) documented routine denial of workers' compensation claims ^[118] even in states with strong presumption statutes.

Scott Jennie, retired fire captain and Firefighter Cancer Support Network director, summarized: "I tell firefighters, 'You're a hero, until you cost them money, then you're a zero.'"

In Texas, Lt. Suzanne LaFollette – a 19-year veteran diagnosed with Stage 4 ovarian and endometrial cancer – had her claim denied because Texas law only covers 11 specific cancers and excludes ovarian cancer; the denial letter called her disease "an ordinary disease of life." ^[119]

Firefighters earned a 90% trust rating in 2001 ^[120].

They are dying by suicide at rates exceeding line-of-duty deaths ^[128]; staffing has declined by 62,100 since 2010 while call volumes have tripled ^{[129][130]}; and the U.S. Forest Service has 26% of firefighting positions vacant. ^[131]

The contradiction between the rhetoric of honoring first responders and the reality of their institutional abandonment distills the broader argument. Exposure is classified as carcinogenic, yet the protective clothing can introduce additional chemicals; cancer

is legally presumed occupational in many jurisdictions, yet claims can still be fought disease by disease; call volume expands while the workforce contracts. Each program can appear defensible in isolation while the combined system transfers uncertainty and delay onto the exposed worker and family.

Recognition is a beginning, not the completed remedy. Durable protection requires preventing avoidable exposure, testing substitutes before marketing them as safer, providing time and facilities for decontamination, maintaining adequate crews, monitoring health over a career, and making compensation follow evidence instead of administrative endurance. The institution fails when heroism becomes the resource used to cover the gap between its public mission and its material support.

Healthcare workers: care without enough capacity

In 2022, 45.6% of U.S. health workers surveyed by CDC reported feeling burned out often or very often. Reported workplace harassment rose from 6.4% in 2018 to 13.4% in 2022, and 44.2% said they were somewhat or very likely to seek another job. The same study found lower burnout where workers had enough time, supervisor support, and trust in management ^[134]. The intervention implied by the data is organizational capacity and worker control, not another demand that depleted people become more resilient.

A National Academies consensus report makes the systems argument explicit. It locates clinician burnout across three interacting levels—frontline care, the healthcare organization, and the external environment—that shape the balance between job demands and job resources. Workload, time pressure, inefficient processes, administrative burden, moral distress, autonomy, support, and usable technology are properties of the care system, even though their consequences appear in individual bodies ^[152].

This distinction protects patients as well as workers. A depleted clinician may remain deeply committed and still have insufficient time, information, staff, or recovery to deliver the care their training requires. Turnover then removes experience, increases the load on those who remain, and makes another departure more likely. Wellness services and confidential treatment matter, but they cannot substitute for enough people, workable schedules, psychological safety, and authority to repair broken workflows.

The institution therefore fails twice when it calls preventable overload a private mental-health problem. It avoids changing the production conditions of care, then asks the person whose professional identity depends on caring to accept responsibility for not enduring those conditions indefinitely. A functioning care system must preserve the capacity of caregivers as part of preserving care itself.

Social workers: relational work under throughput conditions

A 2024 systematic review and meta-analysis of 24 studies covering 16,962 social-service workers in seven countries estimated full-syndrome burnout at 20%, with emotional exhaustion at 50% ^[135]. These pooled estimates cross different services and national contexts; they do not imply that every workplace has the same risk. They do establish that exhaustion is not an anecdotal edge case in a profession asked to manage poverty, abuse, disability, illness, housing instability, family conflict, and institutional eligibility rules at once.

The work depends on judgment and relationship, yet its administrative form is increasingly built around auditable transactions. A systematic synthesis of 39 qualitative studies found that standardized assessments, output measures, fragmented practice, recording requirements, and rigid protocols shifted attention toward compliance and paperwork. Social workers described less meaningful contact, ethical stress when organizational priorities conflicted with professional values, and supervision focused on case monitoring instead of learning and reflection ^[154].

Caseload counts alone cannot describe the demand. One case may require a bounded assessment; another may involve immediate danger, several agencies, court deadlines, language access, unstable housing, and years of relationship work. A 2024 scoping review found no widely established social-work-specific safe-staffing definition outside parts of children's services and only limited evidence for policy. It identified more useful workload approaches that account for complexity, risk, time, worker experience, and team capacity rather than treating every case as an equal unit ^[153].

The damage does not end with the worker. A 2026 scoping review found that turnover in child protection disrupts trusted relationships, contributes to placement instability and delays in permanency, and causes emotional distress for children and families; it also emphasizes that this evidence remains limited and is drawn largely from U.S. studies ^[136]. A service built on durable human relationships cannot be managed as interchangeable case throughput without degrading the service itself. Documentation is necessary for continuity and accountability; the failure begins when documenting care consumes the time and discretion needed to provide it.

Construction workers: building prosperity while absorbing its risk

Construction recorded 1,064 occupational fatalities in 2024 and 2.2 recordable injury and illness cases per 100 full-time workers ^[137]. A completed building makes coordination, capital, and design visible while tending to hide the falls, strains,

noise, dust, heat, chemical exposure, travel, and cumulative pain carried through its production. The hazard is not an unavoidable property of making shelter. It changes with procurement, scheduling, site control, training, equipment, design, and whether a worker can stop unsafe work without losing employment.

The strain also appears beyond the jobsite: in 2021 the suicide rate among men in the construction industry was 56.0 per 100,000, compared with 32.0 across the male civilian working population ^[138]. Suicide cannot be assigned to occupation alone. NIOSH nevertheless identifies a connected set of work conditions that can worsen mental health in construction: seasonal employment, time away from family, injuries and chronic pain, lack of paid sick leave, and demanding schedules. The agency also connects work-related injury and pain with opioid exposure and overdose risk ^[155].

These outcomes are often split into departments. Safety handles the fall, a clinic handles the pain, a prescriber handles medication, a supervisor handles attendance, and a crisis service encounters the worker after the system has ceased tracking the sequence. Prevention through design offers the more honest principle: remove a hazard at the level where the work is designed whenever possible. Applied broadly, that includes not only guardrails and equipment but also schedules, employment continuity, paid recovery, worker voice, and access to treatment without career destruction.

The people who physically build collective wealth absorb costs that rarely appear in the finished asset's price. A cheaper bid can simply mean that injury risk, unstable employment, pain, and family disruption have been moved off the project ledger and into workers, households, healthcare systems, and public services. Cost has not been removed. It has been reassigned.

Police: harmed workers inside a harmful role

Police officers are workers inside the same system, though their role also gives them unusual authority to impose that system's harms on others. A global systematic review and meta-analysis covering 272,463 police personnel across 24 countries estimated point prevalences of 14.6% for depression, 14.2% for PTSD, 8.5% for suicidal ideation, and 25.7% for hazardous drinking. Occupational stress was the strongest identified risk factor for depression and suicidal ideation, while peer support was associated with lower PTSD symptoms ^[139]. These findings warrant care for officers; they do not excuse violence, concealment, or misuse of authority.

Officer-perpetrated domestic violence illustrates why both truths must remain visible. The frequently repeated claim that 40% of officers abuse their families should not be presented as a settled modern prevalence rate. A systematic review found only seven

eligible studies, with self-reported estimates ranging from 4.8% to 40% and major differences in measurement and sampling ^[140]. The defensible conclusion is not that the problem is small; it is that a serious abuse of entrusted power is documented while institutions still fail to measure it consistently.

