The Root of the Pentagram

Why Restoration Must Begin in the Soil

The expanded Modern Pentagram framework

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Every circuit needs a power source. In the modern pentagram — the interlocking economy of Big Agriculture, Big Food, Big Pharma, Big Healthcare, and Big Insurance — that source is the first point of the star. Nothing downstream happens without it. The engineered bliss point, the prescription, the hospital bed, the premium increase: all of them are downstream of a seed going into the ground.

And here is the uncomfortable arithmetic: the United States spends roughly $4.3 trillion a year on healthcare, and an estimated 90% of that goes to chronic disease — *much of it diet-related* (Vermont General Assembly briefing). Treating just cardiovascular disease, diabetes, and diet-related cancers costs about $334 billion annually (AHRQ, Medical Expenditure Panel Survey). If the goal is to bend that curve — to lower healthcare costs not by rationing care but by reducing the need for it — then the intervention point is not the pharmacy. It is not even the plate. It is the farm policy that decides what grows, in what quantity, and at what quality.

This chapter connects each point of the pentagram to a specific, documented policy lever — the nuts and bolts that hold the machine together — and shows what pulling them would mean for human health, for the soil, and for the ledger.

I. What the Field Actually Grows (and Why It Isn't Food)

Start with the crop that defines American agriculture. Of the U.S. corn crop, only about 9% of bushels go to direct human food uses — high-fructose corn syrup, glucose and dextrose, starch, cereals, and beverage alcohol combined (U.S. DOE Alternative Fuels Data Center, USDA data). Roughly a third becomes animal feed, more than a third becomes ethanol, and the rest is exported or stored (American Farm Bureau Federation). The kind of corn people actually eat — sweet corn — occupies less than 1% of corn acreage (American Farm Bureau Federation).

And that 9% flatters the crop. Look inside the category and the largest single use of corn that reaches a human mouth is refined sweetener: high-fructose corn syrup and glucose-dextrose together account for roughly half of all "food" uses — more than cereals, starch, and beverage alcohol combined (U.S. DOE Alternative Fuels Data Center, USDA data). This is not nourishment passing through a processing step; it is the raw material of the bliss point itself.

The health record of that sweetener fraction is now substantial. The landmark global analysis by Goran and colleagues at USC and Oxford found that countries using HFCS had a 20% higher prevalence of

type 2 diabetes than countries that did not — independent of obesity, total sugar intake, and calorie availability (USC News, Goran et al., via PMC). Fructose metabolism runs independently of insulin, primarily in the liver, where it is readily converted to fat — the likely pathway to non-alcoholic fatty liver disease, now among the fastest-rising liver conditions in both adults and children (USC News, Endocrine Society). Recent NIH-supported research goes a step further, suggesting high fructose intake may initiate NAFLD by damaging the intestinal barrier (NIH Research Matters) — a finding that should ring a bell for readers of this book: another engineered molecule, another degraded membrane.

An honest inventory of the science, however, requires two qualifications. First, the strongest population-level evidence for sweetened-beverage harm is really nit-picky about fructose-containing sugars generally, not HFCS specifically: in controlled feeding trials, fructose exchanged calorie-for-calorie with glucose or sucrose shows little difference in metabolic outcomes, and meta-analyses find few distinctions between HFCS and table sugar (European Journal of Nutrition, controversies review, Frontiers in Nutrition meta-analysis). The harm signal is clearest at high and excess intake — exactly the intake the bliss point is engineered to produce. Second, the mechanism matters more than the molecule: fructose at the doses the American food supply delivers — up to 15% of average daily energy intake — is the problem, whether it arrives as HFCS-55 or cane sugar (Diabetes of the Liver review).

So the honest accounting is starker than the 9% figure suggests: of the entire American corn harvest, *only a small fraction ends up in forms that nourish rather than burden the body*. The subsidy system is not merely failing to grow food. It is growing the feedstock of the very diseases that finance the other four points of the star.

