



FOCUS-Asia
INTERNATIONAL RESEARCH MEETING
OF FOREST CULTURE SCIENCE IN ASIA



**UNIVERSITAS
GADJAH MADA**

The 3rd International Research Meeting of Forest Culture Science in Asia (FOCUS-Asia)

April 18 - 24, 2026 Yogyakarta, Indonesia

PROCEEDING

FOREST DIVERSITY

&

LOCAL CULTURE

Organizer:

Faculty of Forestry, Universitas Gadjah Mada, Indonesia,
FOCUS-Asia Committee

Co-organizers:

Chinese Forest Ecosystem Research Network (CFERN), CHINA
International Research Center of Tropical Rainforest Forest Health,
Hainan University, CHINA
Department of Landscape Architecture, School of Tropical Agriculture
and Forestry, Hainan University, CHINA
The University of Tokyo Forests, Graduate School of Agricultural and
Life Sciences, The University of Tokyo, JAPAN

Contact Info: focue-asia2026@googlegroups.com



Aims of the event

“Forest culture” is a broad concept that encompasses the outcomes of people’s long-standing engagement with the diverse resources and environments that forests provide to human societies. It includes multiple dimensions of human life—such as food, clothing, shelter, science, technology, education, art, ethics, religion, and governance. As culture evolves in close relationship with its surrounding natural environment, distinct forest cultures emerge in different regions, each reflecting unique ecological and social characteristics.

As a step toward advancing forest culture research in the Asian region, this meeting seeks to bring together researchers and practitioners engaged in the study of forest–human relationships, to build collaborative networks and deepen cross-disciplinary discussions.

The theme of the International Research Meeting of Forest Culture Science in Asia (FOCUS-Asia 2026) is “Forest Diversity and Local Culture.”

This year’s symposium highlights the vital interconnections between biological diversity and cultural practices rooted in forest ecosystems.

The event features three thematic sessions:

Track 1: Forest Diversity – addressing the ecological variety, resilience, and conservation of forests;

Track 2: Community Roots of Forest – exploring the cultural, social, and historical relationships between local communities and forest landscapes;

Track 3: Health and Tradition from Forest – examining how forest resources support human health, spirituality, and well-being.

Together, these tracks aim to enhance our collective understanding of how forest diversity sustains cultural heritage and strengthens the future of human societies across Asia.



FOCUS-Asia

INTERNATIONAL RESEARCH MEETING
OF FOREST CULTURE SCIENCE IN ASIA



The 3rd International Research Meeting of Forest Culture Science in Asia (FOCUS-Asia)

“Forest Diversity and Local Culture”

18th–24th April 2026
in Yogyakarta, Indonesia



DETAILED SCHEDULE

April 18th 2026, Saturday

Time	Session	Speaker	Affiliation	Topic	Host
06:00—10:00	Arrival and registration				
10:00—14:00	Registration				
12:00—14:00	Lunch break at Lombok Idjo Restourant				
14:00—16:00	Return to UC Hotel (Free time)				
16:00—17:00	Gather and depart to Prambanan Temple				
17:00—19:00	Dinner at Resto near Prambanan Temple				
19:30—20:30	Watching Ramayana Ballet Performance				
20.30	Retreating to UC Hotel (Free time)				

April 19th 2026, Sunday

Time	Session	Speaker	Affiliation	Topic	Host
06:00—07:00	Breakfast (for those who stayed in the UC Hotel)				
07:00—08:30	Registration (continued)				
08:30—08:35	Opening address	Dean of the Faculty of Forestry, Universitas Gadjah Mada, Indonesia			
08:35—08:40		Office of International Affairs, Universitas Gadjah Mada, Indonesia			
08:40—08:45		Chair Committee, FOCUS-Asia 2026, The University of Tokyo, Japan			
08:45—08:50		Representative of the Chinese Delegates, Chief Expert of the China Forest Ecosystem Research Network (CFERN)			
08:50—08:55		Local Host of FOCUS-Asia 2026, Universitas Gadjah Mada, Indonesia			
09:00—09:30	Group photo and refreshments				



