

Designing a Feasible and Adoptable Forest Healing System in West Kalimantan

A Formative Planetary Health Roadmap for Youth Mental Health Promotion and Tropical Forest Stewardship

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Program setting	West Kalimantan, Indonesia
Participants	17 ASRI staff members
Available evidence	Three site assessments; routine program evaluation with six complete paired POMS records
Approach	Formative synthesis and implementation planning
Scope	Youth mental health promotion, feasible service delivery, and tropical forest stewardship
Status of claims	Exploratory program observations; the proposed system remains under development
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Abstract

Background: West Kalimantan needs mental health support that fits daily life, is ecologically responsible, and is feasible for communities facing travel barriers, smoke episodes, and limited access to specialist services.

Objective: To translate ASRI–Wanaprasta site assessments and early program experience into a feasible forest healing system and a practical pathway to institutional adoption in ASRI’s service area.

Approach: This formative synthesis brings together two internal program documents, a technical forest healing assessment, local demographic and youth mental health evidence, wildfire and smoke literature, and service-planning sources. It is not a clinical trial or a systematic review.

Formative findings: Three candidate sites were compared using a developmental Forest Healing Site Index. Gua Maria Kederon-Manjau ranked highest at 74.6 out of 100 and was classified as moderately suitable. Among 17 ASRI staff members who attended a seven-stage Healing Space Inside You session, six complete paired Profile of Mood States records showed a source-reported decrease in mean total mood disturbance from 5.46 to 1.43, a decrease of 4.03 points. These are routine program observations, not evidence of clinical effectiveness.

Proposed system and implications: The model links a facilitated forest route, a planned 0.7-hectare ASRI Mini Forest near clinical and workplace facilities, low-data or offline nature-based practice, stepped referral pathways, environmental safety procedures, and conservation reinvestment. Priorities are service readiness before major construction, youth co-design, culturally safe facilitation, dynamic smoke and heat decisions, standardized measurement, and prospective implementation evaluation. A credible planetary health contribution requires participant well-being, clinical accountability, local livelihoods, and ecological limits to be managed within one accountable system.

Keywords: planetary health; youth mental health; forest healing; eco-anxiety; wildfire smoke; West Kalimantan; implementation feasibility

1 Introduction

Planetary health begins with a straightforward premise: human health depends on the ecological systems that sustain life. In practice, mental health promotion cannot be designed solely as a clinical service, just as conservation cannot be treated solely as land management. Forests can offer sensory restoration, physical activity, social connection, cultural meaning, and opportunities to care for nature. They can also expose people to heat, rain, insects, smoke, difficult terrain, and the emotional effects of ecological loss. Responsible programs must account for both sides of this relationship (Bratman et al., 2015; Whitmee et al., 2015; World Health Organization [WHO], 2022).

This need is particularly important for young people. The Indonesia National Adolescent Mental Health Survey estimated that 34.9% of adolescents experienced mental health problems and 5.5% met criteria for a mental disorder; a much smaller proportion of adolescents with depression accessed treatment (Center for Reproductive Health et al., 2022; United Nations Children's Fund [UNICEF], 2025). These national estimates should not be applied directly to West Kalimantan, but they indicate the scale of the prevention and early-support challenge. The province also has a substantial youth population for service planning. The 2026 population table by age and sex reports 469,540 residents aged 15–19 years and 471,423 aged 20–24 years, or approximately 0.94 million residents aged 15–24 years (Badan Pusat Statistik Provinsi Kalimantan Barat, 2026).

Local studies provide a more context-specific, although incomplete, picture. An online cross-sectional survey of 663 university students in West Kalimantan during the COVID-19 pandemic included 72.1% who were younger than 20 years and 63.0% who were female. Based on the GAD-7, 43.0% were classified as having mild anxiety, 22.2% moderate anxiety, and 1.8% severe anxiety (Putri & Priyono, 2021). A separate descriptive study of 202 high school students in multiethnic Sungai Kakap included Malay, Dayak, Chinese, Bugis, Madurese, and Javanese participants. The psychological dimension was the lowest-scoring mental health dimension assessed (Hendrik et al., 2025). These findings are useful planning signals, not estimates of current provincial prevalence: the first study used online recruitment during the pandemic, and the second was conducted in a single school.

