LUSITANO RETREAT · FIELD GUIDE

Lusitano Retreat — Food Garden & Closed-Loop Ecosystem

Full Due Diligence Report & Implementation Guide

Date: 2026-06-08 | **Status:** Research complete — ready for implementation | **Location assumption:** Norte Portugal, inland rural land, 200–600m elevation, Minho/Braga/Gerês region

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A. Executive Summary

The Lusitano Retreat food garden is a four-layer, closed-loop food production system designed for a rural Norte Portugal site operating at 200–600m elevation on granite and schist terrain. It is not a demonstration project. Its purpose is to supply a meaningful proportion of guest meals, teach practical food skills, provide content for every season of the retreat's media output, and establish an on-site ecological asset that increases in value year on year.

The four layers are: raised beds (heavy-cropping seasonal vegetables), a hydroponic herb wall (year-round herbs and salads with minimal water), an aquaponic greenhouse (fish waste cycling through salad crops), and a young orchard (perennial food and soil infrastructure). Each layer works independently. Together they close a loop: rain, fish waste, kitchen scraps, and fallen leaves all re-enter the system as plant nutrition.

Three implementation levels are defined and costed:

- **Level 1 — Day 1 MVP (€101):** Grow bags, seedlings, compost bucket, and a Kratky hydroponic setup. First herbs harvested within 14 days. No infrastructure, no permits, no electricity.
- **Level 2 — Small Retreat Setup (€1,300–1,900):** Raised beds, drip irrigation, rainwater tank, NFT hydroponic channel, compost and worm farm system. 80% herb and salad self-sufficiency within six months.
- **Level 3 — Signature Ecosystem (€11,000–16,000):** Aquaponic greenhouse, professional irrigation, full orchard, greywater system, guest education infrastructure. Grant-eligible under PDR2030 and EU LIFE Programme. 40–60% total food self-sufficiency by Year 2.

Honest timeline: the aquaponic biological cycle takes 4–6 weeks to stabilise after physical assembly. Nothing in the ecosystem is press-ready or production-ready within 48 hours except the Kratky and grow bag layers. Build the physical structure of aquaponics in September 2026; plan first harvest from it in November 2026.

Key regulatory flag: do not use the word "organic" or "biológico" without certification. Obtain legal advice from RC-Advogados before serving well water to guests or stocking edible fish for guest consumption.

B. Local Portugal Growing Conditions

Climate Classification

The site sits at the Csb/Cfa/Cfb transition — warm-summer Mediterranean to oceanic, depending on elevation. Norte Portugal is the wettest region on the Iberian Peninsula; Atlantic moisture moves inland through the Lima and Cávado river valleys.

Zone	Elevation	Mean Annual Rainfall
Braga city / low valleys	175m	1,500–1,700 mm
Minho inland (Amares, Terras de Bouro)	250–450m	1,600–2,000 mm
Serra do Gerês / Peneda	500–800m	2,000–2,800 mm
Rain shadow slopes (eastern Gerês)	400–600m	900–1,300 mm

Seasonal rainfall split: 70% falls October–March. Summer (July–September) delivers 10% of annual total. Evapotranspiration demand in July–August exceeds 100mm/month against 10–30mm arriving. All summer cropping requires supplemental irrigation.

Summer Stress Window

- Mean daily max: 25–32°C in lowland Braga; 22–28°C at 500m
- Heat events (ondas de calor): peaks of 38–42°C recorded in low valleys in 2017, 2019, 2022
- South-facing granite slopes reach wilting point within 7–10 days without irrigation in peak summer
- Relative humidity drops to 30–50% during heat events — spider mite and desiccation risk for hydroponic systems

Winter Opportunities

Elevation	Mean Jan Temp	Frost Risk	Growing Status
200–300m valley	8–11°C	Rare (0–5 nights/year below 0°C)	Year-round leafy crops viable
400–500m hillside	6–9°C	Occasional (5–20 nights/year)	Hardy brassicas, root veg, garlic, broad beans
500–600m ridge	4–7°C	Moderate (15–40 nights/year)	Frost-sensitive crops require protection

Winter is a productive growing season for couve-galega, broad beans, garlic, onion sets, turnip greens, spinach, chard, and peas. Do not neglect it in planning.

Frost pocket warning: Cold air drains into bowl-shaped depressions and narrow valleys. A frost pocket at 300m can behave like open ground at 600m. Survey on cold still nights before placing citrus or perennial beds.

Soil Types

Dominant parent material is Hercynian granite (Cambisols, Regosols, Leptosols). Key characteristics:

Property	Granite Soil	Management Response
Texture	Sandy-loam to loamy-sand	Low water retention; mulch and compost are essential
pH	5.0–6.2	Lime to 6.5–7.0 for vegetables — apply agricultural lime every 2–3 years
Organic matter	Low to very low on slopes	Building OM is the single most important soil investment
Depth	20–80cm before rock	Raised beds extend effective root zone significantly
Drainage	Excellent to excessive	Advantage in wet winters; disadvantage in dry summers

Schist outcrops on transitional slopes give heavier clay-loam soils with better water retention but winter waterlogging risk on flat ground.

Existing terraces (socalcos) are a critical asset. Stone-walled terraces represent centuries of accumulated topsoil and erosion management. Any existing terrace structure should be prioritised for raised bed placement.

Water Sources

- **Shallow wells (poços):** Granite terrain; water typically reached at 5–15m. Register with SNIRH before using for significant extraction.
- **Boreholes (furos artesianos):** 80–150m depth, yield 0.5–3 m³/hour — highly variable depending on fracture zone.
- **Rainwater collection:** 100m² roof collects 150,000–200,000 litres/year. A 10,000L cistern fills from a single 20mm rain event. Primary buffer for summer irrigation.
- **Streams and levadas:** Legal complexity — historical water rights are community-managed. Consult Junta de Freguesia and check SNIRH before any pump or diversion installation.