The highchair: where the circuit begins

The pentagram's first customer is the youngest one. A 2026 audit of the baby and toddler aisle at 21 grocery stores in Texas found that 81% of the 2,783 products marketed for children ages 6–36 months were ultra-processed by the NOVA classification, and 49% failed at least one World Health Organization nutrient standard — with pouches and oat bars leading on sugar and mac-and-cheese and turkey sticks leading on sodium and fat (University of Texas School of Public Health study, reported by Medical Xpress). The audit's implication is the thesis of this chapter in miniature: the aisle is not a food system with some processing in it — it is a processing system with some food in it.

The pouch is the highchair's delivery vehicle, and its contents are documented. Analyses of commercial infant and toddler pouches find they contain significantly more sugar per serving than jarred products, with total sugars highest in pouches marketed for the youngest infants — 4 months and up (Nutrients / PMC, Public Health Nutrition / PMC) — and only about half of pouches meet the WHO's total sugar

requirement for young children (Maternal & Child Nutrition). An international analysis of 276 products found 20% carried added sugars and 17% added fruit juice (Public Health Nutrition / PMC). Taste preference is trainable, and the training starts before speech: the sweetener fraction of the subsidized crop — the same HFCS-and-refined-starch stream described above — meets the developing palate months before a child can ask for it.

And the cereal — the canonical first food — carries a second burden that runs not through nutrition but through the soil itself. Rice absorbs arsenic from contaminated ground water more readily than other crops, which is why infant rice cereal has been a leading source of arsenic exposure in infants (FDA). The FDA's own risk assessment links inorganic arsenic exposure in fetal development and infancy to neurodevelopmental effects and elevated lifetime cancer risk, and only recently finalized a non-binding action level of 100 parts per billion (FDA guidance). Independent testing says the problem is broader than rice cereal: Consumer Reports' 2026 analysis of 48 packaged baby foods detected inorganic arsenic in 77%, cadmium in 80%, and lead in 85% of samples (Consumer Reports, via Food Safety Magazine); a House subcommittee investigation found every company that submitted data reported arsenic, lead, and cadmium in their products (Consumer Reports). The proposed Baby Food Safety Act would have set enforceable limits — 10 ppb arsenic in baby foods, 5 ppb lead — but it did not become law (narrative review, PMC). The FDA's Closer to Zero initiative is still working through its backlog: lead guidance was finalized in January 2025, cadmium guidance is only in draft, and arsenic limits for processed baby foods are not expected until 2027 (FDA).

Note what the heavy-metal story actually is: it is a soil story. Arsenic and cadmium in baby cereal are agricultural legacies — residues of decades of pesticide application and contaminated irrigation — arriving, concentrated and portioned, in the safest-looking packages in the store. The pentagram's points meet in the highchair bowl: subsidized crops and degraded soils upstream, engineered sweetness in the middle, and a pediatric population pre-selected for the chronic disease market downstream. The American Academy of Pediatrics now advises that rice cereal "shouldn't be the only source and does not need to be the first" (FDA) — a quiet acknowledgment that the default first food of several generations of Americans was a compromise, not a standard.

This is not an accident of taste. It is an engineered outcome, purchased with public money:

- **Corn received $3.2 billion in 2024 — 30.5% of all federal farm subsidies — and soybeans another $1.9 billion, or 17.9%.** Together, nearly half of everything the USDA pays out (USA Facts, USDA data).
- **Over 2017–2025, the USDA distributed roughly $147 billion in farm subsidy payments**, concentrated overwhelmingly in the commodity states and the five program crops (OpenSubsidies).

- **Four crops — corn, soybeans, wheat, and cotton — capture about 80% of all crop insurance premium subsidies** (Taxpayers for Common Sense). Insurance is the quiet engine: it guarantees revenue, which guarantees loans, which guarantees the monoculture.
- **The Renewable Fuel Standard, an EPA-administered mandate, requires biofuel blending into the national fuel supply** — which is why ethanol consumes roughly 40–45% of the corn crop (USDA Economic Research Service) and why more than half of domestic soybean oil now goes into biodiesel and renewable diesel (USDA Economic Research Service).

