The Physical Foundation

Chapter 2 covers who's actually building this. Chapter 3 covers whether the ground itself has a future. This chapter asks a narrower, more mechanical question about the same site: given the people and the place, does the physical resource base actually add up.

Food: how much land this actually takes

Estimates for land needed per person to reach real food self-sufficiency run from roughly 2 to 17 acres, and diet is the single biggest lever inside that range. A standard American diet, meat- and dairy-heavy, needs on the order of 2.7 acres of agricultural land per person per year; a plant-forward diet that still meets USDA nutritional guidelines needs closer to a third of an acre. Climate is the other major variable: the same household might need 5 acres in Tennessee, 8 in Minnesota, or 10 or more in Arizona, for the identical diet and identical self-sufficiency target.

Approach	Approximate land, per person	Notes
Fresh vegetables only, family of four	0.1–0.25 acre total	A well-managed garden; not per person, the whole family's fresh vegetable needs
Vegetables plus storage/preservation, family of four	0.25–0.5 acre total	Adds root cellaring, canning, and other preserved-food capacity
Full self-sufficiency, plant-forward diet	~0.33 acre / person	Meets USDA nutritional guidelines without meat/dairy as the primary calorie source
Full self-sufficiency, standard American diet	~2.7 acres / person	Meat- and dairy-heavy; roughly 8x the plant-forward figure

None of these numbers are exact for any specific site, soil quality, growing season length, and water access all shift the real figure. Treat the table as a planning range to size a candidate site against, not a guarantee.

Permaculture and food forests change this math substantially

The table above reflects conventional homesteading: row crops, pasture, and a standard garden layout. Intensive design, permaculture's multi-layer food forests (stacking a canopy, understory, shrub, herb, root, and ground-cover layer into the same footprint), and square-foot-gardening-style spacing can produce comparable or better food output on a fraction of that land. Square-foot gardening technique needs as little as 16 square feet per person for fresh eating and about 32 square feet per person to grow enough to preserve, well under a tenth of the space the conventional 100-200 square feet per person estimate assumes.

The land figure most often repeated for permaculture specifically, roughly a quarter acre per person combining fruit trees, poultry, and aquaponics, traces back to homesteading guides rather than research, and other sources put full self-sufficiency closer to a half-acre to a full acre; treat it as a loose planning range, not a benchmark with the same footing as the table above. The one figure here with real research behind it is John Jeavons' biointensive method, roughly 4,000 square feet per person for a complete vegetarian diet, but biointensive is intensive annual-crop spacing, a genuinely different technique from a food forest's perennial guild design, not a direct stand-in for it.

Two real examples, at two different scales

The Dervaes family's urban homestead (Pasadena, CA) produced over 6,000 pounds of food a year, meeting roughly 90% of the family's diet, on about 4,000 square feet, the same footprint as Jeavons' biointensive benchmark; it's a genuine, independently documented example of intensive annual gardening, closer to biointensive and square-foot technique than a true multi-layer food forest guild. For an actual food-forest-specific example at real scale, Mark Shepard's New Forest Farm in Wisconsin converted a 106-acre row-crop farm into a commercial perennial system, hazelnuts, chestnuts, walnuts, and apples, over 15 years and roughly 250,000 trees, a clearer US climate analog for what a mature food forest actually looks like at scale.

The tradeoff is real, not a free lunch: these figures assume genuine horticultural design skill, and a food forest specifically takes years to reach full productive yield, perennial systems establish far slower than annual row crops. Less land in exchange for more upfront expertise and patience is the actual trade being made here, not less land for free. See Building a Food Forest for the actual 7-layer design, a real establishment timeline, and which popular permaculture claims, dynamic accumulators among them, don't actually hold up.