09:30—09:50	Keynote speech	Prof. Satyawan PUDYATMOKO	Directorate of Natural Resources and Ecosystem Conservation, Ministry of Forestry of the Republic of Indonesia, Indonesia Conservation Strategies to Secure Viable Population of Elephant in Sumatra	Huaiyue LIANG
09:51—10:10		Prof. Shigemitsu SHIBASAKI	Graduate School of Agriculture and Life Sciences, The University of Tokyo, Japan Conservation of Forestry Heritage in Japan	
10:11—10:30		Dr. William (Bill) Virgil BLEISCH	China Exploration and Research Society (CERS) Explorers, Hong Kong, China Can forest tourism and indigenous forest culture be integrated to support protection of threatened wildlife?	
10:31—10:50		Dr. Wawan SUJARWO	National Research and Innovation Agency (Badan Riset dan Inovasi Nasional), Indonesia Forest Culture in Bali: Harmonizing Spirituality, Tradition, and Conservation through Tri Hita Karana	
10:51—11:10		Prof. Mui-How PHUA	Faculty of Tropical Forestry, University Malaysia Sabah, Malaysia Rebalancing Forest Recreation in the Crocker Range Biosphere Reserve: Advancing Community-Based Ecotourism through Participatory GIS	
11:10—12:00	General discussion			
12:00—13:00	Lunch break			
Oral Presentation Venue: TBA				
13:00—13:50	10 minutes per presentation			Moderator
	Ni Putu Diana MAHAYANI*, Erny POEDJIRAHAJOE, Frita KUSUMAWARDANI, Ryan Adi SATRIA, Reza PAHLEVI Functional Trait-Based Assessment of Ecosystem Service Outcomes for Forest Rehabilitation			Rhomie ARDIANSYAH
	Hui FU, Guang FU, Xuena WAN The Mountain-Sea Synergy Model: University–Rural Collaboration for Forest Rural Revitalization in China			
	Syifa NABILA, Eny FARIDAH* & Daryono PREHATEN The Effect of Nutrient Availability and Water Deficit on <i>Acacia decurrens</i> (J. C. Wendl) Willd. Seedling Growth			
	Adita Fauzan F. WARDANA, Sri RAHAYU*, & Handojo Hadi NURJANTO Diversity and Role of Macrofungi in Cemoro Sewu Track of Lawu Mountain, Magetan, East Java, Indonesia			
Ratih Madya Septiana*, Nunuk Supriyatno, Dwiko Budi Permadi, Intan Pratiwi, Khoirunisa Rahmatika Wanagama Healing Forest Hazard Risk Assessment: Balancing Traditional Healing Practices and Public Health Safety				



13.50—14:40	Nesty Pratiwi ROMADINI*, Sapto INDRIOKO, Eny FARIDAH & Widiyatno Light and Nutrient Availability Drive Chlorophyll and Leaf Nutrient Traits in <i>Dipterocarpus gracilis</i> Blume Seedlings	Hairi CIPTA
	Amelia Amru NAJAH & Emma SORAYA* Dynamics of Mangrove Forest on Protected Areas of Ujungpangkah, Gresik, Indonesia: 10 Years of Evidence from Remote Sensing	
	Hendry RINDUAN, Hero MARHAENTO*, Ambar KUSUMANDARI, Hatma SURYATMOJO & Muhammad Chrisna SATRIAGASA Uncertainty analysis of satellite rainfall input data in hydrological model using Generalized Likelihood Uncertainty Estimation (GLUE) method	
	Ziyadatil INAYAH & Tomy LISTYANTO* Protection of Mahogany Wood (<i>Swietenia macrophylla</i>) from Dry Wood Termite (<i>Cryptotermes cynocephalus</i>) Using Permethrin Dipping Treatment	
	Gathan Bhadra ADIYATMA & Ris Hadi PURWANTO Tree Species Diversity and Carbon Storage Potential across Urban Green Open Spaces in Yogyakarta, Indonesia	
14:40—15:00	Coffee Break	
15:00—16:00	Rhomi ARDIANSYAH*, Kaharuddin KAHARUDDIN*, Retno Nur UTAMI, Stevie NISSAUQODRY, Viola CANTIKA, Fadli Yusuf ROHADI The Development Level of Nature Tourism Destinations in the Special Region of Yogyakarta	Fiqri ARDIANSYAH
	Huaiyue LIANG, Huengyi ZHUO, Fengjiao TAO From barren tunes to coastal forest, green transformation in the past 30 years in Changjiang, Hainan island, China	
	HERMUDANANTO*, Ratih Madya SEPTIANA, Nunuk SUPRIYATNO, Febriyanto Ismu NUGROHO Community-Based Environmental Education Parks for Conserving Forest Diversity and Local Ecological Knowledge in Central Java, Indonesia	
	Agus AFFIANTO, San Afri AWANG, Dwi LARASWATI*, Slamet RIYANTO, Wahyu Tri WIDAYANTI, Tri ATMOJO, & Muhammad Abdul Rahman SUBRATA Toward a decade of the implementation of the social forestry program in Indonesia	
	Johanes Pramana Gentur SUTAPA Culture and Biomass Energy development	
	Hatma SURYATMOJO* & Kristin Banyu Risang HOB0 Traditional Knowledge and Community-Led Watershed Conservation in Coffee-based Agroforestry Systems in the Upstream Area of the Merawu Watershed	
16.00—17:00	Online meeting for Committee Members	
15:45—17:00	Campus Tour walking	
17:00—18:30	Poster presentation preparation	
18:00—20:00	Dinner at UC Hotel Garden Resto	