Forest fires and smoke add both ecological and emotional pressures. Research on Indonesian peatland fires has documented a substantial population-level health burden

associated with fine particulate matter (PM_{2.5}), including effects in Kalimantan. These estimates were modeled regionally rather than measured at ASRI sites (Hein et al., 2022). Evidence on wildfire smoke and mental health is more recent and less consistent than the literature on physical health. Nevertheless, chronic or repeated smoke exposure may plausibly affect well-being through physical discomfort, disrupted routines, uncertainty, social isolation, perceived threat, and reminders of ecological damage (Eisenman & Galway, 2022; Teigen et al., 2026).

Eco-anxiety is not a diagnosis for forest facilitators to assign. In this paper, it refers to a range of climate- and ecology-related concerns, sadness, anger, helplessness, or responsibility that may be adaptive, distressing, or both. An appropriate response should validate these experiences, avoid pathologizing ecological concern, support agency, and offer referral when distress begins to impair functioning (Hickman et al., 2021).

Access barriers cannot be adequately described by saying that West Kalimantan has no mental health services. The provincial health profile documents a primary care network in Ketapang and Kayong Utara. Facility counts, however, do not establish whether youth-specific prevention is available, whether trained professionals can be reached privately and affordably, how long referral takes, or whether a young person can obtain follow-up care. Qualitative research in Indonesia identifies stigma, cost, transportation, service availability, and uncertainty about where to seek help as recurring barriers (Dinas Kesehatan Provinsi Kalimantan Barat, 2024; Munira et al., 2023). For ASRI, this creates a concrete planning task: map care pathways around where young people live and study, then use forest healing as a supported entry point to well-being and early help, rather than as a substitute for diagnosis or treatment.

ASRI is well placed to explore this approach because its work already connects clinical care, forest protection, local livelihoods, and community relationships (Alam Sehat Lestari, n.d.). Forest Therapy Indonesia has contributed place-based assessment and the facilitated Healing Space Inside You (HSIY) protocol, which can be adapted to tropical conditions. This paper brings these resources together with the local mental health, demographic, fire, and service-access context to develop a practical roadmap. It has three objectives: to clarify what the available evidence does and does not support; to specify the minimum components of a

feasible system that local institutions could adopt; and to outline a phased learning agenda for planetary health.

2 Conceptual Framework

The proposed system combines implementation, restorative-environment, and planetary health perspectives (Kaplan & Kaplan, 1989; Proctor et al., 2011). Nature-based interventions may improve short-term psychological well-being, but the literature rarely isolates a single active ingredient or establishes equivalent outcomes across settings (Gritzka et al., 2020; Kaleta et al., 2025; Siah et al., 2023). The relevant unit for ASRI is therefore not the forest in isolation. It is the interaction among site conditions, facilitation, participant choice, cultural meaning, clinical responsibility, repeated practice, and ecological stewardship.

The Forest Healing Site Index (HFSI) identifies environmental opportunities and constraints. The HSIY protocol structures how people engage with those conditions. Referral pathways protect the boundary between health promotion and treatment. Environmental monitoring determines when an experience should be shortened, relocated, or postponed. Conservation reciprocity asks whether health-related use contributes fairly to protecting and restoring the place that makes the experience possible. This systems approach positions the proposal within planetary health, rather than as a wellness activity simply located in a forest.

Figure 1

Proposed planetary health operating logic for the ASRI forest healing system

1	2	3	4	5
Local needs and ecological exposure	Safe and equitable access	HSIY experience in the forest or Mini Forest	Practice, referral, and follow-up	Stewardship and system learning

Note. The links are conceptual, not causal claims. Each connection requires prospective feasibility and implementation evaluation.

3 Formative Evidence and Methods

3.1 Design and Data Sources

This is a formative development and implementation-planning paper. It synthesizes two ASRI –Forest Therapy Indonesia program documents, the underlying technical forest healing assessment, and a focused review of published evidence and public data relevant to youth mental health, wildfire smoke, eco-anxiety, service access, nature-based interventions, and

planetary health (Alam Sehat Lestari & Forest Therapy Indonesia, n.d.-a, n.d.-b). The internal documents describe three site assessments, an HSIY delivery cycle, routine staff evaluation, fire and smoke updates, and plans for the ASRI Mini Forest. Public sources were selected to provide local context without treating small studies or pandemic-era surveys as population surveillance. This synthesis is not a systematic review.