Hydroponics and aquaponics change the water math too

Recirculating systems, hydroponics (plants grown in nutrient-rich water instead of soil) and aquaponics (the same idea, combined with raising fish whose waste feeds the plants), cut water use dramatically rather than just land. Because the water is captured and reused instead of draining into the soil, these systems use up to 90% less water than conventional soil-based farming, a bigger effect on the water figures earlier in this chapter than on the land figures above. Yield per area is also real and substantial: aquaponic systems typically produce something like 8 times more food per acre than soil agriculture, with a documented range from roughly 4 times for slower-growing crops to 25 times for fast-growing leafy greens, and one small-scale documented case produced 220 pounds of food on just 16 square feet. Oklahoma State University Extension's small-scale aquaponics guidance gives a real, practical design ratio to start from: 2 to 4 ounces of fish food per day supports roughly 10 square feet of plants in a raft-style system.

The real tradeoff: land and water for continuous electricity

Hydroponic and aquaponic systems trade land and water for a dependency the soil-based figures above don't have: continuous power for pumps and aeration, and in cold climates, water heating to keep fish alive through winter. See the Energy section below before assuming these systems are simply "better"; they're a different resource trade, not a strictly easier one, and they add real technical complexity, maintaining fish health and water chemistry is a genuine skill, not a set-and-forget system.

Water: agricultural demand is a different order of magnitude

Storing Water Correctly and Sourcing & Hauling Water both work from household emergency figures: roughly 1 to 4 gallons per person per day. Growing food for that same household needs vastly more. Sprinkler irrigation needs up to 10 gallons per minute per acre; drip irrigation, more water-efficient, still needs 3 to 7 gallons per minute per acre. A small farm well needs roughly 5 gallons per minute at minimum to cover a farmstead's house and livestock, which works out to over 700 gallons a day before a single field is irrigated. A single dairy cow alone drinks 40 to 50 gallons a day.

Check the well's real yield, not just its legal right to pump

A water right is a legal permission to use water, not a guarantee the well can actually deliver it. Have any well on a candidate site professionally tested for its actual sustained yield in gallons per minute before sizing food production around it; a well that tests fine in a wet spring can fail the exact demand this chapter is describing during a dry summer.

Energy: power and heat, sized to actually last

Everything above, the well pump, food storage, medical equipment, needs power to run, and none of it works indefinitely on wishful thinking. An energy-conscious off-grid household typically runs 10 to 20 kWh a day, well under the roughly 29 kWh a typical grid-connected U.S. household uses, but still a real number to size against, not zero. Solar sizing works from one formula: daily energy need divided by peak sun hours for the site equals the array size needed. A 5 kWh/day cabin in a good-sun location needs roughly 1.5 kW of panels; a 20 kWh/day homestead in a moderate-sun location needs closer to 6 kW, on the order of 15 standard panels.

Battery storage gets sized in days of autonomy, how many consecutive low-sun days the system can cover without the panels doing any real work. Most off-grid homesteads target 3 to 5 days; cloudier climates need 7 or more, or a generator backup instead of oversizing the battery bank. A propane generator, sized to comfortably carry the site's largest single load and recharge the batteries faster than they're drawn down, is often the more cost-effective choice for a cloudy climate than doubling battery capacity, and propane stores indefinitely, unlike gasoline. See Fire-Starting & Generator Safety for running one safely; a community multiplies a single household's numbers by however many households are actually drawing power, it doesn't get a discount for sharing a site.

Heating fuel scales the same way land does for food. A healthy, actively managed hardwood woodlot sustains roughly 0.5 to 1 cord of firewood per acre per year without depleting the stand, so a household burning 5 cords a winter needs on the order of 5 to 10 acres of standing timber managed for it, indefinitely, not just until the trees run out. A well-managed woodlot in the 10-20 acre range can cover a household's heating fuel indefinitely without ever buying wood or burning a fossil fuel.

Need	Approximate figure	Notes
Daily power, energy-conscious off-grid household	10–20 kWh/day	Vs. ~29 kWh/day for a typical grid-connected U.S. household
Solar array, 5 kWh/day site	~1.5 kW panels	Good-sun location; scales with local peak sun hours
Solar array, 20 kWh/day site	~6 kW panels (~15 panels)	Moderate-sun location
Battery autonomy	3–5 days typical	7+ days, or a generator, in cloudier climates
Sustainable firewood yield	0.5–1 cord / acre / year	Actively managed hardwood woodlot, selective harvest
Woodlot for indefinite heating	10–20 acres	Covers a household's heating fuel without depleting the stand

Alternate power generation and storage

Solar is the default this chapter sizes against because it works almost anywhere with a clear view of the sky, but it isn't the only option, and a site's own specific features can make a different source the better primary choice.