The Stanford Prison Experiment is likewise a poor foundation for the claim that ordinary people automatically become cruel when assigned a uniform. Archival analysis found that guards received direction, demand characteristics were extensive, and the study's data were incomplete and selectively reported ^[141]. In the BBC Prison Study, participants did not passively inhabit their assigned roles; tyranny depended on identification, organization, and the failure of alternatives ^[142]. Later analysis of the Stanford archive similarly emphasized identity leadership: cruelty was cultivated through norms and persuasion rather than produced mechanically by role assignment ^[143].

Dietrich Bonhoeffer offers a philosophical lens rather than an empirical shortcut. Writing from prison under the Nazi state, he described stupidity as less an intellectual defect than a social and moral condition in which external power can induce people to surrender independent judgment and become instruments of slogans ^[144]. Applied to policing, that lens does not mean officers are inherently stupid, nor does it absolve them. It asks which institutional loyalties, commands, myths, and rewards make refusing harm feel like betrayal while carrying it out feels like duty.

Care for police as workers and limits on police power are therefore not opposing positions. Trauma treatment, sustainable schedules, competent supervision, peer support, and the ability to refuse unlawful or harmful commands can reduce damage to officers. Independent investigation, transparent discipline, enforceable boundaries, and removing inappropriate duties from police reduce damage officers can impose on everyone else. A system that offers only loyalty or abandonment makes both forms of reform harder: it ties worker identity to institutional defense and treats accountability as an attack on the person.

Boulder provides a useful local contrast between archetype and design. In 2025 the city's Behavioral Health Crisis Response Team handled 1,479 calls; 0.3% involved officer use of force, 1.6% involved arrest, and clinician participation returned officers to service 515 times ^[145]. The point is not that one program resolves policing. It is that changing who responds, what skills they bring, and what outcomes the system rewards can change the role itself. That redesign needs independent accountability beside it: Boulder says 2024 complaint volume overwhelmed its oversight system, that roughly one in five complaints in recent years required additional robust investigation, and that Colorado's Clean Slate law can restrict access to evidence

[146]. Care for workers, limits on coercive power, credible investigation, and non-police alternatives are not competing commitments. They are parts of the same adaptive system.

The Future of Humanity

What can humans do in the future to maintain sustainable, diverse, evolving cultures when the present high-throughput system is not a viable template for every person, continent, or generation? The historical cases in this paper do not supply one society to copy. They establish a wider design space and a need to preserve alternatives, practical exit, reversible experimentation, and coordination across the boundaries no locality can manage alone.

Respect for diverse humans cannot end at the range of lives currently familiar to one state, market, religion, or generation. Communities may choose radically different social arrangements, relationships with technology, ecological niches, bodies, and time horizons. Over deep time, human descendants could diverge further than modern political culture is prepared to imagine—potentially even to the point at which "human" again describes a family of distinct lineages rather than one surviving species. No institution should prescribe that outcome, sort living people into biological castes, constrain reproduction, or revive racial pseudoscience in its name. The defensible commitment is consent, bodily autonomy, free association, movement, equal dignity, and enough protected commons for difference to develop without being forced into either conformity or rank. A civilization that values adaptive capacity must be capable of protecting forms of humanity it cannot yet predict.

Conclusion: Adaptive capacity as the real bottom line

The evidence across these domains converges on a single thesis. Humans repeatedly built complex and durable societies without concentrating every form of authority in one dominant center. The Xingu garden cities formed regional networks of independent polities; Çatalhöyük sustained an aggressively egalitarian settlement for nearly 1,500 years; the Indus civilization achieved urban scale and technical standardization without the familiar monuments of kingship; and the Haudenosaunee Confederacy distributed authority through councils, nations, clans, and generations. Amazonian peoples engineered fertile soils, fisheries, forests, and fire-managed landscapes whose value persists centuries later. Colonization, genocide, and legal prohibition broke

many of these systems, while modern building codes, seed patents, zoning restrictions, and digital repair locks continue to make distributed alternatives expensive, fragile, or illegal.

The opportunity costs are measurable even when they cannot be reduced to one cause or one accounting method. California absorbed more than \$50 billion in insured wildfire losses from 2015 through 2020 amid climate stress, accumulated fuels, development, and the suppression of cultural burning. One comprehensive estimate placed the annual social burden of U.S. incarceration above \$1 trillion. Open source software carries an estimated \$8.8 trillion in demand-side replacement value while much of its maintenance remains unpaid. Roughly 40% of pharmaceuticals originate from traditional natural products, often drawing on knowledge systems exposed to the same forces of displacement and erasure. Wealthy societies have spent decades treating falling fertility as a technical problem while preserving the housing, labor, debt, and care structures that make family formation increasingly precarious.

At the same time, sub-Saharan Africa – the world's lowest-income major region and one of its least materially consumptive – is projected to grow by 79% by 2054 while many of the richest societies contract. Poverty is not the model. The contrast is the indictment: unprecedented wealth and material glut have not produced human continuity. South Korea remains at 0.75 TFR, China lost 3.39 million people in 2025, and Japan contains 9 million vacant homes. No payment at the margin can repair an incentive landscape that consumes the time, security, trust, and material stability on which another generation depends.

The recurring feature across these alternatives is adaptive capacity: power distributed across multiple centers, knowledge held outside a single institution, and communities able to repair, reorganize, and choose differently when conditions change. The modern state, by centralizing decision-making, criminalizing alternatives, and extracting value from the systems that produce it, is systematically destroying this capacity at the moment of greatest need. The archaeological record no longer permits the claim that concentrated hierarchy was the only path to complexity. The question is whether the legal, economic, and institutional barriers preventing distributed systems from re-emerging can be dismantled before the consequences become irreversible.

Facts and Sources

The gold number returns to the corresponding point in the article. The purple source credit opens the cited work.

- 1 Crumley, Carole L. 1995. "Heterarchy and the Analysis of Complex Societies." In Ehrenreich, Crumley & Levy, eds., *Heterarchy and the Analysis of Complex Societies*. Archaeological Papers of the AAA 6: 1–5.

Carole Crumley's concept of heterarchy gives precise language to this arrangement: "the relation of elements to one another when they are unranked or when they possess the potential for being ranked in a number of different ways".

- 2 Hendon, Julia A., and Rosemary A. Joyce. 2001. "A Flexible Corporation: Classic Period House Societies from Eastern Mesoamerica." Society for American Archaeology Annual Meeting.

The concept has since been applied across Maya studies, Indus Valley archaeology (Kenoyer, 2006; Possehl, 2002), and governance theory (Crumley, 2023, "Heterarchy and Social Theory," in Cerny, ed., *Heterarchy in World Politics*, Routledge).

- 3 Kenoyer, Jonathan Mark. 2006. "Cultures and Societies of the Indus Tradition." In *India: Historical Beginnings and the Concept of the Aryan*. National Book Trust.

The concept has since been applied across Maya studies (Hendon & Joyce, 2001), Indus Valley archaeology, and governance theory (Crumley, 2023, "Heterarchy and Social Theory," in Cerny, ed., *Heterarchy in World Politics*, Routledge).

- 4 Possehl, Gregory L. 2002. *The Indus Civilization: A Contemporary Perspective*. AltaMira Press.

The concept has since been applied across Maya studies (Hendon & Joyce, 2001), Indus Valley archaeology, and governance theory (Crumley, 2023, "Heterarchy and Social Theory," in Cerny, ed., *Heterarchy in World Politics*, Routledge).

