



TECHNICAL SPECIFICATION

GSO Goat Raising Project

Small-Ruminant Production for the Phnom Samkos Wildlife Sanctuary

Prepared for

GLOBAL STUDENT OUTREACH

Food Security • Sustainable Livelihoods • Forest & Wildlife Protection • Climate Resilience — Rural Cambodia

Document Rev. 1.0 — August 2, 2024

Target Cost per Starter Doe Unit: USD \$150–\$250 | Shelter Budget Tiers: Small \$1,000 / Medium \$2,000 / Large \$3,000

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1. Executive Summary

This specification defines a **low-input goat raising program** for Global Student Outreach (GSO) communities living in and around the **Phnom Samkos Wildlife Sanctuary** in the Cardamom Mountains of western Cambodia. Goats are uniquely suited to the sanctuary's jungle environment: they are **browsers** (not grazers), naturally adapted to steep terrain, heat-tolerant, and capable of converting forest-edge vegetation, bamboo leaves, and crop residues into milk and meat for household consumption and income.

However, goat production in the Phnom Samkos jungle presents distinct challenges: **extreme annual precipitation (3,000–4,000 mm)** creates chronic wet conditions that favor internal parasites — particularly the **barber pole worm (*Haemonchus contortus*)**, the single greatest cause of goat mortality in tropical high-rainfall systems. **Feral and free-roaming domestic dogs** pose a severe predation risk, especially to kids. Goats require **constant daily observation** and **active rotation to fresh browsing areas** to prevent parasite buildup, nutritional deficiency, and predator exposure.

This document addresses these challenges head-on with species-specific management protocols, an integrated parasite control strategy, predator-proof shelter designs, and three tiered shelter budgets (**Small \$1,000 / Medium \$2,000 / Large \$3,000**) featuring **tin roofing, chain-link fencing, shade wrap / mosquito netting, 1.8 m elevated platforms with gapped slatted floors for manure collection**, and night-security pens. The design prioritizes hygiene, parasite break, and dog attack prevention while remaining buildable by community crews using locally available materials.

2. Why Goats for Phnom Samkos — Pros & Cons

2.1 Pros

Advantage	Explanation
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Browsers, not grazers	Goats eat leaves, twigs, bamboo shoots, shrubs, and vines — the dominant vegetation in the Cardamom jungle. They do not require open grassland, which is scarce in the sanctuary.
Steep-terrain adapted	Goats are sure-footed on 10–30° slopes where cattle struggle. They can access forest-edge browse on ridges and stream banks that other livestock cannot reach.
Small frame, low feed demand	Indigenous / crossbred does (25–35 kg) require only 2–3% of body weight in dry matter daily — roughly 0.7–1.0 kg of browse. This is achievable on forest margins alone.
High reproductive rate	Does can kid twice per year under good management, with 1–2 kids per birth. A starter doe can produce 3–6 marketable kids within 24 months.
Fast turnover	Kids reach 15–20 kg market weight in 6–8 months — faster than cattle (18–24 months). This provides quicker household income.
Manure value	Goat pellets are a concentrated, dry, high-value organic fertilizer. Collected from elevated slatted floors, they can be sold or applied directly to vegetable beds and aquaponics grow beds.
Milk production	1–2 L/day during lactation provides household protein and can be consumed or sold as fresh milk or fermented yogurt.
Low capital entry	A starter doe costs \$80–\$150 locally. A basic shelter starts at \$1,000. This is accessible to smallholders with limited capital.
Gender equity	Goats are traditionally managed by women and children in Southeast Asia. The project aligns with female-headed household empowerment goals.

2.2 Cons

Disadvantage	Explanation
High parasite burden	The 3,000–4,000 mm annual rainfall and warm temperatures create ideal conditions for <i>Haemonchus contortus</i> * (barber pole worm), liver fluke, and coccidiosis. Goats are more susceptible than cattle.
Predation risk — dogs	Feral dogs and free-roaming village dogs are the **#1 predator** of goats in rural Cambodia. Kids are especially vulnerable. Night attacks, daytime pack harassment, and stress-induced abortion are common.
Require constant observation	Goats cannot be left unattended like cattle. They escape tethering, climb fences, eat toxic plants, and are vulnerable to bloat, predation, and heat stress without active monitoring.
Need fresh browse daily	Goats will over-browse an area in 2–3 days, stripping all edible vegetation and exposing themselves to accumulated parasite larvae. Families must move tethering points or rotate pens every 1–2 days.
Shelter-dependent	Unlike cattle, goats cannot tolerate prolonged rain

	or wet ground. They require elevated, dry housing — especially during the 6-month monsoon (May–October).
Vaccination and deworming burden	Goats require more frequent health intervention than cattle: quarterly deworming, annual enterotoxemia (CD&T) vaccination, and regular hoof trimming in wet conditions.
Market volatility	Goat meat demand in Cambodia is seasonal (peak during Khmer New Year and Pchum Ben). Prices can fluctuate \$2.50–\$4.00/kg live weight seasonally.
Tethering hazards	Tethered goats can wrap themselves in rope, flip, bloat, and die if not checked frequently. Tethering also limits browse access to a small radius.
Toxic plant risk	The Cardamom jungle contains numerous plants toxic to goats (certain ferns, *Datura*, *Jatropha*). Browsing must be supervised.