3.2 Setting and Site Assessment

The program is situated in ASRI's service area in West Kalimantan, with its Sukadana facilities as a potential local hub. Three candidate forest sites were assessed for facilitated use: Air Terjun Batu Hitam, Air Terjun Nibung Lestari, and Gua Maria Kederon-Manjau. The developmental HFSI allocates 100 points across five domains: biophysical conditions (35 points); sensory environment (30); therapeutic dimensions (20); accessibility, facilities, and safety (10); and local community conditions (5). The classification bands are operational planning thresholds, not a validated certification system. Future operating procedures should also be reviewed against SNI 9006:2021, Indonesia's standard for forest tourism for health therapy (Badan Standardisasi Nasional, 2021).

The index is calculated as $HFSI = \sum [(S_j / 5) \times w_j]$, where S_j is the mean rating for domain j and w_j is its point weight. The field materials describe observations and measurements of microclimate, sound, light, air quality, vegetation, terrain, route conditions, facilities, and community context. However, the available archive does not retain complete point-level measurement files, calibration logs, measurement durations, or quality-control records. The scores are therefore treated as decision-support information. Reassessment across seasons is recommended before the index is used for comparison or expansion.

3.3 HSIY Delivery and POMS Evaluation

The selected site was used for a seven-stage HSIY session organized around the source program's six-part sensory framework: sight, sound, smell, touch, sipping or tasting, and synchronized breathing. The session also included tree connection, loving-kindness, river grounding, mindful nourishment, conservation interpretation, journaling, and psychological anchoring.

Seventeen ASRI staff members attended the session. Six (35.3%) had complete paired Profile of Mood States (POMS) records immediately before and after the session, while 11

(64.7%) had incomplete records. These records were collected as part of routine program evaluation to inform further development; the activity was not designed as a clinical study.

The principal summary retains the values reported in the main formative program document: mean total mood disturbance (TMD) was 5.46 before the session and 1.43 afterward, a reported mean decrease of 4.03 points. The revised assessment document reports a corresponding baseline value of 5.47, a difference of 0.01. The source manuscript attributes this difference to rounding, but the underlying records and scoring rules are not available here for independent reconciliation. The value of 5.46 is retained for traceability to the main technical summary, with the discrepancy explicitly documented. The POMS version, language, item set, scoring rules, and use of summed versus averaged subscale scores are not documented. No normative or clinical cutoffs are applied.

4 Findings Informing System Design

4.1 Local Context Signals

Table 1

West Kalimantan context signals and implications for design

Context signal	Available evidence	Design implication
Youth population base	The 2026 BPS age-and-sex table reports 469,540 residents aged 15–19 and 471,423 aged 20–24: a combined 940,963 residents aged 15–24.	Use this as an equity-planning denominator, not an estimate of program demand. Monitor age group, gender, rural or urban residence, school or work status, disability, travel time, and affordability.
Local university mental health signal	A pandemic-era online survey of 663 university students in West Kalimantan included 72.1% younger than 20 and 63.0% female. Some 67.0% fell within a GAD-7 anxiety category, including 24.0% in the moderate or severe categories.	Treat the findings as a local signal. Repeat recruitment in a broader, contemporary youth population and document selection and nonresponse.
Multiethnic adolescent context	A single-school study of 202 adolescents in Sungai Kakap included six major ethnic groups. The psychological dimension was the lowest of the four dimensions assessed.	Use youth and community co-design, culturally safe facilitation, and local-language review. Do not infer between-ethnicity differences from one school.

Context signal	Available evidence	Design implication
Fire and smoke exposure	The provincial dataset is organized by district and year. An internal ASRI update reports that more than 100 hectares of reforestation area were affected. It states that the main Kederon route did not burn directly, but current smoke and route-safety conditions remain uncertain.	Use dated fire information, same-day PM2.5 or official air-quality information, heat, rain, and route checks to inform go/no-go decisions. Add a smoke-exposure and eco-anxiety module.
Mental health access	The provincial health profile documents primary care infrastructure in Ketapang and Kayong Utara. Youth-specific prevention, specialist access, travel burden, privacy, affordability, and referral continuity have not been mapped in the reviewed sources.	Establish a referral directory with named contacts, travel and cost mapping, escalation procedures, and follow-up arrangements before expansion.

Note. Sources: Badan Pusat Statistik Provinsi Kalimantan Barat (2026); Putri and Priyono (2021); Hendrik et al. (2025); Badan Penanggulangan Bencana Daerah Provinsi Kalimantan Barat (2024); Dinas Kesehatan Provinsi Kalimantan Barat (2024); and Alam Sehat Lestari and Forest Therapy Indonesia (n.d.-a, n.d.-b). The university and school studies are not representative prevalence surveys. Internal fire-area statements require dated incident records and site maps before external publication.