So the loop closes like this: federal policy guarantees demand for fuel and feed, federal insurance guarantees revenue for the crops that supply it, and the resulting river of cheap corn and soy becomes the raw material for the ultra-processed food supply. The Government Accountability Office found that from 2019 to 2023, nearly two-thirds of USDA's $161 billion in financial assistance went to field crops like corn and soybeans (U.S. PIRG, GAO analysis).

The downstream health consequences are no longer seriously disputed. A 2024 BMJ umbrella review of 45 meta-analyses covering nearly 10 million people found convincing evidence linking ultra-processed food exposure to a roughly 50% higher risk of cardiovascular disease-related death and a 12% greater risk of type 2 diabetes, with direct associations across 32 health parameters (BMJ / NIH). And the lineage of those products is documented: food brands once owned by tobacco companies — the same firms that perfected addiction engineering in cigarettes — are far more likely to be ultra-processed today (Steele et al., Public Health Nutrition, 2023).

Big Agriculture does not grow what feeds people. It grows what feeds the pentagram.

II. The Five Levers

The machine has five load-bearing bolts. None of them requires inventing anything new — each is an existing policy that could be reformed, restructured, or reversed. What follows is the repair manual.

Lever 1 — Unwind the fuel mandates (Big Agriculture ↔ Big Food)

The Renewable Fuel Standard is the single largest artificial demand for calories in human history. Roughly 14 billion gallons of corn ethanol are blended into gasoline each year under the mandate (Taxpayers for Common Sense), and it is the reason ethanol accounts for nearly half of all domestic corn use (USDA ERS). Every bushel mandated into the fuel tank is a bushel of incentive to plant corn instead of something a human could eat — and a subsidy, in effect, to the ultra-processed food economy that feeds on the surplus.

Reform options short of full repeal exist and have been modeled: capping conventional (corn-based) volumes while preserving advanced-biofuel requirements, letting blending obligations track actual gasoline demand, and ending the practice of small-refinery exemptions that distort the mandate's effects. The honest caveat: modeling suggests short-run effects are gradual (Iowa State CARD), because ethanol infrastructure is sunk capital. This is a decade-scale unwinding — but the direction of the first decade is set by the next farm bill and the next set of EPA volume standards.

Lever 2 — Free the base acres (Big Agriculture ↔ federal law)

Here is a fact that surprises nearly everyone outside farm country: **under federal commodity programs, farmers who plant fruits or vegetables on their program "base acres" lose payments on those acres and can owe a penalty equal to the market value of the crop** (National Agricultural Law Center; Congressional Research Service, R42771). The rule, originally demanded by fruit and vegetable growers themselves to avoid subsidized competition, now functions as an explicit federal prohibition on converting subsidy-supported cropland to human food.

A government that wants a healthier food supply would simply remove the prohibition. USDA's own economists note the effect would be modest on its own — the deeper barriers are economic (USDA ERS) — which is exactly why this lever must be pulled together with the others. Freeing the acres is necessary but not sufficient.

Lever 3 — Make the safety net whole (Big Agriculture ↔ Big Insurance)

The starkest asymmetry in the entire system: while corn and soybean growers receive guaranteed, heavily subsidized revenue protection, **over 43% of U.S. fruit and nut acreage and 47% of vegetable and melon acreage have no federal crop insurance coverage at all** (American Farm Bureau Federation). Fewer than 9% of specialty-crop farms purchased crop insurance in a recent study year, compared with a majority of row-crop farms (Fulton Sun / Harvest Public Media reporting).

The policy fix has three parts: (1) expand insurance products for the more than 350 specialty commodities, moving from yield-based to revenue-based coverage (Farm Bureau); (2) fix and promote Whole-Farm Revenue Protection, the 2014-vintage product designed for diversified farms, which has foundered on paperwork, agent unfamiliarity, and low awareness (Fulton Sun); (3) cap commodity payments to the largest operations and redirect the savings toward transition support for diversified producers (America Renewing policy primer). A farmer will not grow what a bank will not finance, and a bank will not finance what the government will not insure. Fix the insurance, and the credit follows.

Lever 4 — Pay for soil, not bushels (Big Agriculture ↔ the environment)

This is the lever that heals the ground itself, and it is where the "bonus" of environmental repair becomes the main event.