Wind only pays off with a genuinely good wind resource, an average of 12 mph or better at hub height; below about 10 mph, solar almost always wins on return for the money. Where wind does work, a 1.5 kW turbine can cover roughly 300 kWh a month at a 14 mph average site, and power output rises with the cube of wind speed, so small differences in average wind speed change the real output a lot. Siting matters as much as the turbine itself:

it needs to sit at least 30 feet above any obstacle within 300 feet, or turbulence alone can cut output by a quarter or more.

Micro-hydro, a small turbine in a year-round stream, is the strongest option of all if a site actually has it: unlike solar or wind, it runs continuously, day and night, regardless of weather, and most successful off-grid systems that have it use hydro as the baseload and let solar or wind fill the gaps rather than the other way around. Output depends more on how far the water falls (head) than on how much flows: a drop of 50 feet with 50 gallons per minute yields roughly 250 watts continuously, about 6 kWh a day, from a source most people would walk past without a second look. A simple field test: if a 5-gallon bucket fills in under 10 seconds from a source with at least a 10-foot drop, there's likely 200 to 400 watts of continuous power available. Most sites simply don't have a real stream with real fall, though, so this is a bonus to check for, not something to plan around finding.

Geothermal, at homestead scale, means a ground-source heat pump, not electricity generation; real geothermal power plants need specific geological conditions this chapter isn't assuming any site has. What a ground-source system does is cut the electricity or wood needed for heating and cooling substantially, moving heat to and from the stable underground temperature instead of generating it, typically 25 to 50% less electricity than a conventional system, and roughly half the energy for cooling compared to standard central air. That directly reduces both the kWh figures and the woodlot figures earlier in this section, worth real consideration even without a generation angle attached.

Thermal batteries, hot sand or another thermal-mass material heated and kept insulated for months, are a newer, less proven-at-small-scale complement to a battery bank: they store surplus summer heat or excess solar generation as heat rather than electricity, then release it through the winter months when solar production is weakest. They're a real, deployed technology, not speculative, but still an emerging option rather than the default; treat solar-plus-battery-plus-generator as the proven baseline and any of these four as a genuine upgrade worth investigating for a specific site, not a requirement.

Where these tradeoffs actually interact

Food, water, and power aren't independent decisions. Choosing one approach in a given category changes what the others actually need to provide, a low-land, low-water food method that needs continuous power is only as good as whatever's providing that power. The table below puts every approach discussed above on the same six axes, so a food or irrigation choice can be checked directly against which power source can actually back it up.

Enter what you actually have, and the table below dims out anything that needs more than you've got, using the same ratings already shown. Nothing new is being measured here.

Land available
Any

Water available
Any

Power available
Any

Roughly: Low under 0.25 acre (a typical suburban lot, the US median is about 0.2), Medium 0.25–1 acre, High over 1 acre.

Roughly: Low is tap water or basic rain catchment only, Medium is a modest well (~5 gal/min, this chapter's own stated minimum), High is a strong well or real water right (10+ gal/min).

Roughly the tiers from Sizing a Solar Array: Low is bare-essentials (~150–1,000 Wh/day), Medium is a portable power station (~2–5 kWh/day), High is house-essentials or whole-house (continuous multi-kW).

Budget

Any

This rates upfront cost and skill together, not just dollars; there's no clean single number for both, so use your own honest sense of both combined.

Site favorability

Any

This means something different per row (sun for solar, wind for a turbine, a shallow water table for a walipini); there's no single scale for all of them, judge each row against its own actual requirement.

Time before you need output

Any

Roughly, from Building a Food Forest's real timeline: Low is one growing season, Medium is 1–3 years, High is 5+ years to full maturity.