Seasonal Planting Calendar

Month	Sow/Start Indoors	Direct Sow / Transplant Outdoors	Harvest
January	Tomato, pepper, aubergine (heated)	Broad beans, garlic, onion sets	Couve-galega, turnip greens, kale
February	Tomato, pepper, celery	Peas, broad beans, chard	Kale, leeks, stored roots
March	Courgette, cucumber (heated)	Lettuce, spinach, brassica seedlings	Sprouting broccoli, broad beans
April	Squash, pumpkin	Potatoes, onions, beetroot, carrots	Broad beans, peas, spring greens
May	—	Tomato transplants, beans, corn, courgette	Lettuce, peas, early potatoes
June	—	French beans, corn, sunflowers	Garlic, early potatoes, peas, lettuce
July	—	Turnip (for autumn), late beans	Tomatoes, courgette, garlic, onions, beans
August	Leeks, brassicas for autumn	Late carrots, turnips	Tomatoes, peppers, beans, corn, potatoes
September	—	Garlic, autumn onions	Tomatoes (end), peppers, pumpkins, corn
October	—	Broad beans, peas, winter lettuce, spinach, kale	Squash, late potatoes, figs, apples
November	—	Garlic, broad beans, overwintering onions	Kale, leeks, root veg
December	—	Garlic (if mild), broad beans	Couve-galega, turnip greens

Note: Dates shift 2–3 weeks earlier at lower elevations and in sheltered south-facing positions.

Key Constraints

- **Wild boar (javali):** Severe. Will destroy a potato bed or corn plot overnight. Two-strand electric fence at 15cm and 40cm is non-negotiable near forest edge.
- **Deer:** Browse brassicas and young fruit trees. Fencing requires minimum 1.5–1.8m.
- **Abandoned land:** Much Norte PT land has reverted to invasive Acacia dealbata and bracken over 10–30 years. Multiple seasons required to clear and restore.
- **Terrain access:** Most traditional terrace systems require hand tools or walk-behind tillers (motocultor). No tractor access on narrow terraces.

C. Plant & Crop Catalog

Complete Plant Database — 30+ Species

English Name	Portuguese Name	Category	Difficulty	Water Req	First Harvest	Season	Why it fits Lusitano	Main Risk
Fig	Figueira	Fruit Tree	Easy	Low	2–3 yrs (established)	Summer–Autumn	Iconic PT rural tree; ultra-low maintenance	Birds; young trees need protection
Lemon	Limoeiro	Fruit Tree	Easy-Med	Low-Med	2–3 yrs	Year-round (peak Winter–Spring)	Year-round citrus for kitchen and bar	Frost sensitive below −3°C
Orange	Laranjeira	Fruit Tree	Easy-Med	Low-Med	2–3 yrs	Winter–Spring	Navel thrives in Minho; preserves	Frost; codling moth
Olive	Oliveira	Fruit Tree	Easy	Very Low	5+ yrs	Autumn	Cultural cornerstone; zero water once established	Very slow to yield
Quince	Marmeleiro	Fruit Tree	Easy	Low	3–4 yrs	Autumn	Marmelada (PT national preserve); frost hardy to −15°C	Needs long hot summer to ripen
Plum / Mirabelle	Ameixoeira	Fruit Tree	Easy	Low-Med	2–3 yrs	Summer	Fast fruiting; preserves, drying, fermented drinks	Brown rot in wet springs
Almond	Amendoeira	Fruit Tree	Med	Very Low	3–4 yrs	Autumn (nuts)	Iconic PT nut; zero summer water	Early February blossom vulnerable to late frost
Chestnut	Castanheiro	Fruit Tree	Easy	Low-Med	4–6 yrs	Autumn	Native Norte PT species; mass food; retreat experience	Chestnut blight — source grafted stock
Apple	Macieira	Fruit Tree	Easy-Med	Med	2–3 yrs	Autumn	Minho highlands grow excellent apples; stores well	Scab and mildew in humid Norte PT

English Name	Portuguese Name	Category	Difficulty	Water Req	First Harvest	Season	Why it fits Lusitano	Main Risk
Elderberry	Sabugueiro	Berry Bush	Easy	Low-Med	1–2 yrs	Summer (flower) / Autumn (berry)	Wildcraft element; cordial, wine, medicine	Raw berries toxic — must cook
Cape Gooseberry	Fisális	Berry	Med	Low-Med	4–5 months	Summer–Autumn	Photogenic; exotic appeal; retreat food	Self-seeds aggressively; mildew in damp
Blackberry	Amora	Berry / Hedge	Easy	Low	1–2 yrs	Summer–Autumn	Grows wild in Norte PT hedgerows — map and harvest free	Invasive — use as perimeter only
Couve-galega	Couve-galega	PT Staple	Easy	Med	8–12 weeks	Year-round	THE iconic PT vegetable; caldo verde; perennial in mild Norte	Aphid and caterpillar pressure
Garlic	Alho	PT Staple	Easy	Low	6–8 months	Plant Oct–Nov; harvest Jun–Jul	PT flavour staple; no summer irrigation needed	Bulb rot in wet heavy soil
Potato	Batata	PT Staple	Easy	Med	10–16 weeks	Two crops: spring + autumn	Staff food; productive per m²; grows anywhere in Norte PT	Blight in wet summers
Runner / French Beans	Feijão verde	PT Staple	Easy	Med	8–10 weeks	Summer	Climbing = vertical food; productive per m²; pick daily	Aphids on young shoots
Broad Beans	Favas	PT Staple	Easy	Low-Med	12–16 weeks	Sow Oct–Nov; harvest Mar–May	Nitrogen-fixing; beloved PT winter crop	Chocolate spot; blackfly on tips
Corn / Maize	Milho	PT Staple	Easy	Med-High	10–14 weeks	Summer	Norte PT culture (broa bread); Three Sisters planting	Needs 4m×4m block for pollination
Onion	Cebola	PT Staple	Med	Low	18–20 weeks	Sow Jan–Mar; harvest Jul–Aug	Staple; stores months; companion plant	Onion fly; bolting