****Net assessment:**** Goats are a ****high-management, high-return**** asset for Phnom Samkos families. They are not "set and forget" like cattle. Success depends on ****daily observation, parasite vigilance, predator-proof housing, and active browse rotation****. Families unwilling or unable to provide 2–3 hours of daily goat management should not enter the program.

3. The Phnom Samkos Environment — Goat-Specific Challenges

3.1 Precipitation & Humidity

Parameter	Value	Impact on Goats
Annual rainfall	3,000–4,000 mm	Chronic wet conditions; foot rot; shelter decay; parasite larval survival
Rainy season	May–October (6 months)	Goats confined to shelter / pen for extended periods; elevated housing essential
Dry season	November–April (5–6 months)	Reduced browse quality; water sources may shrink; dust and respiratory issues
Relative humidity	75–90% year-round	Fungal skin infections; rapid bamboo rot; high parasite egg hatching rate
Temperature	29–32°C average	Heat stress in unshaded goats; need for roof ventilation and shade wrap

Key design implication: Goats in Phnom Samkos **cannot be housed on the ground**. An **elevated platform (minimum 1.5 m, target 1.8 m)** with a **slatted / gapped floor** is non-negotiable. This keeps goats above mud, manure, and parasite larvae, allows urine and pellets to fall through for collection, and provides airflow to reduce humidity-related disease.

3.2 Barber Pole Worm (*Haemonchus contortus*) — The Primary Threat

The barber pole worm is a blood-sucking gastrointestinal nematode that lives in the abomasum (fourth stomach) of goats and sheep. It is the **leading cause of death** in tropical small-ruminant systems.

Life Cycle in the Phnom Samkos Context

Stage	Duration	Conditions in Sanctuary
Eggs passed in feces	—	Continuous; a single female worm lays 5,000–10,000 eggs/day
Egg hatching to L1	1–2 days	Rapid in warm, moist conditions (year-round in Cardamoms)
L1 to infective L3	3–5 days	Very rapid; in temperate climates this takes 7–14 days
L3 larva survival on pasture	30–60 days	Extended survival in wet, shaded jungle understory
Ingestion by goat	—	L3 larvae climb 2–5 cm up vegetation in morning dew; goats ingest while browsing
Pre-patent period	18–21 days	Worms mature and begin laying eggs; anemia develops rapidly

Why Phnom Samkos Is a High-Risk Zone

1. ****Warm + wet = explosive larval development:**** Eggs hatch and reach infective L3 stage in ****4–5 days**** (vs. 10–14 days in cooler climates). The 6-month rainy season provides continuous favorable conditions.
2. ****Dense vegetation = protected larvae:**** The jungle canopy shields larvae from UV light and desiccation, extending their survival on browse plants.
3. ****Small landholdings = high stocking density:**** Community-zone plots are small (0.2–0.5 ha). Repeated browsing of the same area leads to massive larval accumulation.
4. ****Goat browsing behavior = high exposure:**** Goats browse low shrubs and ground-level vegetation — exactly where L3 larvae concentrate (they climb 2–5 cm up plants, rarely higher).
5. ****Indigenous goats = partial susceptibility:**** Local Cambodian goats have some natural resistance, but without management, barber pole worm can still cause 30–50% mortality in kids and 10–20% in adults.

Integrated Barber Pole Worm Control Strategy

The GSO goat program uses a **five-pillar integrated parasite management (IPM)** approach. No single method is sufficient.

Pillar	Action	Frequency	Cost (USD/year/doe)
1. Elevated housing + slatted floors	Keeps goats above manure and larvae; pellets fall through gaps for collection and removal; breaks re-infection cycle	Continuous	Built into shelter
**2. Browse rotation (tethering point moved	Prevents larval accumulation in any one	Daily	\$0 (labor)

every 1–2 days)**	spot; fresh areas = clean browse		
3. FAMACHA anemia scoring	Examine lower eyelid color (red = healthy, white/pale = anemic, needs deworming). Treats only affected animals, reducing anthelmintic resistance	Weekly	\$0 (training)
4. Strategic deworming	Deworm only FAMACHA-positive animals; full herd deworm at kidding and weaning only. Rotate anthelmintic classes (benzimidazole, macrocyclic lactone, imidazothiazole)	As needed (selective)	\$3–\$6
5. Dry-season pasture rest	Rest heavily browsed areas for 30–45 days during the hot dry season (Mar–Apr). Sun and heat kill larvae on exposed vegetation	Seasonal	\$0

Additional measures:

****Condensed tannin forages:**** Where available, feed **Leucaena leucocephala**, **Moringa oleifera**, or **Casuarina** leaves. Tannins bind to parasite proteins and reduce egg viability. These trees grow wild in the Cardamoms.