-
- 5 Crumley, Carole L. 2023. "Heterarchy and Social Theory." In Philip G. Cerny, ed., *Heterarchy in World Politics*, 30–41. Routledge.

The concept has since been applied across Maya studies (Hendon & Joyce, 2001), Indus Valley archaeology (Kenoyer, 2006; Possehl, 2002), and governance theory.

- 6 Smithsonian Human Origins Program. Human-evolution timeline and *Homo sapiens* history.

What is historically unusual is an authority that permanently claims a territory, monopolizes legitimate force within it, and is difficult for an ordinary person to refuse or leave.

- 7 Brooke, John L. 2014. *Climate Change and the Course of Global History: A Rough Journey*. Cambridge University Press.

What is historically unusual is an authority that permanently claims a territory, monopolizes legitimate force within it, and is difficult for an ordinary person to refuse or leave.

- 8 Heckenberger et al. 2003. "Amazonia 1492: Pristine Forest or Cultural Parkland?" *Science* 301(5640): 1710–1714.

Michael Heckenberger documented "garden cities" in the Upper Xingu River basin of Brazil – multi-centric settlements organized as "small independent polities within a regional peer polity" with no single dominant center.

- 9 Heckenberger et al. 2008. "Pre-Columbian Urbanism, Anthropogenic Landscapes, and the Future of the Amazon." *Science* 321(5893): 1214–1217.

Michael Heckenberger documented "garden cities" in the Upper Xingu River basin of Brazil – multi-centric settlements organized as "small independent polities within a regional peer polity" with no single dominant center.

- 10 Heckenberger, Michael J. 2005. *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, A.D. 1000–2000*. Routledge.

Heckenberger's full account appears in *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, A.D. 1000–2000* (Routledge, 2005).

11 Rostain et al. 2024. "Two Thousand Years of Garden Urbanism in the Upper Amazon." *Science* 383(6679): 183–189.

In January 2024, Stéphen Rostain and colleagues published the discovery of more than 6,000 earthen platforms connected by wide, straight roads in Ecuador's Upano Valley – a networked urban system occupied from approximately 500 BCE to 300–600 CE, making it at least 2,500 years old and over a millennium older than any previously known complex Amazonian society.

12 Prümers et al. 2022. "Lidar Reveals Pre-Hispanic Low-Density Urbanism in the Bolivian Amazon." *Nature* 606(7913): 325–328.

In Bolivia, Heiko Prümers revealed the Casarabe culture's four-tiered settlement system spanning 4,500 km², with sites featuring conical pyramids up to 22 meters tall and an estimated 570,000 cubic meters of earth moved at Cotoca alone.

13 Erickson, Clark. 2000. "An Artificial Landscape-Scale Fishery in the Bolivian Amazon." *Nature* 408: 190–193.

Clark Erickson documented the broader Llanos de Mojos region, where pre-Hispanic peoples built permanent earthen fish weirs covering over 500 km² – the largest fish weir complex ever reported.

14 Hodder, Ian. 2006. *The Leopard's Tale: Revealing the Mysteries of Çatalhöyük*. Thames & Hudson.

7500–5600 BCE) housed 8,000–10,000 people in what excavator Ian Hodder describes as an "aggressively egalitarian society" – no public buildings, no temples, no houses distinguishable by size or wealth, equal diets and workloads for men and women confirmed by skeletal analysis.

15 "Female Lineages and Changing Kinship Patterns in Neolithic Çatalhöyük." *Science* 388(6754), 2025, eadr2915.

A 2025 DNA study published in *Science* found intergenerational burial ties established predominantly through maternal lineage.

16 Green, Adam S. 2021. "Killing the Priest-King: Addressing Egalitarianism in the Indus Civilization." *Journal of Archaeological Research* 29: 153–202.

Adam Green's landmark 2021 analysis argues that "urbanization, collective action, and technological innovation are not driven by the agendas of an exclusionary ruling class... and can occur in their total absence".

17 Green, Adam S. 2022. "Of Revenue Without Rulers." *Frontiers in Political Science*.

Adam Green's landmark 2021 analysis argues that "urbanization, collective action, and technological innovation are not driven by the agendas of an exclusionary ruling class... and can occur in their total absence".

18 U.S. Congress. H.Con.Res.331, 100th Congress. 1988.

U.S. Congress formally acknowledged this influence in H.Con.Res.331 (1988), which passed 408–8.

19 Johansen, Bruce E. 1982. *Forgotten Founders: Benjamin Franklin, the Iroquois, and the Rationale for the American Revolution*. Harvard Common Press.

Key academic treatments include Johansen and Grinde & Johansen (1991, *Exemplar of Liberty*, UCLA).

20 Grinde, Donald A., Jr., and Bruce E. Johansen. 1991. *Exemplar of Liberty: Native America and the Evolution of Democracy*. UCLA American Indian Studies Center.

Key academic treatments include Johansen (1982, *Forgotten Founders*, Gambit) and Grinde & Johansen.

21 Uchendu, Victor Chikezie. 1965. *The Igbo of Southeast Nigeria*. Holt, Rinehart and Winston, p. 41.

The Igbo of southeastern Nigeria likewise organized through village assemblies, age grades, lineage groups, and merit-based title societies constituting what Victor Uchendu called "an exercise in direct democracy".

22 Glaser. 2007. "Prehistorically Modified Soils of Central Amazonia." *Philosophical Transactions of the Royal Society B* 362: 187–196.

These soils have remained fertile under continuous agricultural use for centuries.

23 Schmidt et al. 2023. "Intentional Creation of Carbon-Rich Dark Earth Soils in the Amazon." *Science Advances*.

A 2023 study working with the Kuikuro people demonstrated that dark earth was intentionally created and that descendants continue making it today.

24 World Health Organization. 2019. WHO Global Report on Traditional and Complementary Medicine 2019.

The WHO reports that approximately 40% of pharmaceutical products draw from nature and traditional knowledge.

25 Newman & Cragg. 2020. "Natural Products as Sources of New Drugs over the Nearly Four Decades from 01/1981 to 09/2019." *Journal of Natural Products* 83(3): 770–803.

Newman and Cragg's definitive serial review found that ~33% of drugs approved between 1981 and 2019 were direct natural products, with an additional ~33% natural product-derived or inspired.

26 World Intellectual Property Organization data on traditional knowledge and pharmaceutical derivatives.

The 1995 market value of pharmaceutical derivatives from traditional medicine was \$43 billion.

27 UNESCO. *Atlas of the World's Languages in Danger*.

UNESCO's *Atlas of the World's Languages in Danger* lists 2,473 endangered languages, including 577 critically endangered and 230 already extinct since 1950.

28 Harrison, K. David. 2007. *When Languages Die: The Extinction of the World's Languages and the Erosion of Human Knowledge*. Oxford University Press.

David Harrison documented how languages encode irreplaceable ecological knowledge – the Tofa language of Siberia packs precise reindeer husbandry data into single morphemes; West Nggela fish names are 70% semantically transparent versus 45% for English, encoding ecological relationships directly in vocabulary.

29 Safford, Hugh D., et al. Research on pre-colonial Indigenous burning in California. *Global Ecology and Biogeography*.

Pre-colonial Indigenous peoples burned 3–4 million acres annually in California, maintaining more open, fire-resistant landscapes.

30 Attebery, Russell, Karuk Tribal Chairman. Account reported by CalMatters.

In 1850, California passed the Act for the Government and Protection of Indians, effectively outlawing intentional burning; Native people were "legally shot for burning as late as the 1930s".