Reset filters

Approach	Land	Water	Power / fuel	Upfront cost & skill	Weather / site dependence	Time to output
FOOD & IRRIGATION						
Row crops, sprinkler-irrigated	High	High	Low	Low	Low	Low
Row crops, drip-irrigated	High	Medium	Low	Medium	Low	Low
Permaculture / food forest	Low	Medium	None	High	Medium	High
Hydroponics	Low	Low	High	Medium	Low	Low
Aquaponics	Low	Low	High	High	Medium	Low
POWER & HEAT						
Solar + battery	Low	None	Low	Medium	High	Low
Wind	Medium	None	None	Medium	High	Low
Micro-hydro	Low	None	None	Medium	High	Low
Geothermal (ground-source heat pump)	Medium	None	Medium	High	Medium	Low
Propane generator (backup)	None	None	High	Low	None	Low
Firewood / managed woodlot	High	None	Self	Medium	Medium	Low

Ratings are qualitative summaries, not new figures

Every rating above restates what's already sourced in the prose and tables earlier in this chapter, pulled into one place for a quick comparison; it isn't a new claim. See the relevant section above for the actual numbers behind any given row. A site with genuinely good sun, a real year-round stream, or unusually good soil can shift several of these ratings; treat this as a starting comparison for a specific candidate site, not a substitute for evaluating one.

Wastewater: real treatment, not a bucket toilet

Bathroom & Hygiene Without Running Water covers a household's short-term, no-plumbing toilet setup. A community meant to last years needs real wastewater treatment instead. The EPA's own decentralized wastewater guidance is the right starting reference: individual septic systems, cluster systems that serve multiple properties from one shared system, and lower-cost options like constructed wetlands (which use plants and soil microbes to treat wastewater the way a natural wetland does) or anaerobic lagoons. Roughly one in four U.S. households already depends on a septic or small cluster system rather than a municipal sewer, this is mainstream, well-understood infrastructure, not a fringe workaround, and it needs a qualified septic or wastewater designer to size correctly for the actual soil and population.

Medical capacity: a real benchmark, not a first aid kit

First Aid Basics and the Manual's own Sanitation & Medical chapter cover what one household needs on hand. At community scale, the World Health Organization's Workload Indicators of Staffing Needs (WISN) methodology and U.S. rural health workforce research give a real professional benchmark: roughly 4 community health workers per 10,000 non-metro adults. A founding community is almost always far smaller than that ratio implies a full-time worker for, so the practical takeaway isn't "hire staff," it's honesty about the gap: know explicitly what level of ongoing medical capacity the group does and doesn't have, and what that means for who needs to leave for care versus what can genuinely be handled in place.

Chronic care and aging in place: a different question than staffing

The WISN benchmark above answers a workload question: how much staff a given population's day-to-day demand justifies. Chronic disease, childbirth, and aging in place aren't a workload question, they're a "does this exist here at all" question, and for a community likely sited somewhere rural, per Chapter 3's own site-selection criteria, the honest answer is often already no, not something a disaster would have to cause.

Maternity care specifically is a real, current, and worsening gap, not a hypothetical one: over a third of U.S. counties are already maternity care deserts, nearly 60% of rural counties have no obstetric clinician at all versus under a fifth of urban counties, and the average birthing person in one of these deserts already travels over 30 miles for care. The consequence isn't abstract either, counties without full maternity access have a measurably higher maternal mortality rate than counties with it. A community founding somewhere rural should treat this as an existing condition of the site, the same way Chapter 3 already treats climate and water trends, and arrange something real, a known provider, a trained birth attendant, an actual transport plan, before it's needed, not after.

Chronic disease is a more tractable version of the same gap, and it already has a real, documented answer: the community health worker role sized above isn't just emergency-response headcount, it's a proven chronic-care model in exactly this kind of setting. A rural Appalachian program using community health workers for ongoing chronic-care management, weekly home visits, a caseload of 25 to 30 patients per worker, produced a real measured improvement in blood sugar control (average HbA1c dropped 2.4 points, and 60% or more of enrolled diabetes patients improved) without adding a doctor. The same role this chapter already asks a community to plan for gets meaningfully more useful once its job is understood as ongoing chronic care, not just acute response capacity.