4.2 Site Suitability Findings

Table 2

Developmental HFSI results for three candidate sites

Candidate site	HFSI / 100	Operational class	Planning interpretation
Gua Maria Kederon-Manjau	74.6	Moderately suitable	Highest score; selected for initial HSIY delivery.
Air Terjun Nibung Lestari	65.5	Moderately suitable	Potential future site following priority improvements and reassessment.
Air Terjun Batu Hitam	46.2	Not yet suitable	Requires substantial intervention before therapeutic use.

Note. Source: Alam Sehat Lestari and Forest Therapy Indonesia (n.d.-a, n.d.-b). HFSI thresholds are developmental decision rules and have not undergone formal validity or reliability testing.

Kederon-Manjau scored 74.6 out of 100. Its main strengths were dense canopy cover, flowing water, birdsong, a short 456-meter route, spiritual significance, community fit, and proximity to settlements. Its weakest domain was the sensory environment, scoring 18 out of 30, partly because prominent concrete structures reduced the sense of naturalness. Accessibility and safety also require attention. Site-specific emergency procedures, rescue access, heat and rain precautions, sanitation, and route-condition checks need to be documented before routine delivery.

Table 3*HFSI domain profile for Kederon-Manjau*

HFSI domain	Observed score	Domain share	Implication
Biophysical conditions	30.6 / 35	87.4%	Strong canopy and ecological setting; repeat measurements across seasons.
Sensory environment	18.0 / 30	60.0%	Prioritize naturalness, soundscape, visual quality, and sensory access.
Therapeutic dimensions	14.3 / 20	71.5%	The short route and place meaning support structured sessions; route and zone specifications are still needed.
Accessibility, facilities, and safety	6.7 / 10	67.0%	Clarify sanitation, rest areas, emergency access, communication, and participant accommodations.
Local community conditions	5.0 / 5	100.0%	Maintain community permission, paid local roles, and transparent benefit sharing.
Total	74.6 / 100	74.6%	Moderately suitable for controlled development, not automatic expansion.

4.3 POMS Signals From Routine Evaluation

Table 4*Source-reported paired POMS summary from the initial HSIY activity*

Measure	Value	Interpretation
ASRI staff who attended	17	Total attendance in the program activity.
Complete paired POMS records	6 (35.3%)	Analysis set: 6 of the 17 staff members who attended.
Pre-session TMD	5.46	Source-reported mean for six complete pairs.
Post-session TMD	1.43	Source-reported mean for six complete pairs.
Mean decrease	4.03 points	Pre-session minus post-session; descriptive only.
Pairs with lower post-session TMD	6 of 6	Direction of change only.
Source-reported mean individual percentage decrease	71.7%	Five positive baselines; provisional and not a group response rate.

Note. Seventeen ASRI staff members attended; six provided complete paired POMS records (35.3%), and 11 had incomplete records (64.7%). The revised internal summary reports a baseline mean of 5.47 rather than 5.46. The POMS version, scoring rules, and follow-up are not documented. The six complete pairs cannot establish clinical effectiveness or population-level benefit.

The immediate post-session pattern is encouraging as a descriptive program signal: all six complete pairs changed in the same direction. It is not an effectiveness result. Low

completeness creates substantial risks of selection and nonresponse bias, and the activity had no comparator, randomization, blinding, or longer-term follow-up. Changes could reflect the forest setting, HSIY activities, physical activity, social contact, expectations, time away from work, regression to the mean, or other factors. These findings are appropriately used to improve documentation and inform prospective evaluation, not to market the program as a proven treatment.

Table 5

Exploratory aggregate POMS dimensions reported in the revised internal assessment

POMS dimension	Before	After	Source-reported change
Tension–anxiety	1.55	0.88	43.2% decrease
Anger–hostility	1.43	0.80	44.1% decrease
Fatigue–inertia	1.87	0.73	61.0% decrease
Depression–dejection	1.42	0.47	66.9% decrease
Confusion–bewilderment	1.40	0.90	35.7% decrease
Vigor–activity	2.18	2.35	7.8% increase

Note. Participant-level subscale data are unavailable, and the scoring basis is not documented. These values are retained for traceability and hypothesis generation; they are not used for inferential analyses. The reported TMD summaries cannot be independently reconciled from these aggregates without the original scoring records.

5 Proposed System for Feasibility and Adoption

5.1 Scope and Intended Users

The initial priority population would be adolescents and young adults approximately 15–24 years of age who may benefit from mental health promotion, stress regulation, social connection, and supported contact with nature. The system could also remain open to ASRI staff, community members, and clinic-linked participants when the pathway is appropriate.