31 Knight et al. 2022. “Land Management Explains Major Trends in Forest Structure and Composition over the Last Millennium in California’s Klamath Mountains.” PNAS 119(12): e2116264119.

A 2022 UC Berkeley study found that Klamath Mountain forest biomass was approximately half of current levels historically, maintained by Karuk and Yurok cultural burning even during climate variability.

32 IPBES. 2019. Global Assessment Report on Biodiversity and Ecosystem Services.

The IPBES Global Assessment (2019) found that Indigenous peoples traditionally own, manage, use, or occupy at least a quarter of global land.

33 World Resources Institute. Analysis of Key Biodiversity Areas overlapping Indigenous and local-community lands.

The World Resources Institute found that 43% of Key Biodiversity Areas overlap Indigenous and local community lands.

34 Costanza et al. 2014. Update on the value of global ecosystem services. Global Environmental Change.

Robert Costanza's landmark estimate valued global ecosystem services at \$125–145 trillion per year; the World Economic Forum reported that over half of global GDP (~\$44 trillion) is moderately or highly dependent on nature (WEF, 2020, Nature Risk Rising).

35 World Economic Forum. 2020. Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy.

Robert Costanza's landmark estimate valued global ecosystem services at \$125–145 trillion per year (Costanza et al., 2014 update, Global Environmental Change); the World Economic Forum reported that over half of global GDP (~\$44 trillion) is moderately or highly dependent on nature.

36 Cape Coral Special Magistrate Harold S. Eskin’s 2014 ruling concerning Robin Speronis, off-grid power, and the municipal-water connection requirement, reported by Guardian Liberty Voice.

Special Magistrate Harold Eskin ruled she could live without utility power but must hook up to the city's water system even without using it, citing the International Property Maintenance Code.

37 International Residential Code, Section R104.11, Alternative Materials, Design and Methods of Construction and Equipment.

IRC Section R104.11 explicitly allows alternative materials, designs, and methods, but requires the building official to find them equivalent in quality, strength, effectiveness, fire resistance, durability, and safety.

38 U.S. Environmental Protection Agency. Water Reuse Regulations and Guidelines in the U.S.

EPA neither requires nor restricts particular reuse types at the federal level; states define their own sources, end uses, treatment standards, permits, and guidance.

39 Arizona residential greywater rules for systems under 400 gallons per day.

Arizona pioneered permit-free residential greywater systems under 400 gallons per day

40 Bowman v. Monsanto Co., 569 U.S. 278 (2013).

Justice Kagan's unanimous opinion established that patent exhaustion does not permit farmers to reproduce patented seeds by planting.

41 Center for Food Safety. 2005. Monsanto vs. U.S. Farmers.

The Center for Food Safety documented 142 lawsuits by Monsanto against 410 farmers and 56 small businesses for seed-patent violations; Monsanto won all 11 that went to trial.

42 Monsanto Canada Inc. v. Schmeiser, 2004 SCC 34.

held 5-4 that growing patented genetic material constitutes infringement even without purchase.

43 MacDonald, James M., Xiao Dong, and Keith Fuglie. 2023. Concentration and Competition in U.S. Agribusiness. USDA Economic Research Service, EIB-256.

The USDA reports that Corteva and Bayer now control 71.6% of U.S. corn seed sales and 93.5% of cotton seed sales.

44 Food and Agriculture Organization. Crop Biodiversity: Use It or Lose It.

The FAO estimates 75% of crop genetic diversity has been lost over the past century.

45 J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc., 534 U.S. 124 (2001).

plants can receive utility patents with no farmer saving exemption – overriding the Plant Variety Protection Act's original protections.

46 Federal Trade Commission and five states. Complaint against Deere & Company concerning repair restrictions. January 2025.

The FTC and five states sued Deere in January 2025, alleging that proprietary diagnostic restrictions monopolized repair services and increased farmers' costs and delays.

47 Federal Trade Commission and five states. Proposed Deere right-to-repair settlement. July 2026.

In July 2026 they secured a proposed settlement requiring Deere to make repair resources available through Operations Center PRO Service and other channels on terms comparable to those available to authorized dealers.

48 Digital Millennium Copyright Act, 17 U.S.C. § 1201.

DMCA anti-trafficking rules can continue to constrain the tools independent repair requires.

49 Associated Press. 2011. “Oak Park Drops Case Over Front-Yard Garden.” CBS Detroit.

Julie Bass of Oak Park, Michigan was charged with a misdemeanor carrying 93 days in jail for planting a vegetable garden in her front yard (2011).

50 Village of Belle Terre v. Boraas, 416 U.S. 1 (1974).

upheld one municipality's restriction on groups of unrelated people sharing a dwelling

51 Harlow, Caroline Wolf. Defense Counsel in Criminal Cases. Bureau of Justice Statistics, NCJ 179023. November 2000.

In practice, 82% of state felony defendants rely on publicly financed attorneys.

52 Pace, Nicholas M., et al. National Public Defense Workload Study. RAND Corporation, RR-A2559-1. September 2023.

The 2023 RAND National Public Defense Workload Study – commissioned by ABA SCLAID and NCSC, and representing the first update to caseload standards in fifty years – established evidence-based benchmarks finding that a single "Felony-Low" case requires approximately 35 attorney hours, meaning a public defender can responsibly handle roughly 59 felonies per year.

53 National Advisory Commission on Criminal Justice Standards and Goals. 1973. The Defense, Standard 13.12: Workload of Public Defenders. National Legal Aid & Defender Association archive.

The prior standard, set by the 1973 National Advisory Commission on Criminal Justice Standards and Goals (Standard 13.12), permitted 150 felonies per attorney

54 American Bar Association. National Public Defense Workload Standards. 2023.

The ABA summarized the national finding as: public defenders work three times too many cases.

55 U.S. Sentencing Commission. Annual Report 2023.

Sentencing Commission's Annual Report for FY 2023, covering 64,124 cases, reports that 97.2% of sentenced individuals pleaded guilty – no jury, no trial.

56 American Bar Association Criminal Justice Section. Plea Bargain Task Force Report. February 22, 2023.

The ABA Plea Bargain Task Force Report (February 22, 2023) places the national figure at nearly 98% of convictions from guilty pleas.

57 Gramlich, John. 2023. "Fewer Than 1% of Defendants in Federal Criminal Cases Were Acquitted in 2022." Pew Research Center.

Pew Research Center analysis (June 14, 2023) found that fewer than 1% of federal criminal defendants were acquitted in 2022.

58 Vera Institute of Justice. 2020. In the Shadows: A Review of the Research on Plea Bargaining.

The Vera Institute of Justice's review documented systematic coercion in plea negotiations, including threats of substantially longer sentences at trial – the so-called "trial penalty."

59 Dervan, Lucian E. 2024. "Fourteen Principles and a Path Forward for Plea Bargaining Reform." American Bar Association Criminal Justice Magazine.

The ABA's 2024 analysis noted that only 2.5% of convictions at the federal level resulted from trials.

60 Zeng, Zhen. 2025. Jails Report Series: 2024 Preliminary Data Release. Bureau of Justice Statistics, NCJ 310861.

At midyear 2024, 69% of local jail inmates – approximately 450,600 people – were unconvicted and awaiting court action.

61 Zeng, Zhen. 2025. Jail Inmates in 2023 – Statistical Tables. Bureau of Justice Statistics, NCJ 309965.

At midyear 2023, the figure was 70% (467,600 people).