****Copper oxide wire particles (COWP):**** A slow-release copper bolus (administered under vet guidance) can reduce adult worm burdens. Goats tolerate copper better than sheep, but overdose is toxic.

****Multi-species rotation:**** If cattle are present in the same community zone, rotate goats and cattle through browsing areas. Cattle ingest goat parasites without harm, "cleaning" the pasture of larvae.

****Do not feed on the ground:**** All supplemental feed (rice bran, cut-and-carry) must be offered in ****elevated feed trays**** (60+ cm above the platform). Ground feeding contaminates feed with feces and larvae.

****Critical note:**** *The traditional Cambodian practice of **frequent blanket deworming** (drenching the entire herd every month) is **counterproductive**. It accelerates anthelmintic resistance and is unnecessary with elevated housing + FAMACHA. GSO trains families on **selective treatment** — deworm only the anemic 20–30% of the herd, not the healthy 70–80%.*

3.3 Feral Dog & Domestic Dog Predation

Dog attacks are the **second-greatest threat** to goats in rural Cambodia after parasites. The Phnom Samkos region has three categories of risk:

Dog Category	Behavior	Risk Level
Feral village dogs	Semi-wild, pack-forming, hunt at dawn/dusk	**High** — pack attacks on kids and weak adults

Free-roaming owned dogs	Unsupervised, territorial, chase and harass	**Moderate–High** — stress-induced abortion, kid separation, injury
Hunting dogs	Trained to hunt wildlife; may target goats if game is scarce	**Moderate** — typically single-dog, but persistent
Asian wild dog (Dhole)	Native pack hunter in sanctuary core zone	**Low** — rarely enters community zones, but possible

Dog Attack Patterns

****Time:**** 80% of attacks occur between ****04:00–07:00**** (dawn) and ****18:00–21:00**** (dusk).

****Target:**** Kids under 3 months are the primary target. Pregnant does and weak adults are secondary.

****Method:**** Pack harassment → separation from herd → chase to exhaustion → throat/abdomen bite.

****Stress impact:**** Even unsuccessful attacks cause abortion in pregnant does, reduced milk production, and self-injury (goats panic and entangle in tethers or fences).

Dog Attack Prevention Strategy

Measure	Implementation	Cost
Night pen / dog-proof lock-up	All goats locked in elevated chain-link pen from 18:00–07:00. Pen has 1.8 m chain-link walls with 30 cm underground skirt to prevent digging.	Built into shelter
Family house proximity	Shelter located within 20 m of family house. Goats are less likely to be attacked if near human activity and light.	\$0
Tethering supervision	If tethered during the day, goats must be within sight and hearing of a family member. Never tether out of sight.	\$0 (labor)
Guard animal	A single donkey, mule, or large dog (trained livestock guardian) kept with the goat herd. Donkeys naturally attack canines.	\$150–\$300 (donkey)
Community dog management	Work with village chief to enforce dog vaccination, registration, and nighttime confinement of owned dogs. Coordinate with GSO on humane population control.	\$0 (advocacy)
Kid protection	Kids kept in a separate, smaller elevated "kid pen" with 12 mm mesh (smaller gaps) until 3 months old.	Built into shelter
Noise deterrents	Tin cans, bells, or motion-activated alarms on pen perimeter.	\$5–\$15

****Design note:**** The GSO shelter specification includes ****chain-link fencing on all four sides of the elevated platform****, not just a roof and posts. Goats must be fully enclosed — dogs can and will climb bamboo poles or

jump 1.2 m barriers. The 1.8 m platform height also provides protection: dogs struggle to reach goats at this elevation.