The intention is not to create a forest-based service for acute psychiatric crises. Anyone with immediate safety concerns, severe functional impairment, or a need for diagnosis and treatment should be directed to qualified clinical or emergency support. Facilitators may welcome, orient, observe, and refer; they must not diagnose or promise that a session will resolve a mental disorder.

5.2 Minimum Operating Components

Adoption depends on compatibility with ASRI's existing relationships and working routines. Feasibility depends on a small set of nonnegotiable safeguards and a delivery model that can operate with modest infrastructure. The proposed components are summarized in Table 6.

Table 6

Minimum components of the proposed ASRI forest healing system

System function	Proposed operating design	Minimum readiness standard
Equitable access and outreach	Recruit through ASRI's clinical and community relationships, schools, youth groups, and staff networks. Provide clear, nonstigmatizing information about the program, including travel, time, cost, and physical demands.	A simple intake pathway, a fee-waiver or subsidy policy, transport information, and an equity-monitoring plan.
Screening and stepped support	Use a brief well-being and safety check before participation. Explain that facilitators do not diagnose. Define clear pathways for urgent risk, clinical referral, and routine follow-up.	Named referral contacts, response-time expectations, consent for referral, safeguards for participants younger than 18, and crisis procedures.
Facilitated HSIY experience	Deliver the seven-stage framework with opt-outs, culturally respectful language, accessible alternatives, and permission to rest or observe. Record permitted adaptations without treating them as protocol failures.	Competency-based facilitator preparation, a session checklist, stage timing, supervision, and an adaptation log.
Environmental safety decisions	Before each session, review official fire or smoke information, same-day PM2.5 or air-quality information where available, heat and humidity, rainfall, water levels, trail conditions, insects, communications, and evacuation access.	A designated decision-maker, written go/no-go criteria, route checks, a communication plan, and records of relocation or postponement decisions.
Two-site delivery model	Use Kederon-Manjau for controlled, facilitated immersion and the proposed approximately 0.7-hectare ASRI Mini Forest for nearby brief practice. Treat the Mini Forest as complementary, not equivalent, until evaluated.	Site-specific operating plans, maintenance responsibilities, accessibility review, and ecological safeguards before construction or routine referral.
Continuity through low-data or offline practice	Offer optional 5–15-minute post-session practices through printed sheets, audio, SMS, or WhatsApp with consent. Invite reflection on coping, agency, and stewardship without requiring disclosure of personal mental health information.	Privacy-conscious contact procedures, opt-out arrangements, follow-up at defined intervals, and a mechanism to identify worsening distress.

System function	Proposed operating design	Minimum readiness standard
Clinical and community referral	Connect participants with ASRI clinical services, Puskesmas (community health centers), trained counselors, psychologists, psychiatrists, or locally available emergency services. Map travel time, cost, privacy, language, and family or peer support.	A verified directory, supported referral handoffs, referral tracking without unnecessary identifiers, and regular service-map updates.
Conservation reciprocity	Link program use with restoration, habitat protection, trail maintenance, and paid local contributions. Make reinvestment transparent and measure conservation outcomes directly.	Written agreements with site managers and communities, a conservation budget line, local benefit sharing, and ecological indicators.
Data governance and learning	Separate routine service data from research data. Collect only what is needed, protect small-cell confidentiality, and report completeness, missingness, incidents, adaptations, and costs transparently.	A data steward, consent language, retention rules, an ethics determination for research, and quarterly learning reviews.

5.3 Two Complementary Sites

Kederon-Manjau would serve as the initial site for full sessions. Its 456-meter route, water, canopy, spiritual significance, and community fit provide a reasonable setting for carefully facilitated HSIY experiences. A provisional limit of 15 participants per group could help preserve quiet and reduce disturbance, but this is an operating assumption, not a measured ecological carrying capacity. Group size should be reduced whenever safety, accessibility, facilitator coverage, or wildlife sensitivity requires it.

The proposed ASRI Mini Forest and organic garden near the Sukadana facilities would serve a different function. Internal plans describe approximately 0.7 hectares, with a possible future 0.5-hectare extension toward the national park landscape. These remain plans, not completed infrastructure or confirmed ecological connectivity. If developed, the Mini Forest could provide brief restorative breaks, introductory sensory exercises, clinic-linked green prescriptions, and lower-travel options for people unable to attend a full forest session. It should not be presented as equivalent to Kederon-Manjau until reach, acceptability, safety, repeated use, and well-being outcomes have been evaluated.