62 U.S. Commission on Civil Rights. 2022. The Civil Rights Implications of Cash Bail.

Commission on Civil Rights reported in January 2022 that more than 60% of defendants are detained pretrial because they cannot afford to post bail.

63 Wylie, Stephanie, and Ames Grawert. 2024. Challenges to Advancing Bail Reform. Brennan Center for Justice.

The Brennan Center for Justice estimates that most of the roughly two-thirds of jail inmates awaiting case resolution simply cannot afford bail.

64 Rabuy, Bernadette, and Daniel Kopf. 2016. Detaining the Poor: How Money Bail Perpetuates an Endless Cycle of Poverty and Jail Time. Prison Policy Initiative.

The most methodologically rigorous figure, from BJS's 2009 data analyzed by the Prison Policy Initiative, found 34% of defendants were detained specifically for inability to post money bail.

65 City of Grants Pass v. Johnson, 144 S. Ct. 2202 (2024).

the Supreme Court held that enforcing public camping bans does not violate the Eighth Amendment's prohibition on cruel and unusual punishment

66 Martin v. City of Boise, 920 F.3d 584 (9th Cir. 2019), amending 902 F.3d 1031 (2018).

overturning the Ninth Circuit's Martin v. Boise (2018) precedent

67 National Homelessness Law Center. 2021. Housing Not Handcuffs: State Law Supplement.

The National Homelessness Law Center's Housing Not Handcuffs 2021 had already documented that 48 states had at least one law criminalizing homelessness-related behavior.

68 Sequeira, Robbie. 2025. "Many More Cities Ban Sleeping Outside Despite a Lack of Shelter Space." Stateline.

After Grants Pass, the pace accelerated dramatically: by January 2025, approximately 150 cities in 32 states had passed or strengthened camping and sleeping ban ordinances.

69 Abraham, Roshan. 2025. "Criminalizing Homelessness Doesn't Work, Study Finds." Shelterforce.

By the one-year anniversary of the decision, 260 new laws criminalizing homelessness had been enacted across the country, and 57 state-level bills were introduced in 17 states.

70 Danziger, Levav & Avnaim-Pesso. 2011. "Extraneous Factors in Judicial Decisions." PNAS 108(17): 6889–6892.

The original study by Danziger, Levav, and Avnaim-Pesso, edited by Daniel Kahneman, analyzed 1,112 rulings by Israeli parole boards and found favorable decision rates dropped from approximately 65% at the start of each session to nearly 0% by the end, resetting to approximately 65% after food breaks.

71 Glöckner, Andreas. 2016. "The Irrational Hungry Judge Effect Revisited: Simulations Reveal That the Magnitude of the Effect Is Overestimated." Judgment and Decision Making 11(6): 601–610.

However, subsequent analysis by Glöckner demonstrated via simulation that the pattern could be a statistical artifact of case scheduling: favorable rulings take longer (approximately 7.4 minutes) than unfavorable ones (approximately 5.2 minutes), so judges rationally avoid starting complex cases before scheduled breaks.

72 Prison Policy Initiative. Mass Incarceration: The Whole Pie 2025.

The United States incarcerates nearly 2 million people across federal, state, and local facilities.

73 McLaughlin, Michael, and Carrie Pettus-Davis. 2016. The Economic Burden of Incarceration in the U.S. Institute for Advancing Justice Research and Innovation.

Louis study led by Michael McLaughlin found the aggregate annual burden reaches \$1.014 trillion – nearly 6% of GDP and 11 times direct spending – once lost wages, adverse health effects, family damage, and intergenerational effects are included.

74 Craigie, Terry-Ann, Ames Grawert, and Cameron Kimble. 2020. Conviction, Imprisonment, and Lost Earnings. Brennan Center for Justice; foreword by Joseph E. Stiglitz.

The Brennan Center calculated \$370 billion per year in lost earnings for the 70+ million Americans with criminal records; prison causes a 52% reduction in annual earnings.

75 Hoffmann, Nagle & Zhou. 2024. The Value of Open Source Software. Harvard Business School Working Paper 24-038.

That is not a wage bill or cash value, but it reveals the extraordinary dependence of commercial systems on a shared software commons.

76 Tidelift. 2024. The State of the Open Source Maintainer Report.

Yet 60% of open source maintainers remain unpaid.

77 Cybersecurity and Infrastructure Security Agency. CVE-2024-3094 / XZ Utils backdoor advisory.

The XZ Utils backdoor (CVE-2024-3094) – a near-catastrophic security breach that could have compromised millions of Linux servers – exploited this

78 Synopsys Cybersecurity Research Center. 2024. Open Source Security and Risk Analysis Report.

Some 96% of commercial codebases contain open source components; 25% of OSS projects have only one developer contributing code.

79 Sharma. 2023. “A Tragedy of the Digital Commons.” North Carolina Law Review.

Some 96% of commercial codebases contain open source components; 25% of OSS projects have only one developer contributing code.

80 Himmelstein et al. 2019. "Medical Bankruptcy: Still Common Despite the Affordable Care Act." American Journal of Public Health 109(3): 431-433.

The landmark study by Himmelstein et al. estimated that 66.5% of U.S. bankruptcies were tied to medical issues – respondents cited medical expenses, illness-related work loss, or both as contributors – equivalent to approximately 530,000 families annually.

81 Rae, Matthew, Gary Claxton, Emma Wager, Cynthia Cox, and Krutika Amin. The Burden of Medical Debt in the United States. Peterson-KFF Health System Tracker.

Total medical debt stands at approximately \$220 billion; a 2022 KFF survey found 41% of adults carry some form of health care debt.

82 Mezza, Alvaro, Daniel Ringo, Shane Sherlund, and Kamila Sommer. 2020. "Student Loans and Homeownership." Journal of Labor Economics 38(1): 215-260.

Student debt – now \$1.83 trillion across 43 million borrowers – has precluded approximately 400,000 young adults from homeownership.

83 Ambrose, Brent W., Larry Cordell, and Shuwei Ma. 2015. "The Impact of Student Loan Debt on Small Business Formation." Federal Reserve Bank of Philadelphia.

A Philadelphia Federal Reserve study found that a ~3% increase in student debt produced a 14.4% decrease in small firm formation (2015).

84 International Labour Organization. 2024. Global Employment Trends for Youth 2024.

Globally, 262 million young people (1 in 4) are classified as NEET – not in education, employment, or training.

85 Burning Glass Institute and Strada Institute for the Future of Work. 2024. Talent Disrupted: College Graduates, Underemployment, and the Way Forward.

The "Talent Disrupted" report found that 52% of bachelor's degree graduates are underemployed one year after graduation, and 73% who start underemployed remain so a decade later.

86 ManpowerGroup. 2024. Global Talent Shortage.

Meanwhile, 77% of employers report difficulty finding workers with needed skills.

87 Japan Cabinet Office. 2022 Survey on Loneliness and Isolation.

Japan's hikikomori population has reached 1.46 million working-age people, while South Korea's male NEET rate among university graduates reached 23% (KEIS, 2025).

88 Song Su-jong. 2025. Changes in the Composition of Youth NEETs and Measures to Promote Labor-Market Entry. Korea Employment Information Service.

Japan's hikikomori population has reached 1.46 million working-age people (Japanese Cabinet Office, 2022), while South Korea's male NEET rate among university graduates reached 23%.

89 World Bank. World Development Indicators: Current GDP, Sub-Saharan Africa.

Nine countries – including Angola, the Democratic Republic of the Congo, Niger, and Tanzania – are expected to double in population between 2024 and 2054.