English Name	Portuguese Name	Category	Difficulty	Water Req	First Harvest	Season	Why it fits Lusitano	Main Risk
Lavender	Lavanda	Mediterranean	Easy	Very Low	Perennial yr 1	Summer	Sensory retreat element; bees; fire retardant	Hates wet heavy soil — south-facing terrace only
Rosemary	Alecrim	Mediterranean	Easy	Very Low	Perennial yr 1	Year-round	Medicinal, culinary, bee plant; fire retardant hedge	Root rot in poor drainage — plant on mounds
Globe Artichoke	Alcachofra	Mediterranean	Med	Low-Med	12–14 weeks (yr 2 full)	Spring–early Summer	Architectural beauty; sculptural; very PT	Slugs on young crowns
Fennel	Funcho	Mediterranean	Easy	Low	8–12 weeks	Summer–Autumn	Grows wild across PT; deep taproot; pollinator powerhouse	Allelopathic — keep away from tomatoes/beans
Sunflower	Girassol	Fast-Growing / Visual	Easy	Low-Med	10–14 weeks	Summer	Giant visual impact; edible seeds; content magnet	Birds eat seeds before harvest — net heads
Pumpkin / Squash	Abóbora	Fast-Growing / Visual	Easy	Med	10–14 weeks	Summer–Autumn	PT staple soup; stores 6 months; sprawling visual	Powdery mildew in humid Norte
Climbing Beans on Trellis	Feijão trepadeiro	Fast-Growing / Visual	Easy	Med	8–10 weeks	Summer	Vertical structure; Three Sisters planting	Pick daily to keep producing
Zucchini / Courgette	Curgete	Fast-Growing / Visual	Easy	Med	6–8 weeks	Summer	Single plant feeds a crew; large yellow flowers = content	Powdery mildew; pick before marrow stage
Jerusalem Artichoke	Topinambur	Root / Perennial	Easy	Low	16–20 weeks	Autumn	Perennial; zero maintenance; poor soil tolerant	Extremely invasive — root barrier essential
Sweet Potato	Batata-doce	Root Crop	Med	Low-Med	16–20 weeks	Summer–Autumn	Drought tolerant; dual harvest (leaves + tubers)	Norte PT marginal at altitude; south-facing slope required

English Name	Portuguese Name	Category	Difficulty	Water Req	First Harvest	Season	Why it fits Lusitano	Main Risk
Borage	Boragem	Edible Flower	Easy	Low	6–8 weeks (flower)	Spring–Autumn	Edible blue star flowers; cocktail garnish; self-seeds; companion to tomatoes	Self-seeds aggressively after year 1

Top 10 Plants to Start Within 7 Days On Site

Priority	Plant	Why
1	Rocket / Arugula	Germinates 3–5 days; edible in 3 weeks; near-zero failure rate
2	Radish	Fastest root crop; 3–5 weeks; shows system working immediately
3	Couve-galega	Transplants available at any PT market for pennies; perennial investment
4	Climbing Beans on trellis	Quick visual structure; sow direct; 8 weeks to harvest
5	Sunflower	Sow direct; dramatic height within weeks; content magnet
6	Mint	One pot divided = 20 plants; zero skill required; instant kitchen herb
7	Zucchini / Curgete	One packet, one row; feeding crew in 6–8 weeks
8	Swiss Chard	Colourful; cut-and-come-again for months; transplants well
9	Basil	High retreat value; pairs with tomato; start indoors if cool
10	Borage	Sow direct anywhere; edible flowers for first retreat table

June note: Past the ideal spring window for brassicas and cool-season crops. Focus on warm-season direct sowing (beans, squash, sunflower) and buy transplants for couve-galega, chard, and herbs from local markets rather than starting from seed.

Top 5 Visual / Content Plants

Rank	Plant	Content Angle
1	Sunflower (Girassol)	Hero background; DJI Pocket 4 at golden hour; volunteer walking through
2	Globe Artichoke (Alcachofra)	Architectural silhouette; silver-grey leaves; harvest moment close-up
3	Pumpkin / Abóbora	Sprawling vines over reclaimed wood; stacked harvest scene
4	Cape Gooseberry (Fisális)	Paper-lantern close-ups; backlit amber fruit; scroll-stopping
5	Couve-galega	Quintessentially Portuguese; morning light through giant blue-green leaves

Top 5 Drought-Tolerant Plants

Rank	Plant	Drought Strategy
1	Rosemary (Alecrim)	Established plants: zero irrigation; grows in retaining wall cracks
2	Lavender (Lavanda)	South-facing terrace; no irrigation after year 1
3	Fennel (Funcho)	Deep taproot accesses subsoil moisture; grows wild in dry PT roadsides
4	Fig (Figueira)	Once established, survives entire PT summer on zero water
5	Garlic (Alho)	Planted autumn; dormant/harvested before peak drought

Do NOT Grow in Season 1

Plant	Reason
Carrot	Granite soils too rocky and compacted without significant bed preparation; forked ugly roots demoralise beginners
Blueberry	Requires pH 4.5–5.5; Norte PT soils too high; acidifying is a multi-season project
Large-fruiting Tomato	Disease pressure (blight, TMV) in Norte PT humidity is severe; needs mature aquaponics and drip system
Pepper / Capsicum	Needs 3–4 months of consistent heat (>20°C nights); Norte PT Atlantic influence = cool nights at altitude
Cucumber	Pest magnet; needs consistent watering and structure; save until drip irrigation installed
Large Sweetcorn block	Requires 4m×4m minimum for wind pollination; high water demand in July–August
Fruit trees from seed	All orchard trees should be grafted nursery stock; seed = 15+ years to fruit
Watermelon / Melon	Norte PT summers shorter and cooler than Alentejo; high failure rate at altitude

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D. First 1–2 Day MVP Setup Plan

Day 1 — Shopping Run (2 hours)

Recommended suppliers in Norte Portugal: - Agriloja (Braga, Guimarães, Viana do Castelo) - Ferragro (Braga region) - Cooperativa Agrícola de Braga (Rua do Carmo, Braga) — local seedlings often cheaper and better variety - OLX — recycled IBCs, pallets, containers