Serious mental illness deserves the same honesty as physical chronic disease, and the rural picture is just as stark: roughly one in 25 adults nationally lives with a serious mental illness in a given year, and rural adults are more likely to be among them, while rural depression care already lags urban care on both whether someone gets seen at all and how many visits they get once they do. Distance measurably raises the stakes, not just the inconvenience, small rural areas average over an hour of driving to reach a crisis intervention team, and for men specifically, each additional hour of travel time to a hospital roughly doubles suicide risk. The community health worker role above doesn't automatically cover this; mental health needs its own trained role, and a real, evidence-based one already exists. Peer support specialists, people with their own lived experience of a mental health condition, trained to support others navigating one, have been recognized by HHS as an evidence-based practice since 2007, and they measurably reduce rehospitalization and inpatient days, not just provide anecdotal comfort. A rural crisis line staffed by trained peer specialists, the real model behind Montana's statewide Recovery Warmline, is a genuinely buildable version of this at far smaller scale than a clinical practice requires.

Aging in place has a real, working model already, and it isn't hired staff

Members don't stay the same age they were at founding, and a community running for decades has to answer for that directly. The Village Model, active in over 200 U.S. communities through the national Village-to-Village Network, is the documented answer, and it runs on the same logic Chapter 7's labor-credit systems and Chapter 5's consensus governance already use: a member-governed group, not a hired-staff agency, where a real share of members, roughly 40% in the studied model, volunteer to support others directly with transportation, errands, and checking in. A Thriving community that's already built mutual-aid and labor-credit systems by this point in the manual has most of what a Village needs already in place; formalizing eldercare as one more explicit category inside that existing system, rather than assuming it'll sort itself out, is the real, low-cost step that's actually needed.

Death is the actual endpoint eldercare doesn't cover

Aging in place, sooner or later, ends in death, and a community that's built real answers for chronic care and eldercare needs a real answer for this too, not an assumption that a funeral home is always nearby and always will be. The honest starting point: this varies enormously by state, in a way that makes it a genuinely bad candidate for guessing, and it changes over time even where it's already settled, Washington only legalized private-property burial in mid-2026 (SHB 2239) after decades of requiring a licensed cemetery, exactly the kind of shift that makes "confirm the current rule" the only safe default, not "confirm the rule as of whenever this was written." Home burial on private land is legal in roughly 30 states, but with real, specific conditions, Texas and Vermont are among the most permissive, while California and Indiana prohibit it outright, and even a permissive state almost always requires a real burial permit, a minimum property size, and setback distances from water, buildings, and property lines that a small homestead lot may not actually have room for. Zoning can override an otherwise-permissive state law entirely; confirm the actual rule for the specific site, the same "not a DIY legal decision" caution this manual gives everywhere else, rather than assuming a "new beginnings" community's back forty automatically qualifies. The Death, Burial & Body Disposition skill guide covers the practical layer underneath this: the death certificate and permit process, and how to actually preserve a body without embalming while that paperwork is in progress.

Green, natural burial (no embalming, a biodegradable container, no concrete vault) is the real, growing, and often simpler-to-arrange alternative where a full home burial doesn't fit: over 220 dedicated natural-burial cemeteries already operate across the U.S., a genuinely mainstream practice at this point, not a fringe one, and it aligns with the same environmental values this chapter's own land-use choices already reflect. Whichever path a community plans around, deciding it in advance, who's responsible for the arrangements, where, and under what actual legal process, is what keeps a death from becoming a legal crisis layered on top of a grief the community is already carrying. Chapter 9's case for shared ritual applies with particular weight here too; marking a death together is exactly the kind of real, load-bearing communal practice that chapter already argues for.

Veterinary capacity: the gap is worse than the human one

Every dairy cow, chicken, and fish tank in the food section above is a health liability too, not just a food source, and professional help for them is harder to reach than human care is. Since the end of World War II, the U.S. has lost roughly 90% of its large-animal veterinarians, and over 500 counties across 46 states are now federally designated veterinary shortage areas; nationally there are roughly 8,000 large-animal or mixed-practice veterinarians against 68,000 small-animal-only practices. A sick or injured dairy cow, specifically, is exactly the kind of animal this shortage hits hardest.