5.4 HSIY Session Architecture

Table 7

Proposed seven-stage HSIY delivery architecture for ASRI's tropical setting

Stage	Session title	Indicative time	Core activities	Intended function
Open	Membuka Ruang Hening (Opening a Quiet Space)	08:30–09:00	Welcome, grounding, heart-focused breathing, intention setting, and safety orientation.	Transition, choice, and present-moment awareness.
Grow	Jalan Bertumbuh (A Path of Growth)	09:00–10:00	Conservation walk, mindful movement, biodiversity interpretation, and soft fascination.	Nature connection and ecological literacy.
Unite	6S	10:00–11:00	Sight, sound, smell, touch, sipping or tasting, and synchronized breathing.	Multisensory and embodied attention.
Connect	Tree Connection	11:00–12:00	Tree reflection, imagery, somatic awareness, and loving-kindness.	Connection, self-compassion, and regulation.
Grow Healthy	Mindful Nourishment	12:00–13:00	Mindful eating, herbal tea, Liberica coffee, and local plant knowledge.	Interoception, gratitude, nourishment, and place connection.
Release	River Grounding	13:00–14:00	Water-based grounding, body awareness, imagery, and symbolic release.	Somatic regulation, cooling, acceptance, and restoration.
Integrate	Reflection and Anchoring	14:00–15:30	Journaling, dialogue, gratitude, psychological anchoring, and closure.	Meaning, learning transfer, and plans for continued practice.

Note. The indicative timetable and stage labels are retained from the ASRI source manuscript. Timing requires adaptation to heat, rain, accessibility, participant needs, and safe daylight conditions. All adaptations should be documented and approved through the operating procedures. This timetable is not a record of verified active intervention minutes.

5.5 Dynamic Fire and Weather Safety

Fire-season preparedness should be a routine operating function, not an emergency afterthought. Decisions to proceed should combine dated local fire or smoke information, same-day air-quality information, route inspection, heat and humidity, rainfall and water levels, and the group's health profile. The program needs to specify who checks conditions, when checks occur, what makes a session unsafe, and who can postpone it. Numerical PM2.5 and heat thresholds must be set using appropriate public health and occupational safety advice; they should not be invented from the existing assessment. Relocation is protective only when the alternative site is demonstrably cleaner and safer. A nearby Mini

Forest may experience the same regional smoke. Public health guidance on heat and wildfire smoke should inform these procedures (WHO, 2026a, 2026b).

Participants should receive a plain-language explanation that a forest can feel restorative while still containing harmful smoke. The program must not claim that forest air is pure oxygen, that phytoncides neutralize smoke exposure, or that a pleasant experience prevents respiratory or mental health effects. This honest framing is important for trust and is consistent with evidence that wildfire smoke and fire-related distress involve several interacting pathways rather than a single, simple exposure (Eisenman & Galway, 2022; Hein et al., 2022; WHO, 2026b).

6 Phased Implementation Roadmap

The most feasible sequence is to establish a functioning service before making major infrastructure commitments. Each phase should end with a decision gate: a point at which ASRI and its partners decide whether the evidence supports proceeding, adapting, pausing, or stopping. These gates are part of responsible development, not simply administrative delays.

Table 8

Proposed three-year implementation roadmap

Phase	Timing	Core work	Decision gate
Phase 0 Preparation	Months 0–3	Reassess the three sites across seasons; verify fire-area maps and local smoke sources; finalize the HFSI manual; identify referral partners; establish safety go/no-go rules; train facilitators; agree on data governance; and co-design with young people and communities.	Signed roles and agreements, a verified referral directory, a trained team, route and rescue procedures, consent materials, and a baseline monitoring plan.
Phase 1 Pilot and learn	Months 4–12	Deliver small, controlled HSIY cohorts at Kederon-Manjau, with brief Mini Forest practice only if the site is ready. Use a provisional maximum of 15 participants per group. Record reach, missing data, acceptability, adverse events, fidelity, adaptations, costs, and short-term well-being.	Proceed only when delivery meets safety requirements, participants understand choice and referral, data completeness improves, and no serious incident remains unresolved.