Day 1 Shopping List

Item	Qty	Unit Cost	Total
Herb seedlings (basil, mint, rosemary, parsley, thyme, oregano)	6 pots	€1.50	€9.00
Salad seedlings (lettuce varieties, rocket/rúcula)	4 pots	€1.00	€4.00
Potting mix 20L bags	3 bags	€4.00	€12.00
50L grow bags (sacas de cultivo)	4 bags	€2.00	€8.00
Watering can 10L	1	€8.00	€8.00
Garden gloves (luvas de jardim)	1 pair	€3.00	€3.00
Plant labels / stakes (20 pack)	1	€2.00	€2.00
Compost bucket with lid	1	€8.00	€8.00
Hydroponic nutrient solution A+B starter	1 set	€18.00	€18.00
Kratky jars (recycled 5L water bottles — free)	4–6	€0	€0
Trowel and hand fork	1 set	€8.00	€8.00
Permanent marker for labels	1	€2.00	€2.00
Day 1 Total			**~€82**

Optional additions to reach €120: extra seedlings (tomatoes, courgette if season allows €10), biodegradable propagation pots €5, 5L worm tea bucket €3.

Day 1 Afternoon Setup Sequence (3–4 hours, 1–2 people)

1. **Site selection (30 min):** South-facing spot close to kitchen/caravans. Partially shaded from afternoon sun in September heat. Mark a 4m × 2m zone.
2. **Collect free pallets (30 min):** 4–6 pallets from logistics depots or OLX pre-arranged form base structure for beds and visual frame.
3. **Fill grow bags and plant (60 min):** Fill 4 × 50L grow bags. Plant herb seedlings. Insert bilingual labels: - Manjericão / Basil - Hortelã / Mint - Alecrim / Rosemary - Salsa / Parsley - Tomilho / Thyme - Orégão / Oregano
4. **Set up Kratky jars (30 min):** 4 × recycled 5L water bottles. Cut hole in cap for net pot or foam-wrapped seedling. Fill two-thirds with water plus nutrient solution per instructions (EC 1.4–1.8 mS/cm, pH 5.8–6.2). Label in masking tape: "Alface sem solo / Lettuce without soil."
5. **Compost bucket setup (15 min):** In kitchen area. First layer of dry cardboard. Label: "Resíduos orgânicos / Food scraps."
6. **Sign and visual dressing (30 min):** One hand-painted or lettered sign: "O Jardim Alimentar / The Food Garden — Lusitano Retreat 2026." This is the hero shot for Day 1 content.

Day 1 Visual Content Checklist

- Wide shot of full food zone with sign, grow bags, Kratky jars
- Close-up of each bilingual herb label with plant
- Hands filling grow bag with soil
- Kratky jar close-up with seedling in net
- Compost bucket first kitchen scraps
- Time-lapse or B-roll of watering sequence

Progress Milestones

Milestone	Days from Planting	What You See
Herbs establishing	Day 3–5	New leaf growth on basil and mint
Kratky root development	Day 5–7	Visible roots in jar
First harvest-ready herbs	Day 10–14	Mint and basil ready to cut
First salad harvest	Day 25–35	Full lettuce, rocket leaves
Productive herb garden	Day 60–90	All 6 herbs established and self-sustaining
First meal with retreat-grown food	Day 30–45	Salad + herb garnish for guests

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E. Hydroponics Due Diligence

System Comparison Table

System	Complexity	Cost	Power	Best Crops	Portugal Summer Risk	MVP Phase
Kratky	Beginner	€50–100	None	Lettuce, basil, rocket, mint, herbs	Heat: manageable with shade + white containers	Day 1 — EXCELLENT
Wicking Beds	Beginner	€20–60 (6 units)	None	Seedlings, herbs, microgreens	Very low — passive capillary	Day 1 — EXCELLENT (propagation)
DWC (buried reservoir)	Intermediate	€80–135	5–10W air pump	Lettuce, bok choy, basil, kale, chard	Water temp: bury reservoir + beneficial bacteria inoculant	Month 2 — GOOD
NFT Channels	Intermediate	€185–275	5–20W pump	Lettuce, rocket, herbs, strawberries	Pump failure = dead plants in 30 min at 35°C — keep spare pump	Month 3+ — GOOD
Vertical Towers	Moderate	€95–175 per unit	5W per tower	Herbs, lettuce, strawberries, nasturtiums	Uneven moisture top-to-bottom; add timer	Month 2–3 — MODERATE (high content value)
Solar off-grid power	Add-on	€95–175 additional	Solar input	Powers any pump system	No grid dependency = zero single-point failure on power	Month 2 add-on

Heat Management Protocol (Mandatory June–September)

- 40–50% shade cloth over all growing areas — no exceptions in July and August
- White or light grey containers only; never black
- Insulate reservoir sides with foam, burlap, or double-bucket method
- Bury or semi-bury reservoirs where possible (soil at 20cm depth stays 18–20°C in summer)
- Target water temperature measurement at noon: if consistently above 24°C, add insulation layer
- For Kratky specifically: white opaque containers + shade cloth maintains root zone at 24–27°C even at 35°C ambient

Nutrient Management

Use two-part hydroponic nutrients (A+B concentrate). Available in Portugal and Spain: Biobizz Hydro, GHE Flora Series, Haifa Multicote.

Growth Stage	Target EC	Target pH
Seedling / early	0.8–1.2 mS/cm	5.8–6.2
Vegetative leafy greens	1.4–1.8 mS/cm	5.8–6.2
Herbs and fruiting	1.8–2.4 mS/cm	5.8–6.2

Test pH and EC every 2–3 days in hot weather. pH drift above 6.5 locks out iron and manganese (yellowing between veins). pH drift below 5.5 locks out calcium and magnesium. A shared €10 pH meter and €10 EC meter are non-negotiable.