The realistic response isn't hiring a vet, it's building real skill before it's needed: recognizing an animal's normal behavior well enough to catch a problem early, basic hands-on skills like giving an injection, trimming hooves, or deworming, a stocked livestock first-aid kit (wound spray, syringes, electrolytes, gloves), and, per the Manual's own Pet Evacuation & Shelter addendum, treating large-animal handling as a genuinely different skill from companion-animal handling rather than assuming it transfers. Find an actual livestock vet, even a distant or occasional one, before the community needs one, the same "arrange this in advance" principle this manual applies everywhere else.

Security: sized, not re-explained

The physical footprint needed for shared security, a watch rotation's actual coverage area, an observation point's sightlines, follows the same has-to-actually-work logic as everything else in this chapter, but the technique itself is already covered in depth elsewhere. See the Manual's own Security & Shelter chapter, especially its Tier 4 section, and Surviving Part 8's watch-rotation guidance, for the actual mechanics; this chapter's only addition is to size them against the group's real population and site, the same way food, water, and wastewater are sized above.

Next: Governance

Sizing the resource base is necessary, but it doesn't decide who gets to make decisions about it once it exists. See Chapter 5: Governance.

Sources

- Land-per-person self-sufficiency estimates and the diet/climate variables behind them: The Homesteading Hippy; New Life on a Homestead
- Intensive/square-foot-gardening and permaculture land-per-person figures: Homesteading Family
- The Dervaes family's documented Pasadena urban homestead yield: Wikipedia; Mother Earth News
- John Jeavons' biointensive land-per-person figure: Ecology Action

- Mark Shepard's New Forest Farm, a real, documented commercial-scale food forest: New Forest Farm; Wikipedia
- Aquaponics/hydroponics water-use reduction and yield-per-area figures: H-Alo; Farmonaut
- Small-scale aquaponics system design ratios: Oklahoma State University Extension
- Irrigation water-use rates and small farm well sizing: Penn State Extension; USGS
- Off-grid solar sizing, battery autonomy, and generator backup: How to Go Solar; SunForgeLab
- Small wind turbine sizing, wind-speed requirements, and siting: Wind Power Engineering; Wind Turbine Home
- Micro-hydro power output, head vs. flow, and continuous baseload behavior: Spheral Solar; SolarTech Online
- Ground-source heat pump efficiency (coefficient of performance, electricity reduction): Wikipedia; Ingrams Water & Air
- Thermal/sand battery storage technology: Polar Night Energy
- Sustainable firewood yield and woodlot sizing: Hearth.com; Survipedia
- EPA decentralized wastewater treatment options for small communities: EPA; EPA, Types of Septic Systems
- WHO Workload Indicators of Staffing Needs (WISN) and U.S. rural community health worker staffing ratios: WHO; Rural Health Information Hub
- U.S. maternity care deserts, rural obstetric clinician shortage, and the maternal mortality gap: March of Dimes, "Nowhere to Go: Maternity Care Deserts Across the U.S."
- Community health worker-based chronic care management, a real rural Appalachian program's measured outcomes: CDC, Preventing Chronic Disease
- The Village Model for member-governed aging in place: The Gerontologist, "'Village' Model: A Consumer-Driven Approach for Aging in Place"; AARP
- Rural serious mental illness prevalence, access-gap, and travel-time/suicide-risk data: Rural Health Information Hub; PMC, rural-urban mental health access disparities
- Peer support specialists as an HHS-recognized evidence-based practice, and a real rural crisis-line example: Peer support specialist; SAMHSA, Peer Recovery Supports for Behavioral Health in Rural Communities
- Home burial legality by state and its real conditions: Rome Monuments, "How You Can Be Buried on Your Own Property In All 50 States"
- Washington's 2026 legalization of private-property burial (SHB 2239), overturning its prior licensed-cemetery-only rule: People's Memorial Association
- Green/natural burial as a real, documented, growing practice: Green Burial Council
- The U.S. large-animal veterinarian shortage, county-level shortage designations, and the small-animal/large-animal practice split: AGDAILY; American Veterinary Medical Association
- Basic livestock health skills homesteaders can realistically build: Hobby Farms; Homestead.org