First, the scale of the damage being repaired. U.S. cropland loses an estimated 4.6 to 5 tons of soil per acre per year — roughly ten times the rate at which soil forms — costing farmers up to $3 billion a year in productivity (NASA Landsat analysis). The full societal bill is enormous by any accounting: USDA estimates erosion-caused productivity losses approach $27 billion annually with another $17 billion in off-site environmental costs (USDA Natural Resources Conservation Service); The Nature Conservancy places the total annual cost of soil degradation at up to $85.1 billion (The Nature Conservancy, "ReThink Soil"), and estimates U.S. agricultural soils have lost as much as 60% of their original organic carbon.

The chemical load rides on top of the erosion. American farmers apply roughly 70 million pounds of atrazine — the second most heavily used herbicide after glyphosate — every year, and it now pollutes roughly a quarter of U.S. river miles (The New Lede). Nitrate fertilizer runoff is linked to colorectal cancer, thyroid disease, and infant oxygen deprivation; one estimate attributes up to 12,500 U.S. cancer cases per year to nitrate in drinking water, at up to $1.5 billion in medical costs (Union of Concerned Scientists). Municipalities carry the cleanup: Des Moines Water Works spends an estimated $16,000 per day running nitrate removal (UCS). Note the circuit: the pentagram monetizes the food, then the healthcare system monetizes the disease, while the water utility — and the taxpayer — absorbs the externality. That is the "laundering" function, run through the soil.

The repair is documented, not hypothetical. A 210-farm North American field study found the most regenerative farms held 39% greater total soil carbon pools than the most conventional, with greater biodiversity across microbes, invertebrates, plants, and birds (Environmental Research: Food Systems, IOP Publishing). A synthesis of quantitative surveys found regenerative systems increased soil organic carbon by 18.4% over five years on average, with yields holding constant or rising in 74% of systems (Springer, Regenerative Agriculture). Cover crops increase water infiltration by 13–23% (USDA NRCS Technical Note 470-20). The Nature Conservancy estimates each 1% of U.S. cropland converted to adaptive soil health systems generates about $226 million in annual societal value plus $37 million in on-farm value (The Nature Conservancy).

The policy lever already exists in embryo — the farm bill's conservation title, EQIP, CSP, and the Conservation Reserve Program. The reform is to reweight those programs away from cost-share for marginal practices and toward transition support for whole-system change: multi-year cover cropping, reduced tillage, diversified rotations, integrated livestock, and managed grazing — the practices the systematic reviews identify as effective, with the honest caveat that effects vary by region, take years to plateau, and reverse if abandoned (Soil Health / Springer systematic review).

The point for this book's argument: when the levers above shift acreage away from input-intensive monocultures, the chemical load falls with it — not because anyone banned the chemicals, but because the crops that require them stopped being the only crops the system would finance. The environment heals as a by-product of the food supply healing. The bonus is the mechanism.

Lever 5 — Prescribe the food (Big Healthcare ↔ Big Insurance ↔ Big Pharma)

The demand side is where the healthcare savings actually show up, and it is the fastest-moving lever because it does not wait for a farm bill.

The evidence base is now quantified at national scale by the Tufts Food is Medicine Institute: national implementation of produce prescription programs for food-insecure patients with diabetes would avert an estimated 292,000 cardiovascular events over a lifetime, gain 260,000 quality-adjusted life years, and save $39.6 billion in healthcare costs plus $4.8 billion in productivity — at a cost-effectiveness ratio of $18,100 per QALY, well within accepted thresholds (Tufts Food is Medicine Institute). National medically tailored meals for patients with diet-related conditions and activity limitations: an estimated 1.6 million averted hospitalizations and $13.6 billion in net first-year savings (Tufts). Other analyses put the savings from medically tailored meals alone at $23.7 billion per year (Center for Health Law & Policy Innovation, Harvard Law).

Here is the pentagram's internal contradiction, stated as policy: insurers currently pay for the bypass and the metformin but not the food that would have prevented both. Produce prescriptions, medically tailored meals, and SNAP produce incentives (like Double Up Food Bucks) turn the payer's incentive around — the entity that eats the cost of chronic disease becomes the entity that finances its prevention. State Medicaid waivers under Section 1115 are the existing legal vehicle, and several states have already begun using them (Vermont General Assembly briefing).