Pest Management

Pest	Conditions	Intervention
Spider mites	July–August, humidity below 40%, temps above 30°C	Weekly inspection (underside of leaves); neem oil spray 1% every 5 days for 3 cycles
Aphids	Shade conditions; new growth herbs	Physical water spray removal; marigold companion planting; pyrethrin as last resort
Algae	Any light reaching nutrient solution	Fully opaque containers — mandatory. Flush with 3ml/L of 3% H_2O_2 if present

Recommended Deployment Order

Start with Kratky. On the first volunteer sprint week, a 12-plant setup is operational by Day 2 for under €100. Produces food within 4 weeks. Teaches the fundamental hydroponics principle in three sentences.

Add a vertical tower in Month 2, positioned near the communal kitchen. Disproportionate content and education value relative to modest food output.

Deploy NFT once someone has spent 4–6 weeks managing the Kratky system and understands nutrient management. Buy a commercial kit (Nutriculture, Garland, or Spanish hydroponics supplier). Wire to solar panel and battery from the start.

Complete system cost: Kratky shelf + buried DWC + two vertical towers + NFT channels = 40–60 plant sites, salad and herbs for 10–15 guests continuously, under 30W solar at peak, under **€700 total** from scratch.

F. Aquaponics Due Diligence

System Description

Aquaponics combines fish cultivation with hydroponic plant production in a closed water loop. Fish produce ammonia-rich waste; beneficial bacteria (Nitrosomonas, Nitrobacter) convert ammonia to nitrites then nitrates; plants absorb nitrates as fertiliser and return clean water to the fish. Once the biological cycle is established, no water changes are needed and no synthetic fertiliser is required.

Critical Honest Timeline

The biological nitrogen cycle takes 4–6 weeks to establish. This is not optional. You can assemble the physical system in 1–2 days. You cannot harvest food from it for 4–6 weeks. Plan accordingly. Do not announce an "operational aquaponic food system" before the cycle is complete.

Cycle stages: 1. Days 1–7: System fills with water; add ammonia source (fish or liquid ammonia to prime) 2. Days 7–21: Nitrosomonas bacteria establish; ammonia converts to nitrites (toxic to fish — do not stock fish during this stage) 3. Days 21–42: Nitrobacter establish; nitrites convert to nitrates; system stabilises 4. Day 42+: Cycled system; safe for fish stocking; plant uptake of nitrates begins

IBC-Based System for Norte Portugal

Recommended starter configuration: - 1 × 1000L IBC tank as fish tank (second-hand from OLX: €45–80) - 1 × 500L IBC half as media grow bed (clay pebbles substrate, 300mm depth) - Solar-powered 12V pump (5–8W) circulating water from fish tank to grow bed, gravity return - Bell siphon or timed flood-drain cycle on grow bed

Fish Species for Norte Portugal

Species	Status	Suitability	Notes
Common goldfish (Carassius auratus)	No restrictions	Excellent for starter system	Tolerates 8–28°C; sufficient waste for small grow bed; no feed registration
Common carp (Cyprinus carpio)	Native range — check ICNF	Good for upgraded system	Higher nutrient load; check local ICNF before stocking
Tench (Tinca tinca)	Verify ICNF status	Possible	Cold-water tolerant; check current ICNF position for your water catchment
Rainbow trout	Possible at altitude	Specialist	Requires cold water sustained below 18°C; Norte PT highland streams only
Nile tilapia (Oreochromis niloticus)	EU Invasive Species List	**BANNED**	Do not keep under any circumstances
Clarias catfish	Restricted in PT	**DO NOT USE**	Restricted species

Start with goldfish only. No feed registration required, no ICNF consultation needed, tolerates the biological cycle establishment period, and produces sufficient waste for a small grow bed. Upgrade to carp once system is proven stable.

Grow Bed Crop Selection

Best results in aquaponics: leafy greens and herbs.

Recommended	Avoid in Season 1
Lettuce, watercress, rocket	Tomatoes (need supplemental nutrients)
Swiss chard, kale, basil	Root vegetables (compete for grow bed media)
Mint, lemon balm, pak choi	Cucumbers (need supplemental calcium)

Water Temperature Management

DWC aquaponic water above 22°C triggers pythium root rot and drops dissolved oxygen. Mitigation: - Shade the fish tank completely — IBC dark sides help but insulate - Bury tank partially in ground (soil at 20cm stays 18–20°C) - Add beneficial bacteria inoculant (Hydroguard or equivalent €15–20) to outcompete pythium

Build Sequence

- **September 2026 (Days 1–3):** Physical assembly of IBC tank and grow bed; install pump and plumbing; fill with water
- **September–October 2026:** Cycle system without fish (use liquid ammonia or a few disposable fish to prime)
- **October–November 2026:** First fish stocking (goldfish); first plant transplants into grow bed
- **November 2026:** First aquaponic harvest of watercress and lettuce

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G. Closed-Loop Ecosystem Design