90 United Nations Department of Economic and Social Affairs. World Population Prospects 2024.

Nine countries – including Angola, the Democratic Republic of the Congo, Niger, and Tanzania – are expected to double in population between 2024 and 2054.

91 Schandl et al. 2016. Global Material Flows and Resource Productivity. United Nations Environment Programme International Resource Panel.

But the contrast demonstrates that material excess is not a prerequisite for human continuity.

92 Statistics Korea. 2025. Birth Statistics in 2024.

South Korea's TFR hit 0.75 in 2024.

93 Japan Ministry of Health, Labour and Welfare. 2024 Final Vital Statistics.

Japan stands at 1.15

94 U.S. Centers for Disease Control and Prevention, National Center for Health Statistics. Births: Final Data for 2024.

Japan stands at 1.15, the U.S. at a record-low 1.599.

95 Couillard, Benjamin. 2025. "Build, Baby, Build: How Housing Shapes Fertility." University of Toronto working paper.

Benjamin Couillard found rising housing costs since 1990 are responsible for 11% fewer children and 51% of the TFR decline between the 2000s and 2010s in the United States.

96 Li, Wenchao. 2024. "Do Surging House Prices Discourage Fertility? Global Evidence, 1870–2012." *Labour Economics* 90: 102572.

Li et al. corroborated this globally using house price data from 1870–2012.

97 Van Doornik, Bernardus, Dimas Fazio, Tarun Ramadorai, and Jānis Skrastiņš. 2024. "Housing and Fertility." CEPR Discussion Paper 19805.

Van Doornik et al. provided causal evidence from a Brazilian housing credit lottery.

98 International Monetary Fund. 2025. Republic of Korea: 2024 Article IV Consultation. IMF Country Report 25/41.

In South Korea, median families spend 63% of household income on mortgage repayment.

99 Mahler, Lukas, Michèle Tertilt, and Minchul Yum. 2025. "Policy Concerns in an Era of Low Fertility: The Role of Social Comparisons and Intensive Parenting." *Brookings Papers on Economic Activity*.

The competitive "parental rat race" – social comparison motives that drive intensive investment in fewer children – further amplifies the effect.

100 Levine et al. 2023. "Temporal Trends in Sperm Count: A Systematic Review and Meta-Regression Analysis of Samples Collected Globally in the 20th and 21st Centuries." *Human Reproduction Update* 29(2): 157–176.

Biological factors may also contribute: Levine et al.'s 2023 meta-analysis documented accelerating global declines in sperm counts.

101 Aitken, Robert John. 2024. "Population Decline: Where Demography, Social Science, and Biology Intersect." *Reproduction* 168(1): e240070.

Aitken reviews the interacting socioeconomic, cultural, environmental, and biological forces that constrain fertility and may affect human fecundity.

-
- 102 Cook, Linda J., Elena R. Iarskaia-Smirnova, and Vladimir A. Kozlov. 2023. "Trying to Reverse Demographic Decline: Pro-Natalist and Family Policies in Russia, Poland and Hungary." *Social Policy and Society* 22(2): 355–375.

Hungary raised family spending from 3.5% to 6.2% of GDP – among the highest in the OECD – and TFR rose modestly to ~1.55 before declining again, still far below its 2.1 target.

- 103 "Reversing Fertility Decline in Japan with Foreign Pro-Natalist Policies, 1990–2035: A Systematic Review and Secondary Data Analysis." 2025.

The study's model assigns Japan's existing policy package a low probability of reversing fertility decline by 2030.

- 104 Choo, Dahae, and Hugo Jales. 2021. "Childbearing and the Distribution of the Reservation Price of Fertility: The Case of the Korean Baby Bonus Program." *Journal of Asian Economics* 77: 101395.

Choo and Jales estimate that more than 94% of births receiving South Korea's baby bonus were infra-marginal: they would have occurred without the incentive.

- 105 Statistics Bureau of Japan. 2023 Housing and Land Survey.

Japan has 9 million vacant homes (13.8% of all residential properties), projected to reach 23 million by 2038.

- 106 Comolli, Chiara Ludovica. 2023. "Social Climate, Uncertainty and Fertility Intentions: From the Great Recession to the Covid-19 Crisis." *European Journal of Population* 39: 35.

Across the Great Recession and COVID-19 crisis, worsening perceptions of the social climate were associated with weaker fertility intentions beyond personal economic uncertainty.

- 107 Deng, Xin, Yang Wang, and Xiaobo Tao. 2025. "Social Trust and Fertility Intentions: Evidence from China with Causal and Structural Insights." *International Review of Financial Analysis* 107: 104616.

The study finds that social trust supports fertility intentions partly by reducing the perceived cost of childbearing.

108 Lantz, Paula M. 2021. "The Social Determinants of Declining Birth Rates in the United States: Implications for Population Health and Public Policy." Milbank Quarterly Opinion.

The Milbank Memorial Fund (2022) explicitly framed declining births as "a warning sign regarding the social and economic factors that are the fundamental drivers of all population dynamics."

109 Lim, Sojung. 2024. "The Necessary Paradigm Shift for South Korea's Ultra-Low Fertility." Georgetown Journal of International Affairs.

Sojung Lim describes South Korea's crisis as "an extreme manifestation of social problems that many societies share."

110 International Agency for Research on Cancer. Occupational Exposure as a Firefighter. IARC Monographs, Volume 132. 2022.

The International Agency for Research on Cancer classified firefighting as Group 1 – Carcinogenic to Humans in July 2022.

111 Daniels et al. 2014. Pooled cohort study of 29,993 U.S. firefighters. Occupational and Environmental Medicine 71: 388–397.

The NIOSH pooled cohort study of 29,993 career firefighters found a 9% higher cancer diagnosis rate and 14% higher cancer mortality rate versus the general population, including a twofold increase in mesothelioma.

112 DeBono et al. 2023. Meta-analysis of firefighter cancer risk. Safety and Health at Work.

The IARC meta-analysis identified statistically significant elevated risks for mesothelioma (58% increase), testicular cancer (37%), melanoma (36%), thyroid cancer (28%), prostate cancer (21%), colon cancer (19%), bladder cancer (16%), and non-Hodgkin lymphoma (12%).

113 International Association of Fire Fighters. Fire Fighter Cancer Awareness Month: 2025 Line-of-Duty-Death Data.

In 2025, occupational cancer caused nearly 80% of IAFF member line-of-duty deaths.

114 National Institute of Standards and Technology. 2023. Per- and Polyfluoroalkyl Substances in Firefighter Turnout Gear. NIST Technical Note 2248.

NIST identified 26 different PFAS compounds in turnout gear textiles, with highest concentrations in the outer layers designed to protect firefighters from flame.

115 Treitman, Robert D., William A. Burgess, and Avram Gold. 1980. "Air Contaminants Encountered by Firefighters." American Industrial Hygiene Association Journal 41(11): 796–802.

Treitman, Burgess, and Gold measured air contaminants at more than 200 Boston fires; benzene was detected in 181 of 197 samples.

116 Herkert et al. 2026. "Per- and Polyfluoroalkyl Substances (PFAS) and Brominated Flame Retardants (BFRs) in Firefighter Turnout Gear: Two Chemical Classes of Concern to Consider." Environmental Science & Technology Letters 13(1): 28–33.

Brominated flame retardants appeared in all three tested garment layers, including non-PFAS-treated moisture barriers, indicating another chemical-exposure concern.

117 U.S. Congress. H.R. 1269, Honoring Our Fallen Heroes Act, 119th Congress; enacted through the FY2026 National Defense Authorization Act.