3.4 Daily Browse Management

Goats are **obligate browsers**. They will not thrive on grass alone. In the Phnom Samkos jungle, the following plants are preferred browse:

Plant Type	Examples in Cardamoms	Nutritional Value
Bamboo leaves & shoots	*Bambusa*, *Dendrocalamus*	Moderate protein; palatable year-round
Leguminous trees	*Leucaena leucocephala*, *Gliricidia sepium*, *Moringa oleifera*	High protein (20–25%); anti-parasitic tannins
Native shrubs	*Ficus* spp., *Lantana camara*, *Chromolaena odorata*	Moderate protein; widely available
Liana / vines	Various forest-edge climbers	Variable; good dry-season filler
Crop residues	Rice straw, maize stover, peanut haulm	Low protein; roughage filler
Banana leaves & pseudostem	*Musa* spp.	Moderate energy; palatable

Browse Rotation Protocol

Day	Action	Rationale
Day 1	Move tether to fresh forest-edge clearing or open new pen section	Clean browse, minimal larval contamination
Day 2	Continue on same spot if vegetation remains	Goats strip preferred plants first; monitor for depletion
Day 3	**Move to new spot**	By Day 3, goats have stripped most edible material and begun ingesting lower-quality / higher-contamination vegetation
Rest period	Previous spot rested for 30–45 days	Sun and heat kill larvae; vegetation regrows

****Labor implication:**** A family with 3–5 goats must dedicate ****1.5–2.5 hours/day**** to browse management: cutting fresh branches, moving tethers, supervising browsing, and collecting pellets. This is in addition to 0.5–1.0 hour/day for pen cleaning, feeding, and health checks.

4. Shelter Specification — Three Budget Tiers

All three shelter designs share the following **non-negotiable features** for the Phnom Samkos environment:

Feature	Specification	Rationale
Elevation	1.8 m above ground (platform height)	Above flood line; dog-proof; manure collection; airflow
Floor type	Slatted / gapped floor (25–35 mm gaps between slats)	Pellets and urine fall through; goats stay dry; parasite break
Roof	Corrugated galvanized tin, minimum 15° pitch	Sheds 3,000+ mm annual rainfall; 15+ year lifespan
Walls / fencing	Chain-link mesh (50 mm	Dog-proof; goat-proof (goats

	aperture), 1.8 m height	climb bamboo); durable
Shade wrap / mosquito netting	50% shade cloth or fine mesh (1–2 mm) on 2–3 sides	Reduces heat; blocks mosquitoes (reduce mosquito-borne illness); windbreak during monsoon
Posts	Treated hardwood or galvanized steel, set in concrete footings	Termite-resistant; monsoon-stable; 10+ year lifespan
Manure collection	Concrete or compacted-earth pad under platform, sloped 1:20 for drainage	Collects pellets for easy scooping; prevents ground contamination
Kid pen	Separate 1.0 m × 1.5 m elevated section with 12 mm mesh	Protects kids from adult trampling and dog access
Feed tray	Elevated 60 cm above platform, slatted base	Prevents ground contamination of supplemental feed
Water point	20 L hanging bucket or nipple drinker, elevated 80 cm	Clean water; no ground contamination

4.1 Small Shelter — \$1,000 Budget

Capacity: 3–5 adult does + 1 buck + kids

Component	Specification	Qty	Unit Cost (USD)	Total (USD)
Platform frame	Treated hardwood posts (10 cm × 10 cm), 2.0 m length, set 60 cm in concrete	9	\$8	\$72
Platform decking	Bamboo slats (50 mm wide, 30 mm gaps), treated with used motor oil	1 set	\$45	\$45
Roof frame	Hardwood purlins (5 cm × 7 cm) on 60 cm centers	1 set	\$25	\$25
Tin roofing	Corrugated galvanized tin, 0.4 mm, 3.0 m × 6.0 m coverage, with ridge cap	1 set	\$85	\$85
Chain-link fencing	50 mm mesh, 1.8 m height, 12 m total length (3 m × 4 m pen)	12 m	\$4/m	\$48
Shade cloth / mosquito mesh	50% shade cloth, 3 m × 4 m, on 2 sides + roof overhang	1 set	\$20	\$20
Stairs / ramp	Bamboo ladder with 30 cm treads, 45° angle	1	\$15	\$15
Kid pen	1.0 m × 1.5 m chain-link section with 12 mm mesh, bamboo floor	1	\$35	\$35
Feed tray	Split bamboo elevated tray, 1.0 m × 0.4 m	2	\$8	\$16

Water bucket + hanger	20 L plastic bucket with nipple or trough	2	\$5	\$10
Manure pad	Compacted earth + sand, 3.5 m × 4.5 m, sloped, with 100 mm gravel drainage layer	1	\$30	\$30
Hardware	Wire ties, U-nails, screws, hinges, latch	1 set	\$25	\$25
Labor	Community crew (2 people, 3 days)	1	\$80	\$80
Contingency	10% buffer	—	—	\$50
			TOTAL	**\$1,000**

Dimensions: 3.0 m (width) × 4.0 m (length) × 1.8 m (platform height) × 2.4 m (ridge height)

Pros: Lowest cost; buildable in 3 days; uses 90% local materials.

Cons: Bamboo floor lasts 2–3 years before replacement; termite risk if oil treatment skipped; no separate buck pen.