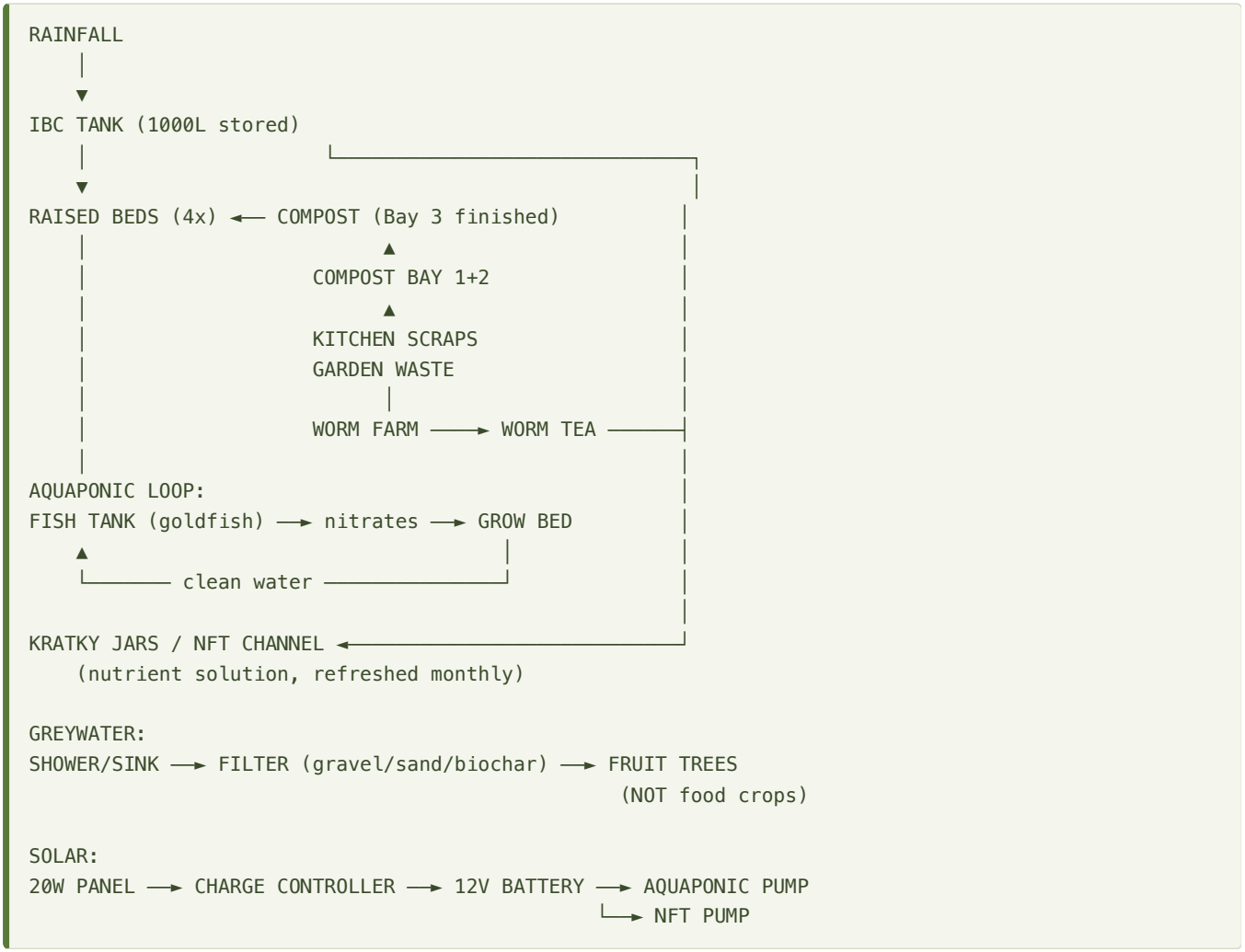
System Philosophy

Every output from one component becomes an input to another. Guests understand the logic within a 10-minute walk-around. The system scales from 30 minutes/week maintenance to a full permaculture demonstration site.

The Eight Components

Component	Input	Output	Next Destination
Rainwater Harvesting	Rainfall from roof catchment	Stored clean water	Aquaponic tank, hydroponic herb wall, raised beds
Raised Beds	Compost, worm tea, irrigation water	Vegetables, herbs	Kitchen; spent plant material to compost
Hydroponic Herb Wall	Nutrient solution, rainwater	Herbs year-round	Kitchen; spent solution to fruit trees
Aquaponic Loop	Fish waste, water	Nitrate-rich water, salad crops	Plants filter water back to fish
Compost System	Kitchen scraps, garden waste, cardboard	Finished compost in 4–6 weeks	Raised beds
Worm Farm	Soft kitchen scraps, cardboard, coffee grounds	Worm castings (vermicompost), worm tea liquid	Castings to raised beds; tea diluted 1:10 to plants weekly
Greywater System	Shower and sink water	Filtered water for non-food irrigation	Fruit trees and ornamentals only — never food crops
Solar Pump System	Sunlight (20W panel + 12V battery)	Power for aquaponic and NFT pumps	Circulates water through aquaponic and hydroponic systems

System Flow Diagram



Rainwater Collection Specifications

- 1mm rain on 10m² of roof = 10 litres collected
- 50mm event on 20m² caravan roof = approximately 800L after first-flush loss
- One IBC 1000L fills within 2–3 autumn rain events at Norte Portugal rainfall levels
- Install first-flush diverter (T-junction with capped vertical pipe) to exclude first dirty rainfall
- Mesh cover prevents insects and debris

Compost System Specifications

Three-bin pallet bay, each bay 1m × 1m × 1m.

Bay	Status	Contents
Bay 1	Active filling	Today's kitchen scraps and garden waste
Bay 2	Decomposing	Turned batch, 4–6 weeks old
Bay 3	Finished	Ready to apply to raised beds

Carbon:Nitrogen ratio target: 25–30:1 (roughly 3 parts brown material to 1 part green). One 1m³ bay produces approximately 300–400L of finished compost per cycle.

Worm Farm Specifications

- Species: Eisenia fetida (red wigglers / minhocas vermelhas) — available from fishing shops, organic farms, OLX Portugal
- Starter quantity: 200–500g of worms (500–1000 individuals)
- Worm tea: dilute 1:10 with water, apply to plant roots weekly; visible growth response in 5–7 days
- One tray handles kitchen waste of 2–4 people continuously
- Feed small amounts every 3–4 days; keep moist; cover with dampened cardboard

Greywater Rules

Safe uses: Fruit tree irrigation, ornamental plants, grass areas — minimum 30 days before any harvest from irrigated area.

Never use greywater for: Salad crops, herbs, anything eaten raw, seedling irrigation, pond top-up where fish are kept for food.

Use biodegradable soap (Marseille / coco-based) before diverting greywater to garden. Phosphate-free products protect soil biology.

Guest Education Walk

10-minute guided walk covers all 8 stations in sequence: rain collection → raised beds → compost → worm farm → aquaponics → hydroponics → greywater → solar. Each station has one bilingual sign (EN/PT). This becomes a standard part of the arrival experience and a filming asset every season.