Phase	Timing	Core work	Decision gate
Phase 2 Integration	Months 13–24	Integrate suitable sessions into staff well-being, youth outreach, and clinic-linked prevention. Add low-data follow-up and transparent conservation reinvestment. Repeat HFSI and ecological checks across seasons.	An independent feasibility review indicates reasonable reach, acceptable burden, functioning referrals, affordability, local benefit, and no unacceptable ecological pressure.
Phase 3 Evaluation and expansion	Months 25–36	Conduct prospective comparative or phased implementation evaluation across sites. Evaluate HFSI reliability, standardize POMS or replace it with a documented measure, assess eco-anxiety and smoke exposure, and analyze costs and conservation outcomes.	Expand only with appropriate ethics approval, adequate data quality, an affordability plan, verified partner capacity, and ecological safeguards.

6.1 Measurement and Learning Framework

Implementation outcomes should take priority during the first year (Proctor et al., 2011). Mood change can be tracked, but it should not carry the entire burden of demonstrating that the system works. The program needs to understand who can access it, who chooses to return, what it costs, when delivery is safe, whether referrals function, and whether use is compatible with forest conditions.

Table 9

Recommended monitoring framework

Domain	Indicators	Frequency	Use of findings
Reach and equity	Invited, enrolled, attended, completed, and returned; age group, gender, rural or urban residence, school or work status, disability, travel time, and affordability.	Each cycle; quarterly review.	Identify who is not being reached and adjust outreach, transport, timing, or subsidies.
Acceptability and choice	Comfort, perceived relevance, cultural fit, ability to decline, satisfaction, and reasons for withdrawal.	Each cycle.	Adapt language, activities, group size, or access arrangements.
Safety and environment	PM2.5 or official air-quality indicator, smoke, heat and humidity, rainfall, water levels, trail conditions, incidents, and near misses.	Before and during each session; seasonal review.	Decide whether to proceed, shorten, relocate, or postpone; update operating procedures.

Domain	Indicators	Frequency	Use of findings
Fidelity and adaptation	HSIY stages delivered, dose, facilitator competency, permitted adaptations, and participant engagement.	Each session; monthly supervision.	Strengthen training or formally revise the protocol.
Well-being outcomes	A documented POMS version or alternative measure; well-being, perceived stress, nature connection, and self-compassion; immediate and follow-up change.	Baseline, immediately after the session, and at 2–4 weeks where appropriate.	Interpret as state or well-being change, not as a clinical diagnosis.
Smoke and eco-anxiety	Recent smoke exposure, perceived ecological threat, worry, sadness, agency, coping, social support, and functional impact.	Baseline and seasonal follow-up; after major smoke events.	Offer psychoeducation, community action, or referral; avoid pathologizing concern.
Referral functioning	Positive screening results, referrals offered, supported handoffs, time to contact, and referral completion with consent.	Monthly and quarterly.	Improve care pathways and identify service gaps.
Conservation and cost	Trail damage, wildlife disturbance, habitat condition, restoration activity, paid local roles, participant costs, operating costs, and conservation reinvestment.	Each cycle; quarterly and annual review.	Adjust capacity limits, pricing, reinvestment, and infrastructure.

Demographic information about young people should be collected only when needed for equity analysis and with appropriate privacy protections. Small cells should be suppressed or combined. Ethnicity and cultural identity should be self-described, never inferred by the evaluation team, and collected only when there is a clear, co-designed purpose for using that information. The program should not disclose that a young person is considered “high risk” to facilitators, community members, employers, or family members without appropriate consent or a safeguarding basis for disclosure.

7 Ethical Governance and Sustainability

A credible ASRI system needs clearly assigned responsibility for participant care, site and environmental safety, community and cultural relationships, and data stewardship. ASRI could coordinate health and program pathways; Forest Therapy Indonesia could define facilitator competencies and provide protocol support. Site managers and local communities should have meaningful roles in access, interpretation, safety, and benefit sharing. Clinical

partners should determine what happens when a participant needs more than a facilitated nature experience. These roles need to be established in agreements, rather than assumed on the basis of goodwill.

Youth participation requires additional safeguards. Participants younger than 18 years need age-appropriate assent and consent arrangements, child protection procedures, and a private route to seek help. No one should be required to touch a tree, enter water, share a personal story, use spiritual language, consume local foods or drinks, or continue a session after becoming uncomfortable. Sensory and place-based activities should be offered as invitations, not obligations. The cultural or religious meaning of Kederon-Manjau should be approached with permission and humility, not converted into a universal therapeutic claim.