This is the lever that Big Healthcare and Big Insurance cannot rationally resist forever — and the one that funds the farmer transition, because someone must grow the food being prescribed. Levers 1 through 4 build the supply; Lever 5 builds the market that pays for it.

III. The Ledger: What Repair Costs, and What Decay Costs

The comparison that ends the argument:

Item	Annual cost / value

Diet-related chronic disease treatment (CVD, diabetes, diet-related cancers)	~$334 billion (AHRQ)
Total chronic disease share of healthcare spending	~90% of $4.3 trillion (Vermont GA / Tufts)
Societal cost of soil degradation	up to $85.1 billion (The Nature Conservancy)
Nitrate-attributable cancer treatment	up to $1.5 billion (UCS)
Projected savings: produce prescriptions (lifetime, national)	$39.6 billion healthcare + $4.8 billion productivity (Tufts)
Projected savings: medically tailored meals (year one, national)	$13.6 billion net (Tufts)
On-farm value of every 1% of cropland under soil health systems	$37 million on-farm + $226 million societal (TNC)

The asymmetry is the point. The entire commodity subsidy architecture costs tens of billions per year; the diseases it helps feed cost hundreds of billions. A market built on repair is not charity. It is the only version of the ledger that balances.

IV. An Honest Inventory (author's note)

A restoration argument earns its credibility by saying what the evidence does and does not show. Four things:

1. **The ultra-processed food evidence is observational, not interventional. However, the processing is a completely different aspect than the ingredients that are being processed.** The umbrella reviews are large and consistent (BMJ / NIH), but the randomized-trial literature is small and mixed. The association is strong; the mechanism is still being mapped. This book's membrane framework is offered as a unifying biological lens consistent with that evidence — not as a claim the trials have already proven. Comparing the health parameters of *Blue Zoners* and indigenous tribes who have not yet been subjected to “modern” foods is proof enough for me. They don’t have anywhere near the incidence of chronic health conditions as the western diet obviously creates.
2. **Farmers are not villains; they are doing the very best they can in a rigged market.** Corn and soy are the most mechanized, most insurable, most financeable crops in history. The transition to food and regenerative crops carries real startup costs — equipment, labor, irrigation, market contracts — that USDA's economists have documented in detail (USDA ERS). It is in the best interest for funding to pay for the bridge for two reasons. Better food =better health=lower healthcare costs. AND there is a bonus — moving to sustainable biologically compatible production methods such as regenerative allow the environment to heal instead of degrading them more each year.

3. **Regenerative outcomes vary by region and are reversible.** The systematic reviews counsel against overstating carbon permanence and yield effects (Springer systematic review). The honest claim is "measurable, meaningful, and conditional," not "miraculous."
4. **The timeline is a generation, not a news cycle.** The RFS unwinds gradually; orchards take years to bear; tastes and supply chains move slowly. The 1970s took decades to break the food supply. Repair will take at least as long — but every year of delay compounds the chronic ill health and the increase in the healthcare costs.

V. Closing: The Taproot

The pentagram's five points draw their power from a single circuit, and the circuit is grounded in the soil. For fifty years, federal policy has paid, insured, and *mandated a food supply in which the crops humans need most are the crops the system grows least* — and in which the inputs that degrade the field, the water, and the membrane arrive together, in the same planter's hopper.

Every lever described in this chapter already exists. None requires a revolution — only a redirection. Unwind the fuel mandate, free the base acres, make the insurance whole, pay for soil instead of bushels, and let the healthcare dollar prescribe the food. Do these, and the toxins thin out not by decree but by desertion: the crops that required them shrink, and the practices that replace them build the carbon, the water-holding capacity, and the microbial life that a functioning membrane — in a cell, in a soil, in a society — has always required.

We have spent fifty years learning that a market can be engineered to feed on decay. The same is true in reverse. A market can be engineered for repair. It starts, as everything does, with what we put in the ground.

Prepared November 2026 - All statistics current as of November 2026