H. Risk & Compliance Notes

Research only — not legal advice. Seek written opinion from RC-Advogados Vieira do Minho (`geral@rc-advogados.pt` *) before acting on any regulatory matter listed as requiring legal review.*

Area	Regulatory Risk	Legal Review Needed	Urgency
Well/borehole water for guest drinking	MEDIUM-HIGH	YES	Before first paying guest
Rainwater for irrigation only	LOW	NO	—
Stream/river abstraction	MEDIUM	YES	Before any infrastructure
Radon in water (Norte PT granite)	MEDIUM	MAYBE	Test first; radon maps at APA; action level 1,000 Bq/L
Serving garden produce to AL guests	MEDIUM	YES	Confirm ASAE threshold with RC-Advogados
Selling food products commercially	HIGH	YES	Before any sales
Goldfish-only ornamental aquaponics	LOW	NO	—
Edible fish farming for guests	MEDIUM	YES	Before stocking edible fish
Tilapia / Clarias	HIGH (banned under EU Reg 1143/2014)	DO NOT PROCEED	Immediate hard stop
Using word "organic" / "biológico"	HIGH if uncertified	NO (avoid the word now)	Immediate — audit all website, social, print materials
Organic certification pursuit	LOW once certified	MAYBE	Plan 2-year transition; use Ecocert PT, CERTIS, or Certiplanet
Greywater on fruit trees	LOW	NO	—
Greywater on food crops	HIGH — food safety and PT sanitation law	DO NOT DO THIS	Absolute rule
Polytunnel or greenhouse over 30m²	LOW-MEDIUM	MAYBE	Check PDM with relevant Câmara Municipal before building
Guest food liability insurance	HIGH	YES	Before first paying guest

Safe Language Without Certification

Can say: "Grown in our own garden" / "No chemical pesticides or synthetic fertilisers used" / "Naturally grown produce" / "From our land" / "Agroecological methods"

Cannot say without certification: "Organic" / "Biológico" / "Certified natural" / Any EU organic logo

Water Testing Requirements

Before serving any well or spring water to guests, commission an IPAC-accredited laboratory test including: E. coli / total coliforms, nitrates, pH, arsenic, **radon** (Norte PT granite = documented high-radon zone), manganese, iron, turbidity, pesticides. Budget €150–300 for full panel. Test annually and after any construction disturbance near the well.

Recommended Legal Consultation Scope

Single consultation with RC-Advogados covering: (a) AL/TER licence food service threshold; (b) ASAE registration requirement; (c) stream abstraction licence process for the specific property; (d) aquaponics edible fish position under DL 93/2014.

I. Cost Model

Three-Level Summary

Dimension	Level 1 — Day 1 MVP	Level 2 — Small Retreat	Level 3 — Signature Ecosystem
Budget	~€101	€1,300–1,900	€11,000–16,000
Setup time	1 day	2–3 weekends	3–6 months
Food self-sufficiency	Herbs and salads only	80% salads and herbs	40–60% total food
Maintenance per week	30 min	2–3 hours	4–6 hours
Marketing value	High	Very High	Exceptional
Guest experience contribution	Visual / story	Participatory	Programme element
Grant eligibility	None	Low	High (PDR2030, EU LIFE)
Infrastructure risk	Very Low	Low–Medium	Medium
Recommended timing	Day 1, September 2026	Month 2–3, late 2026	Year 2, 2027

Level 1 Itemised (Day 1 MVP, ~€101)

Item	Cost
4× grow bags + seedlings + potting mix	€60
Kratky jars (recycled 5L bottles)	€0
Nutrient solution A+B starter	€18
Compost bucket with lid	€8
Labels, trowel, gloves, watering can	€15
Total	**~€101**

Level 2 Itemised (Small Retreat, €1,300–1,900)

Item	Cost
4× raised wooden beds (2m × 1m, reclaimed timber)	€200
Shade structure or basic polytunnel	€400–800
IBC 1000L rainwater tank (second-hand OLX)	€80
Guttering and first-flush diverter	€60
Drip irrigation kit with timer	€150
Kratky station + NFT gutter channel	€150–300
3-bin compost bay (pallet construction)	€40
Worm farm (DIY stacked tote boxes)	€20
Red wiggler worms 500g starter	€20–30
Seeds and additional seedlings	€40
Tools (fork, rake, hoe, pruners)	€60
Bilingual education signs (10, A4 laminated)	€30
Soil amendments (perlite, sand, extra compost)	€60
Total	**€1,310–1,870**

Level 3 Itemised (Signature Ecosystem, €11,000–16,000)

Item	Cost
Aquaponic greenhouse (IBC + grow beds + solar pump + structure)	€3,000–5,000
Professional raised bed system with stone edging (reclaimed granite)	€1,500
Rainwater system: 3× IBC in series + sediment filter + UV sterilisation	€1,200
Orchard: 10–15 fruit trees (apple, pear, fig, quince, cherry)	€600–900
Vermicompost and compost system (3-bin masonry bay + 2 worm farms)	€400
Greywater filter system (3-stage)	€200
Guest education signage (20 signs, weatherproof printed)	€600
Professional drip irrigation with soil moisture sensors	€600
Solar irrigation system (40W panel + battery bank)	€300
Greenhouse or timber-frame polytunnel	€2,000–4,000
Seed bank and propagation station	€300
Professional permaculture designer consultation (1 day site visit)	€400–600
Total	**€11,100–15,600**