4.2 Medium Shelter — \$2,000 Budget

Capacity: 8–12 adult does + 2 bucks + kids

Component	Specification	Qty	Unit Cost (USD)	Total (USD)
Platform frame	Treated hardwood posts (10 cm × 10 cm) + galvanized steel corner brackets	12	\$10	\$120
Platform decking	Hardwood slats (50 mm wide, 25 mm gaps), treated	1 set	\$120	\$120
Roof frame	Hardwood purlins + galvanized steel truss plates	1 set	\$55	\$55
Tin roofing	Corrugated galvanized tin, 0.5 mm, 4.5 m × 6.0 m coverage, ridge cap, gutter	1 set	\$140	\$140
Chain-link fencing	50 mm mesh, 1.8 m height, 22 m total length (4.5 m × 6.0 m pen)	22 m	\$4/m	\$88
Shade cloth + mosquito mesh	50% shade cloth on 3 sides; fine mosquito mesh (1.5 mm) on 1 side	1 set	\$45	\$45
Stairs / ramp	Hardwood ramp with 25 cm treads, non-slip slats, 40°	1	\$35	\$35

	angle			
Kid pen	2.0 m × 2.5 m section, 12 mm mesh, hardwood floor, separate roof	1	\$85	\$85
Buck pen	1.5 m × 2.0 m section, 50 mm mesh, solid partition from does	1	\$60	\$60
Feed tray	Hardwood elevated tray with slatted base, 1.2 m × 0.5 m	3	\$12	\$36
Water system	40 L hanging tank with 3 nipple drinkers, 80 cm elevation	1 set	\$35	\$35
Manure pad	Concrete pad (50 mm), 5.0 m × 7.0 m, sloped to collection gutter	1	\$120	\$120
Hardware	Galvanized wire, U-bolts, screws, latches, padlock	1 set	\$55	\$55
Labor	Community crew + skilled carpenter (3 people, 5 days)	1	\$180	\$180
Contingency	10% buffer	—	—	\$110
			TOTAL	**\$2,000**

Dimensions: 4.5 m (width) × 6.0 m (length) × 1.8 m (platform height) × 2.6 m (ridge height)

Pros: Separate buck and kid pens; concrete manure pad; longer-lasting hardwood floor; water nipple system reduces labor.

Cons: Higher initial investment; requires skilled carpenter for concrete work.

4.3 Large Shelter — \$3,000 Budget

Capacity: 15–20 adult does + 3 bucks + kids + communal kidding bay

Component	Specification	Qty	Unit Cost (USD)	Total (USD)
Platform frame	Galvanized steel posts (75 mm × 75 mm RHS) + hardwood beams, set in concrete	16	\$18	\$288
Platform decking	Hardwood slats (60 mm wide, 25 mm gaps), treated, with 100 mm hardwood bearers	1 set	\$220	\$220
Roof frame	Galvanized steel purlins + hardwood rafters,	1 set	\$120	\$120

	bolted connections			
Tin roofing	Corrugated galvanized tin, 0.5 mm, 6.0 m × 9.0 m coverage, ridge cap, gutters, downpipe	1 set	\$220	\$220
Chain-link fencing	50 mm mesh, 1.8 m height, 32 m total length (6 m × 9 m pen), with gate	32 m	\$4/m	\$128
Shade cloth + mosquito mesh	50% shade cloth on all 4 sides (roll-up for ventilation); fine mesh on 2 sides	1 set	\$80	\$80
Stairs / ramp	Galvanized steel ramp with hardwood treads, 35° angle, handrail	1	\$65	\$65
Kid pen (2 bays)	2.5 m × 3.0 m each, 12 mm mesh, hardwood floor, separate roof hatches	2	\$90	\$180
Buck pen (2 bays)	2.0 m × 2.5 m each, 50 mm mesh, solid partitions, separate roof	2	\$70	\$140
Communal kidding bay	3.0 m × 3.0 m, solid floor (no gaps), heat lamp mount, observation window	1	\$120	\$120
Feed tray	Galvanized steel elevated tray, 1.5 m × 0.6 m, 3 units	3	\$20	\$60
Water system	100 L elevated tank with 5 nipple drinkers, gravity-fed	1 set	\$65	\$65
Manure pad + collection	Concrete pad (75 mm), 7.0 m × 10.0 m, sloped to central gutter, with 1,000 L collection pit	1	\$220	\$220
Storage locker	1.0 m × 0.8 m × 1.0 m lockable box under platform for feed / medicine	1	\$35	\$35
Hardware	Galvanized fittings, padlocks, hinges, wire, bolts	1 set	\$85	\$85
Labor	Community crew + skilled builder + steelworker (4	1	\$280	\$280

	people, 7 days)			
Contingency	10% buffer	—	—	\$160
			TOTAL	**\$3,000**

Dimensions: 6.0 m (width) × 9.0 m (length) × 1.8 m (platform height) × 2.8 m (ridge height)

Pros: Commercial-scale capacity; steel frame resists termites; communal kidding bay for assisted births; centralized manure collection for sale / aquaponics; storage locker protects feed and medicine from humidity and pests.