Conservation-financing proposals should be transparent enough for communities and partners to audit. Future participant fees or institutional payments could support restoration and local roles, but positive participant feedback is not evidence of conservation impact or financial self-sufficiency. The program should report operating costs, participant subsidies, payments to local contributors, the proportion reinvested, and ecological outcomes. Major structures should be avoided unless they solve a documented access or safety problem. Minimal, reversible infrastructure is more consistent with naturalness and stewardship.

Publication readiness should be treated as part of implementation quality. Before journal submission, ASRI and Forest Therapy Indonesia need to confirm an institutional or ethics determination, permissions for secondary data use, funding and conflict-of-interest statements, individual authorship and contributions, and whether anonymized data can be shared without enabling indirect identification (International Committee of Medical Journal Editors, n.d.). The paper must not imply that the internal evaluation received research approval that was never granted, or that the full intervention system has been implemented while agreements, expansion, or monitoring arrangements remain under development.

8 Future Evaluation Agenda

The next evaluation should be prospective and keep its initial claims bounded. The intervention description, recruitment process, eligibility criteria, assessment timing, missing-data rules, primary implementation outcomes, and safety procedures should be prespecified, or at least finalized before the study begins. The POMS version and scoring rules should be

fixed before data collection, with a documented Indonesian-language version and permission for use. If POMS is unsuitable for routine delivery, ASRI should select a validated, feasible measure of short-term well-being while keeping clinical referral screening separate.

A useful design could compare different doses or settings rather than ask a small uncontrolled group to establish effectiveness. For example, future cohorts could compare full HSIY sessions at Kederon-Manjau, brief practices in the Mini Forest, and routine staff or youth support, using the same implementation outcomes. Such a design should record travel, time away from work or school, physical activity, social contact, facilitator contact, smoke conditions, and participant expectations. This would help distinguish the contribution of place from those of attention, movement, group contact, and structured rest.

The eco-anxiety component should begin with listening. Brief quantitative measures could be paired with open-ended questions about smoke, fire, loss, responsibility, and agency, then translated and piloted for local language and meaning. International studies indicate that climate concern is common among young people and that wildfire exposure, rural context, food insecurity, and social marginalization can shape these experiences. These findings are not prevalence estimates for West Kalimantan (Hickman et al., 2021; Wang et al., 2026). The local task is to understand which concerns arise, what support is wanted, and how conservation participation can strengthen agency without making young people solely responsible for ecological recovery.

Finally, the living laboratory concept needs an operating structure. It would connect repeated site assessment, participant feedback, facilitator supervision, referral learning, and ecological monitoring within a single review cycle. Its practical purpose would be to make the system safer, more inclusive, more measurable, and more protective of the forest from one season to the next. A living laboratory should function as learning infrastructure, not merely as a branding claim.

9 Limitations

This paper is a formative synthesis, not a systematic review, trial report, or population mental health survey. Local youth evidence is limited by pandemic timing, online recruitment, single-school sampling, and incomplete geographic coverage. BPS age-specific population counts are planning denominators, not measures of mental health need or program demand. The

provincial health profile describes service infrastructure but does not establish capacity, quality, availability, or youth-specific access in ASRI’s service area.

The HFSI remains developmental and has been applied to only three sites within one service landscape. The available field records do not contain enough detail to reproduce every score independently. The assessments are historical snapshots, and smoke, heat, rainfall, route conditions, and land use can change. Internal fire-area estimates, the proposed Mini Forest and possible extension, governance agreements, and conservation-financing arrangements require dated verification.

The POMS findings come from six complete pairs among 17 ASRI staff members who attended the activity; 11 staff members had incomplete records. There was no comparator, randomization, follow-up, or documented instrument version. Baseline TMD values also differ slightly across source summaries, and subscale values are aggregate summaries without participant-level data. These limitations define the work required before stronger claims can be made.

10 Conclusion

ASRI and Forest Therapy Indonesia have a locally grounded foundation for a forest healing system: three site assessments, a selected Kederon-Manjau route, a place-based HSIY protocol, clinical and conservation relationships, and an initial mood signal from routine evaluation. The next step is not to claim demonstrated clinical benefit. It is to build a system that is safe, understandable, accessible, culturally respectful, measurable, and protective of the forest on which it depends. A two-site model—facilitated forest immersion at Kederon-Manjau and accessible brief practice near ASRI’s facilities—could reduce travel barriers while preserving the distinctive value of the larger forest experience. With dynamic smoke and heat safeguards, functioning referral pathways, youth co-design, transparent community benefit sharing, and prospective evaluation, ASRI can test whether forest healing can make a credible contribution to planetary health in West Kalimantan.

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