J. Prioritised Action Plan

Top 10 Actions — Ranked

Priority	Action	Owner	Timing
1	Deploy Level 1 MVP: shopping run, grow bags, Kratky jars, compost bucket, bilingual signage	Volunteer crew + Pawel	Day 1 of September 2026 sprint
2	Film and photograph Day 1 setup for content — full visual checklist from Section D	Content person (DJI Pocket 4)	Day 1
3	Source 4–6 wooden pallets and IBC tanks from OLX before arriving on site	Pawel or João	Pre-arrival, August 2026
4	Commission IPAC-accredited water test for any well or spring water intended for guest use	Pawel	Before first paid guest stays
5	Legal consultation with RC-Advogados on: AL food service threshold, ASAE registration, stream abstraction licence, edible fish position	Pawel	Before stocking edible fish or serving commercially
6	Audit all website, social media, and print materials for use of "organic" / "biológico" — remove or replace with compliant language	Pawel	Immediate — before site launch
7	Build 3-bin compost bay from pallets and wire (Level 2 foundation, adds €40 to Day 1 build)	Volunteer crew	Days 2–3 of sprint
8	Assemble IBC aquaponic physical structure and begin biological cycling (without fish)	Volunteer crew + one knowledgeable lead	Days 3–5 of sprint
9	Source red wiggler worms locally (OLX, fishing shops, organic farms around Braga) and set up worm farm	João or local contact	Week 2 of sprint
10	Order orchard trees for autumn planting: fig, quince, plum, apple (Bravo de Esmolfe variety), chestnut — grafted stock from Viveiro near Braga	Pawel	By end of September 2026 for October planting

What NOT to Do at Start

- Do not plant carrots, blueberries, large-fruiting tomatoes, peppers, cucumbers, or sweetcorn in Season 1
- Do not stock tilapia or clarias under any circumstances
- Do not announce the aquaponics system as "operational" until biological cycle is complete (4–6 weeks minimum)
- Do not use the words "organic" or "biológico" in any public communication
- Do not use greywater on food crops
- Do not assume stream or river access without checking SNIRH and consulting the Junta de Freguesia
- Do not serve well water to guests before IPAC laboratory testing is complete

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K. Website-Ready Text

(See full copy blocks in the synthesis report — used directly in foodGardenContent in src/data/site.ts)

L. Image Generation Prompts

```
PROMPT 1:
Wide-angle cinematic photograph of granite-edged raised garden beds set into a hillside
in rural northern Portugal, golden late-afternoon light, rows of rocket and kale at
different stages of growth, rough stone walls, terracotta soil visible at the edges,
no people, no text, warm and genuine, slightly overcast sky behind

PROMPT 2:
Interior of a rustic aquaponic greenhouse, wooden structure, fish tank visible with
silver water surface, grow bed alongside filled with lettuce and watercress, soft
diffused light through polycarbonate panels, water pump visible, tools hanging on wall,
no text, warm and practical atmosphere

PROMPT 3:
Close-up photographic detail of a hydroponic herb wall mounted on a weathered stone
kitchen wall in southern European light, rows of basil, mint and lemon balm in white
growing cups, water visible dripping from a header pipe, warm golden morning light,
shallow depth of field, no text

PROMPT 4:
Wide documentary photograph of a rainwater-fed kitchen garden in northern Portugal,
terracotta cistern visible against a stone wall, irrigation pipe running to raised beds,
herbs in foreground, granite hills in background, late summer light, honest working
atmosphere, no text, no people

PROMPT 5:
A single guest in simple clothing crouching beside a raised bed in early morning light,
harvesting rocket leaves into a wooden trug, dew on the leaves, granite-edged bed,
stone building wall in soft focus behind, warm cinematic colour grade, no text,
genuine and unposed

PROMPT 6:
Aerial or elevated view of a small food garden on a hillside in rural Portugal, raised
beds in geometric arrangement, glass greenhouse to one side, young orchard trees in
rows beyond, early morning mist in the valley below, warm light catching the stone
walls, no text, drone-like perspective

PROMPT 7:
Interior close-up of an aquaponic fish tank in a rustic greenhouse setting, several
carp visible beneath a clear water surface, grow media and plant roots visible above
the waterline, late golden light through glass, no text, calm and beautiful

PROMPT 8:
A working compost bay built from reclaimed wooden pallets in a garden setting, dark
finished compost visible in one bay, fresh green garden cuttings in another, garden
fork leaning against the structure, northern Portuguese countryside visible behind,
no text, warm working light

PROMPT 9:
Rustic greenhouse exterior in northern Portugal countryside, wooden frame and
polycarbonate panels, surrounded by raised beds with herbs, evening golden hour light,
hillside and oak trees in background, no text, cinematic and warm, slightly wide angle

PROMPT 10:
Extreme close-up of freshly harvested herbs laid on a rough wooden surface — basil
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leaves, nasturtium flowers, a sprig of mint, watercress — morning light, water droplets
still visible, high detail, natural colour, no text, beautiful and edible
```

M. Next Best Tasks

#	Task	Owner	Notes
1	**Pre-order pallets and IBC tank via OLX before August 2026** — arrange collection for sprint arrival week	Pawel / João	4–6 pallets free or €5 each; IBC 1000L €45–80
2	**Commission IPAC water test for any well or spring water on the property**	Pawel	Budget €150–300; include radon and arsenic given Norte PT granite geology; required before guest water use
3	**Book RC-Advogados consultation** covering: AL/TER food service threshold, ASAE registration trigger, stream abstraction licence, edible fish position under DL 93/2014	Pawel	Single meeting covers 4 regulatory questions; do before stocking edible fish or first paid guest
4	**Language audit: search site and social media for "organic" / "biológico" / "certified"** — replace with compliant alternatives	Pawel	Can be done immediately at zero cost; non-compliance is the most common first-year trap for eco-retreats
5	**Add /food-garden page to Astro site** using the EN+PT copy blocks — follows the same pattern as existing modules	Pawel or volunteer dev	site.ts foodGardenContent + src/pages/food-garden.astro + src/pages/pt/jardim-alimentar.astro
6	**Generate the 10 food garden images** using prompts in Section L (gpt-image-1 or equivalent); deposit to `public/images/food-garden/`	Pawel	Gitignored, deployed via rsync; same workflow as axe-throwing and natural-gym images
7	**Source red wiggler worms locally before or during September sprint** — check OLX Braga, local fishing shops (minhocas vermelhas para iscos), organic farms near Amares or Terras de Bouro	João or local contact	200–500g starter (€8–20); needed for worm farm in Level 2 build