Cons: Highest initial cost; requires steel cutting and welding skills (or pre-fabricated frame from Pursat); longer build time.

4.4 Shelter Comparison Summary

Feature	Small (\$1,000)	Medium (\$2,000)	Large (\$3,000)
Capacity	3–5 does + 1 buck	8–12 does + 2 bucks	15–20 does + 3 bucks
Platform area	12 m ²	27 m ²	54 m ²
Floor material	Bamboo slats	Hardwood slats	Hardwood + steel bearers
Post material	Hardwood	Hardwood + steel brackets	Galvanized steel RHS
Roof pitch	15°	15°	20°
Manure pad	Earth + gravel	50 mm concrete	75 mm concrete + collection pit
Kid pen	1 small bay	1 medium bay	2 bays + communal kidding
Buck pen	None (shared)	1 bay	2 bays
Water system	Hanging buckets	40 L tank + nipples	100 L tank + 5 nipples
Build time	3 days	5 days	7 days
Crew size	2 people	3 people	4 people
Lifespan	5–7 years	10–12 years	15+ years

5. Animal Specification & Sourcing

5.1 Recommended Breeds

Breed	Origin	Mature Weight	Pros for Phnom Samkos	Cons
Indigenous Cambodian goat	Local	20–30 kg	Highly adapted; heat-tolerant; parasite-resistant; low input; available locally	Small size; slower growth; lower milk
Boer × local cross	South Africa × local	30–45 kg	Fast growth; good meat yield; retains some heat tolerance	Higher feed demand; more susceptible to parasites than pure local
Anglo-Nubian × local	Britain × local	35–50 kg	High milk yield (2–3 L/day); large	Very high feed demand; heat-

			frame; good temperament	sensitive; not recommended for jungle beginners
Philippine goat	Philippines	25–35 kg	Proven in tropical high-rainfall; good mothering; twinning rate	Must be imported; transport stress; limited availability

GSO Recommendation: Start with **indigenous Cambodian does** (80% of herd) and introduce **one Boer-cross buck** for genetic improvement. This maintains hardiness while improving kid growth rates. Avoid pure dairy breeds (Nubian, Saanen) in the first 2 years.

5.2 Sourcing Criteria

Check	Standard
Age	Does: 12–24 months (proven fertile preferred); Buck: 18–30 months
Body condition	Score 2.5–3.0 / 5 (ribs faintly visible; good hip cover)
Health	Bright eyes; clean nose; no diarrhea; no external parasites; firm hooves
Reproduction	Doe: confirmed pregnant or has kidded before; Buck: proven fertility
Vaccination	CD&T (enterotoxemia) at minimum; dewormed within 30 days
Source	Pursat, Battambang, or Koh Kong district markets; avoid Phnom Penh (transport stress)

5.3 Starter Flock Composition

Flock Size	Does	Buck	Kids Expected (Year 1)	Total Cost (Animals)
Small	3	1	3–6	\$320–\$500
Medium	8	2	8–16	\$800–\$1,200
Large	15	3	15–30	\$1,500–\$2,250

****Note:**** Buck-to-doe ratio of 1:15–20 for natural service. Bucks must be rotated every 18 months to prevent inbreeding.

6. Daily Management Protocol

6.1 Daily Schedule (Per Family)

Time	Task	Duration	Notes
06:00	Open pen; visual health check; FAMACHA scan if due	15 min	Check for overnight dog signs, diarrhea, limping
06:30	Move goats to fresh tether / browsing spot; provide cut-and-carry	30 min	Supervise initial browsing; ensure no toxic plants

08:00–11:00	Family works fields / NTFP collection; goats browse under periodic check	—	Check every 60–90 min for entanglement, distress, predators
11:00	Midday water check; move tether if spot depleted	15 min	Hot season: provide shade break
12:00–15:00	Goats rest in shade; family continues other work	—	Hottest part of day; goats should not be in direct sun
15:00	Move to afternoon browsing spot; fresh cut-and-carry	20 min	
17:30	Return goats to pen; lock in; feed supplement in elevated tray	20 min	**Critical: all goats must be locked in before dusk (18:00)**
18:00	Pen cleaning: rake slatted floor, scoop manure pad, check water	15 min	
Total daily labor		**1.5–2.5 hours**	

6.2 Weekly Tasks

Task	Frequency	Time
Hoof trimming	Every 2 weeks (wet season); monthly (dry season)	30 min
Full FAMACHA scoring	Weekly	20 min
Pen underside spray (vinegar/disinfectant)	Weekly	15 min
Feed tray deep clean	Weekly	10 min
Browse area assessment	Weekly	15 min