Federal recognition of occupational cancer as a line-of-duty death came only in December 2025 with the Honoring Our Fallen Heroes Act, passed as part of the NDAA.

118 Ostrov, Barbara Feder. 2023. "Firefighters Battle for Their Lives." Public Health Watch; co-published by Investigative Reporting Workshop and Mother Jones.

Public Health Watch documented routine initial denials and years-long delays in firefighter cancer claims, including cases covered by state presumption laws.

119 International Association of Fire Fighters. 2026. "Austin Fire Fighter Wins Landmark Cancer Case."

Lt. Suzanne LaFollette's claim was denied because uterine cancer was not on Texas's presumptive list and was treated as a disease of life; she later prevailed on appeal.

120 Moore, David W. 2001. "Firefighters Top Gallup's 'Honesty and Ethics' List." Gallup News Service.

Firefighters earned a 90% trust rating in 2001.

121 USAFacts. 2025. "How Much Do States Spend on Housing Prisoners?" Data from the U.S. Census Bureau and Bureau of Justice Statistics.

direct corrections spending – \$63.6 billion annually – captures only a fraction of the true cost.

122 Lim, Jessie Yeung and Jun Michael Park. 2024. "Why Experts Say South Korea Shouldn't Just Throw Cash at Its Low Birth Rate Problem." Time.

South Korea has spent over \$280 billion since 2006 on birth bonuses, childcare subsidies, fertility treatments, and housing incentives

123 Seoul Shinmun. 2026. Report on 4,008 South Korean school closures since 1980, based on Ministry of Education and National Assembly materials.

Ministry of Education and National Assembly materials showed that 4,008 elementary, middle, and high schools had closed nationwide since 1980.

124 Lee, Hae-rin. 2026. "Demographic Decline Puts Dozens of Universities at Risk, Experts Warn." The Korea Times; citing Ministry of Education projections.

The Ministry of Education projected 298,178 new first-graders in 2026, while universities and two-year colleges were built for roughly 450,000–500,000 new students annually.

125 National Bureau of Statistics of China. 2026. "National Economy Pushed Forward with Innovation-Led and High-Quality Development and Expected Targets Achieved Successfully in 2025."

China's official 2025 statistics recorded 7.92 million births and a year-end population decrease of 3.39 million.

126 Peng Xiujian and Shanghai Academy of Social Sciences research team. 2024 population projection for China through 2100, reported in "How China Miscalculated Its Way to a Baby Bust."

The joint Victoria University-Shanghai Academy research team projected China's population at approximately 525 million in 2100 under its updated forecast.

127 Frankfurt Main Finance. 2026. Number of Pension Contributors per Retiree Since 1960. Open Data Hessen / GovData.

The longitudinal dataset tracks Germany's decline from roughly six pension contributors per retiree in the 1960s to about two today.

128 Heyman, Miriam, Jeff Dill, and Robert Douglas. 2018. The Ruderman White Paper on Mental Health and Suicide of First Responders. Ruderman Family Foundation.

The report recorded at least 103 firefighter suicides in 2017, compared with 93 firefighter line-of-duty deaths.

129 National Fire Protection Association. 2022. U.S. Fire Department Profile 2020: Supporting Tables.

The NFPA's 2020 estimate counted 1,041,200 career and volunteer firefighters in the United States, 62,100 fewer than in 2010.

130 National Volunteer Fire Council. 2017. Volunteer Fire Service Culture: Essential Strategies for Success.

Volunteer fire departments' call volumes tripled over the preceding 30 years while their services and training demands expanded.

131 Mohr, Kylie. 2025. "The Forest Service Claims It's Fully Staffed for a Worsening Fire Season. Data Shows Thousands of Unfilled Jobs." Government Executive and ProPublica.

A July 2025 internal Forest Service staffing report reviewed by the reporters showed more than 5,100 unfilled firefighting positions—over 26% of the total.

132 Carson, E. Ann, and Rich Kluckow. 2025. Prisoners in 2023 – Statistical Tables. Bureau of Justice Statistics, NCJ 310201.

The Bureau of Justice Statistics counted 1,254,200 people under state or federal prison jurisdiction at year-end 2023, an increase of 24,100 from 2022.

133 USAFacts. 2025. "How Many States Use Private Prisons?" Based on Bureau of Justice Statistics data.

In 2023, 28 states used private prisons, which held 7.1% of state and federal prisoners.

-
- 134 Nigam, J. et al. 2023. “Vital Signs: Health Worker-Perceived Working Conditions and Symptoms of Poor Mental Health – Quality of Worklife Survey, United States, 2018–2022.” *MMWR* 72(44): 1197–1205.

In 2022, 45.6% of surveyed health workers reported burnout often or very often; 44.2% were somewhat or very likely to seek another job, and reported workplace harassment had risen from 6.4% in 2018 to 13.4%.

-
- 135 Giménez-Bertomeu, Víctor M. et al. 2024. “Burnout Among Social Workers in Social Services: A Systematic Review and Meta-Analysis of Prevalence.” *Journal of Social Service Research* 50(4): 664–683.

Across 24 studies and 16,962 social-service workers in seven countries, pooled prevalence was 20% for full-syndrome burnout and 50% for emotional exhaustion.

-
- 136 MacLochlainn, Justin et al. 2026. “The Effects of Child Protection Social Worker Turnover on Children and Families: A Scoping Review Addressing a Critical Gap in Social Work Turnover Research.” *British Journal of Social Work* 56(3): 1240–1262.

The eleven-study scoping review links turnover with relationship disruption, trust erosion, placement instability, delayed permanency, and emotional distress, while noting a limited literature drawn largely from the United States.

-
- 137 U.S. Bureau of Labor Statistics. Construction: NAICS 23, fatalities, injuries, and illnesses data.

BLS recorded 1,064 construction-industry occupational fatalities in 2024 and 2.2 recordable injury and illness cases per 100 full-time workers.

-
- 138 Sussell, Aaron et al. 2023. “Suicide Rates by Industry and Occupation – National Vital Statistics System, United States, 2021.” *MMWR* 72(50): 1346–1350.

In 2021, the suicide rate among men in the construction industry was 56.0 per 100,000, compared with 32.0 across the male civilian noninstitutionalized working population.

-
- 139 Syed, Shabeer et al. 2020. “Global Prevalence and Risk Factors for Mental Health Problems in Police Personnel: A Systematic Review and Meta-Analysis.” *Occupational and Environmental Medicine* 77(11): 737–747.

Across 67 studies involving 272,463 police personnel in 24 countries, pooled point prevalence was 14.6% for depression, 14.2% for PTSD, 8.5% for suicidal ideation, and 25.7% for hazardous drinking.

140 Mennicke, Annelise M., and Katie Ropes. 2016. "Estimating the Rate of Domestic Violence Perpetrated by Law Enforcement Officers: A Review of Methods and Estimates." *Aggression and Violent Behavior* 31: 157–164.

Only seven studies met the review criteria; self-reported prevalence estimates ranged from 4.8% to 40%, with substantial differences in measurement and sampling.

141 Le Texier, Thibault. 2019. "Debunking the Stanford Prison Experiment." *American Psychologist* 74(7): 823–839.

Archival analysis identified extensive demand characteristics, instructions given to guards, incomplete and biased data collection, and selective reporting.

142 Reicher, Stephen, and S. Alexander Haslam. 2006. "Rethinking the Psychology of Tyranny: The BBC Prison Study." *British Journal of Social Psychology* 45(1): 1–40.