6.3 Monthly Tasks

Task	Frequency	Time
Selective deworming (FAMACHA-positive only)	Monthly or as needed	30 min
Weight / body condition scoring	Monthly	20 min
Chain-link and bamboo inspection	Monthly	15 min
Record update (kidding, breeding, deaths, sales)	Monthly	15 min

7. Health & Veterinary Protocol

7.1 Vaccination Schedule

Vaccine	Age	Booster	Cost (USD)
CD&T (Clostridium perfringens C & D + Tetanus)	4 weeks	Annual	\$1.50–\$2.50/dose

Peste des Petits Ruminants (PPR)	3 months	Annual	\$1.00–\$2.00/dose
Foot-and-Mouth Disease (FMD)	6 months	Every 6 months	\$1.50–\$2.50/dose
Contagious Caprine Pleuropneumonia (CCPP)	6 months	Annual	\$2.00–\$3.00/dose

7.2 Parasite Control Calendar

Month	Action	Target
Jan (Cool dry)	Fecal egg count (FEC) on all does; deworm if >500 epg	All herd
Feb (Hot dry)	FAMACHA weekly; selective deworm	Anemic individuals only
Mar (Hot dry)	Pre-monsoon full deworm; hoof trim	All herd
Apr (Pre-monsoon)	Move to elevated pen full-time; rest all browse spots	Management
May–Oct (Monsoon)	FAMACHA weekly; selective deworm; elevated housing enforced	Anemic individuals
Nov (Post-monsoon)	Post-monsoon FEC; deworm if >500 epg	All herd
Dec (Cool dry)	Breeding season prep; buck health check; mineral supplement	Bucks + breeding does

7.3 Common Ailments in Phnom Samkos

Ailment	Cause	Symptoms	Treatment	Prevention
Barber pole worm (Haemonchus)	Parasite	Pale eyelids, weakness, bottle jaw, dark diarrhea	Selective deworm + iron supplement	Elevated housing + FAMACHA + browse rotation
Foot rot	Bacteria (wet conditions)	Lameness, foul-smelling hooves, swollen foot	Hoof trim + topical antibiotic spray	Elevated floor + dry bedding + regular hoof care
Coccidiosis	Protozoa (kids)	Bloody diarrhea, dehydration, death	Amprolium or sulfa drugs	Clean kid pen + elevated floor + no ground feeding
Enterotoxemia	Bacteria (overeating)	Sudden death, bloat, convulsions	Vaccination (prevention only)	CD&T vaccine + gradual diet changes
Mange / lice	External parasite	Hair loss, scratching, skin thickening	Ivermectin or topical dip	Regular inspection; isolate affected animals
Bloat	Gas accumulation (legume overeating)	Distended left side, difficulty breathing, death	Vegetable oil drench + massage	Controlled legume access; avoid wet legumes
Dog attack trauma	Predation	Wounds, shock, abortion	Wound cleaning + antibiotics + tetanus	Night pen + dog-proof fencing

8. Reproduction & Breeding

8.1 Reproductive Parameters

Parameter	Indigenous Doe	Boer-Cross Doe
Age at first kidding	12–15 months	10–12 months
Kidding interval	8–10 months	7–8 months
Kids per birth	1.2–1.5	1.5–2.0
Gestation	145–155 days ($\approx$ 5 months)	145–155 days
Kid birth weight	1.5–2.0 kg	2.0–3.0 kg
Weaning age	3 months	3 months
Weaning weight	6–8 kg	8–12 kg
Market weight	15–20 kg (6–8 months)	20–30 kg (5–7 months)

8.2 Breeding Calendar

Season	Activity	Rationale
Nov–Dec (Cool dry)	Main breeding season; expose does to buck	Kids born Mar–Apr when forage is abundant pre-monsoon
Mar–Apr (Hot dry)	Second breeding season (if does recover)	Kids born Jul–Aug; risk of monsoon disease but possible
May–Oct (Monsoon)	**Avoid breeding** ; separate buck	High parasite load; wet conditions stress pregnant does

8.3 Kidding Management

- **Pre-kidding:**** Move doe to communal kidding bay (solid floor, no gaps) 3–5 days before due date. Provide clean bedding (dry grass or rice straw).
- **Birth:**** Most kidding is unassisted. Be present for first-time kidders. Clean kid's nostrils and mouth immediately. Ensure kid nurses colostrum within 1 hour.
- **Post-kidding:**** Dip umbilical cord in iodine. Keep doe and kid in kidding bay for 3–5 days before returning to main pen.
- **Kid protection:**** Kids remain in elevated kid pen (12 mm mesh) until 3 months old. They browse under supervision during the day but sleep in the kid pen at night.