Participants did not automatically conform to assigned roles; collective identification and the organization or failure of alternatives shaped whether domination emerged.

143 Haslam, S. Alexander, Stephen D. Reicher, and Jay J. Van Bavel. 2019. "Rethinking the Nature of Cruelty: The Role of Identity Leadership in the Stanford Prison Experiment." *American Psychologist* 74(7): 809–822.

The authors argue that cruelty in the Stanford Prison Experiment was cultivated through identity leadership, norms, and persuasion rather than mechanically produced by an assigned role.

144 Bonhoeffer, Dietrich. 1943. "Von der Dummheit." In *Widerstand und Ergebung*.

Bonhoeffer presents stupidity as a social and moral condition under power rather than simply an intellectual deficit; the essay is used here as a philosophical lens, not an empirical measure.

145 City of Boulder. 2026. 2025 Behavioral Health Crisis Response Team Annual Report.

In 2025 BHCRT handled 1,479 calls; 0.3% involved officer use of force, 1.6% involved arrest, and clinician participation returned officers to service 515 times.

146 City of Boulder. Police Oversight: Independent Police Monitor and Police Oversight Panel.

Boulder reports that 2024 complaint volume overwhelmed the oversight system, roughly one in five complaints in recent years required additional robust investigation, and Colorado's Clean Slate law can restrict access to evidence.

147 Singh, Manvir, and Luke Glowacki. 2022. "Human Social Organization During the Late Pleistocene: Beyond the Nomadic-Egalitarian Model." *Evolution and Human Behavior* 43(5): 418–431.

The review covers ethnographic findings from 34 world regions and archaeological findings from 27 Middle Stone Age sites, documenting substantial social diversity among non-agricultural peoples and challenging one universal nomadic-egalitarian model.

148 Hill, Kim R. et al. 2011. "Co-Residence Patterns in Hunter-Gatherer Societies Show Unique Human Social Structure." *Science* 331(6022): 1286–1289.

Across 5,067 adults in 32 hunter-gatherer societies, either sex could disperse or remain, adult siblings often co-resided, and most members of residential groups were not close genetic relatives.

149 Kaplan, Hillard S., Paul L. Hooper, and Michael Gurven. 2009. "The Evolutionary and Ecological Roots of Human Social Organization." *Philosophical Transactions of the Royal Society B* 364(1533): 3289–3299.

The framework connects forager social organization to skill-intensive production, complementary inputs, gains from cooperation and risk reduction, and the limited economic defensibility of many foraged resources.

150 Kohler, Timothy A. et al. 2017. "Greater Post-Neolithic Wealth Disparities in Eurasia Than in North America and Mesoamerica." *Nature* 551: 619–622.

Using house-size distributions as a consistent wealth proxy, the study found inequality generally increased with domestication and sociopolitical scale, with a stronger post-Neolithic rise in its Eurasian sample.

151 Smith, Monica L. 2022. "The Fundamentals of the State." *Annual Review of Anthropology* 51: 493–508.

The review examines the state through politics, violence, literacy, and borders, describing outcomes that range from collaborative integration to institutionalized inequality and power.

-
- 152 National Academies of Sciences, Engineering, and Medicine. 2019. Taking Action Against Clinician Burnout: A Systems Approach to Professional Well-Being. Washington, DC: The National Academies Press.

The consensus report locates burnout across frontline care, healthcare organizations, and the external environment, where decisions shape clinicians' job demands and resources.

- 153 McFadden, Paula et al. 2024. "Safe Staffing and Workload Management in Social Work: A Scoping Review of Legislation, Policy and Practice." *British Journal of Social Work* 54(5): 2006–2026.

The review found limited evidence and no broadly established social-work-specific safe-staffing definition outside parts of children's services; identified workload approaches account for case complexity, risk, time, experience, and team capacity.

- 154 Pascoe, Katheryn Margaret, Bethany Waterhouse-Bradley, and Tony McGinn. 2023. "Social Workers' Experiences of Bureaucracy: A Systematic Synthesis of Qualitative Studies." *British Journal of Social Work* 53(1): 513–533.

The synthesis of 39 qualitative studies found recurring negative effects of standardized, paperwork-oriented managerial systems on social workers, service users, discretion, and relationship-based practice.

- 155 National Institute for Occupational Safety and Health. 2024. "Construction." Centers for Disease Control and Prevention.

NIOSH identifies seasonal work, time away from family, injuries and chronic pain, lack of paid sick leave, and demanding schedules among factors that can harm construction workers' mental health, alongside elevated opioid and suicide concerns.

- 156 Sumer, Arev P. et al. 2024. "Earliest Modern Human Genomes Constrain Timing of Neanderthal Admixture." *Nature* 638: 711–717.

Genomes from roughly 45,000-year-old people date the Neanderthal admixture event shared by the ancestors of living non-Africans to approximately 45,000–49,000 years ago; present-day non-African populations retain roughly 2–3% Neanderthal ancestry.

- 157 Ongaro, Linda, and Emilia Huerta-Sánchez. 2024. "A History of Multiple Denisovan Introgression Events in Modern Humans." *Nature Genetics* 56: 2612–2622.

The review finds genomic evidence for at least three introgression events from distinct Denisovan populations, despite the small and fragmentary fossil record attributed to Denisovans.

-
- 158 Lorenzen, Eline D. et al. 2011. "Species-Specific Responses of Late Quaternary Megafauna to Climate and Humans." *Nature* 479: 359–364.

Comparative radiocarbon, ancient-DNA, and distribution evidence showed species-specific responses among six megafaunal groups; neither climate change nor human pressure alone explained every decline or extinction.

-
- 159 Steffen, Will et al. 2015. "The Trajectory of the Anthropocene: The Great Acceleration." *Anthropocene Review* 2(1): 81–98.

Updated socioeconomic and Earth-system datasets show pronounced post-1950 changes across many measures, while the trajectories vary and do not all accelerate continuously.

-
- 160 International Commission on Stratigraphy. 2024. "Anthropocene Working Group." Subcommission on Quaternary Stratigraphy.

The SQS rejected the proposed Anthropocene Epoch beginning in 1952, and the ICS and IUGS approved that decision in March 2024; the formal Geological Time Scale therefore remains within the Holocene.

-
- 161 Waters, Colin N. et al. 2024. "Part 2: Descriptions of the Proposed Crawford Lake GSSP and Supporting SABSS." *The Anthropocene Epoch and Crawfordian Age: Proposals by the Anthropocene Working Group*. EarthArXiv preprint.

The proposal placed the boundary in a 1952 varve at Crawford Lake where combined plutonium-239 and plutonium-240 concentrations rise rapidly, coinciding with a globally recognizable signal from the first above-ground thermonuclear tests.

-
- 162 Edgeworth, Matthew et al. 2023. "The Stratigraphic Basis of the Anthropocene Event." *Quaternary Science Advances* 11: 100088.

The peer-reviewed paper argues that artificial strata, humanly modified ground, legacy sediments, and artefact-bearing natural deposits form a diachronous record better understood as an unfolding Anthropocene Event than a synchronous epoch.

-
- 163 Erlandson, Jon M. 2013. "Shell Middens and Other Anthropogenic Soils as Global Stratigraphic Signatures of the Anthropocene." *Anthropocene* 4.

The paper documents ancient shell-midden soils and other anthropogenic soils, arguing that their widespread appearance between roughly 12,000 and 6,000 years ago records a deep and geographically dispersed history of human niche construction.