9. Economics — Per-Doe Annual Model

9.1 Costs (USD per doe per year)

Item	Cost
Feed (cut-and-carry, crop residues)	\$0–\$20 (mostly family labor)
Mineral block / salt	\$5–\$8
Deworming (selective, 2–3x/year)	\$3–\$6
Vaccination (CD&T, PPR, FMD)	\$4–\$8
Veterinary reserve	\$5–\$10
Shelter amortization (Small, 7 years)	\$15–\$20
Labor (imputed)	\$0 (family)

Total annual cost per doe	**\$30–\$70**
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9.2 Returns (USD per doe per year)

Item	Value
Kids produced (1.5 kids, 80% survival)	1.2 marketable kids
Kid sale value (18 kg @ \$3.50/kg)	\$63 per kid × 1.2 = **\$75**
Milk offtake (1 L/day × 120 days)	\$0.50/L = **\$60** (household value)
Manure value (sold or applied)	**\$15–\$25**
Cull doe value (Year 5–6)	**\$40–\$60** (one-time)
Total annual return per doe	**\$90–\$160**

9.3 Net Position

Metric	Value
Break-even	Year 1–2 (depending on kid survival)
Net annual profit per doe (Years 2–5)	**\$60–\$130**
Return on investment (doe + shelter share)	40–80% annually after Year 2

10. Implementation Phasing

Phase	Scope	Duration	Cost
Phase 0 — Site selection + community agreement	Identify village; map browse areas; establish Goat Committee; sign MOU; assess dog situation	2 weeks	\$0
Phase 1 — Training	2-day workshop: goat husbandry, FAMACHA, elevated housing construction, dog protection, record keeping	3 days	\$10/person
Phase 2 — Shelter construction	Build selected shelter tier (Small/Medium/Large) using community labor + GSO materials grant	3–7 days	\$1,000–\$3,000
Phase 3 — Animal procurement	Source does and buck from local market; veterinary inspection; transport; quarantine for 14 days	2–3 weeks	\$320–\$2,250
Phase 4 — Breeding & kidding support	First breeding season assistance; kidding supervision; kid pen management	Months 3–8	\$0 (GSO staff)
Phase 5 — Monitoring & scale-up	Quarterly visits; FAMACHA refresher; shelter maintenance; expansion planning	Months 9–24	\$0 (GSO advisory)

11. Bill of Materials — Shelter Tiers Summary

Item	Small (\$1,000)	Medium (\$2,000)	Large (\$3,000)
Capacity	3–5 does	8–12 does	15–20 does
Platform size	3 m × 4 m	4.5 m × 6 m	6 m × 9 m
Elevation	1.8 m	1.8 m	1.8 m
Floor	Bamboo slats, 30 mm gaps	Hardwood slats, 25 mm gaps	Hardwood slats, 25 mm gaps
Roof	Tin, 15° pitch	Tin, 15° pitch + gutter	Tin, 20° pitch + gutters
Fencing	Chain-link, 1.8 m	Chain-link, 1.8 m	Chain-link, 1.8 m + gate
Shade / mesh	2 sides shade cloth	3 sides shade + 1 side mesh	4 sides shade (roll-up) + mesh
Kid pen	1 small bay	1 medium bay	2 bays + communal kidding
Buck pen	Shared	1 bay	2 bays
Manure pad	Earth + gravel	50 mm concrete	75 mm concrete + pit
Water	Hanging buckets	40 L tank + nipples	100 L tank + 5 nipples
Build time	3 days	5 days	7 days
Lifespan	5–7 years	10–12 years	15+ years

12. Safety & Conservation Alignment

****Community zone only:**** All goat browsing, tethering, and shelter construction is restricted to the sanctuary ****community zone****. No goats enter the core or conservation zones.

****No forest clearance:**** Goats browse on ****existing forest margins, fallow swiddens, and crop residues****. The program does not justify clearing primary or secondary forest.

****Manure for aquaponics:**** Collected goat pellets are a high-value nitrogen source for GSO aquaponics grow beds and vegetable gardens, reducing chemical fertilizer demand.

****Dog management coordination:**** GSO works with village chiefs and sanctuary rangers on humane dog population management, vaccination, and nighttime confinement. The goat program is not a justification for poisoning or shooting dogs.

****Snare reporting:**** Goat-keeping families are encouraged to report wildlife snares found during daily browse rotation. This aligns with GSO's wildlife protection mission.

****Kid protection = wildlife protection:**** By reducing kid mortality through predator-proof housing, families are less likely to expand herds unsustainably or clear additional forest for browse.

13. Revision & Contact

This is a planning-stage specification (Rev. 1.0) intended to guide pilot goat shelter construction across the first GSO community cohort in Phnom Samkos. Shelter costs, local material prices, and dog predation patterns should be validated on the ground in Pursat province before scaling.

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