April 20th 2026, Monday

Time	Session	Speaker	Affiliation & Topic	Host
06:00—07:00	Breakfast			
08:00—08:20	Keynote speech	Prof. Bing WANG	Chinese Academy of Forestry (CAF), Beijing, China Chinese Forest Ecosystem Research Network: Construction, Contributions, and Applications	Huaiyue LIANG
08:21—08:40		Prof. Ho Sang KANG	Institutes of Green Bio Science and Technology (GBST), Seoul National University, South Korea From Reforestation to Forest Welfare: Korea's Integrated Policy Model for Public Health, Social Inclusion, and Regional Revitalization	
08:41—09:00		Prof. Upul SUBASINGHE	Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka Thirty Years in the Canopy: Bridging the Divide between Forest Science and Cultural Wisdom	
09:00—09:30	Tea break			
09:31—09:50	Keynote speech	Dr. Chiang WEI	National Taiwan University Experimental Forest (NTUEF), Taiwan, China Cross-Sector Forest Guardianship: A Culture-Centered Framework for Sustainable Management Integrating Corporate Social Responsibility, University Social Responsibility, and Smart Forestry	Yoko SHIBATA
09:51—10:10		Prof. Hui ZHANG	School of Ecology, Hainan University, China How to solve the living challenge during performing forest healing	
10:10—11:00	General Discussion			
11:00—12:00	Poster Presentation & Competition			
12:00—13:00	Lunch break			
Oral Presentaion Venue: TBA				
13:00—13:50	10 minutes per presentation			Moderator
	Woro LARAS, Muhammad Ali IMRON & Sena Adi SUBRATA Belambangan Biosphere Reserve supports wildlife corridors: evidence from population genetics of Rusa deer (<i>Cervus timorensis</i>) in Java, Indonesia			Fiqri ARDIANSYAH
	Jingjing WANG Xiaoyan LIN Bingsun WU Zixun CHEN Yongyi LIANG Effects of Geographical and Climatic Factors on the Intrinsic Water Use Efficiency of Tropical Plants: Evidence from Leaf 13C			



	<p>Gunawan NUGRAHANTO, Mohammad NA'IEEM, Sapto INDRIOKO*, Eny FARIDAH, WIDIYATNO, SURYANAJI, Padang JAYANTO, & Pujo SUMANTORO</p> <p>Genetic variation of <i>Pinus merkusii</i> based on microsatellite markers to support the breeding of high-resin-yield</p>	
	<p>MUSYAFA</p> <p>The Role of Soil Macrofauna in the Decomposition Process of Mahogany Litter in the Wanagama Educational Forest, Yogyakarta, Indonesia</p>	
	<p>Rizky Arif CAHYONO, Ananto TRIYOGO*, WIDIYATNO</p> <p>Identification of Stem Borer Pests and Damage Description in Clove Plants (<i>Syzygium aromaticum</i> L.)</p>	
13.50—14:40	<p>Subeno SUBENO, Anggoro Wibisono, & Atus SYAHBUDIN</p> <p>Wildlife Diversity in the Fragmented Forest Area on the North Slope of Mount Lawu, Ngawi Regency, East Java Province, Indonesia</p>	Hairi CIPTA
	<p>Fiqri ARDIANSYAH*, Sri RAHAYU, Muhammad Ali IMRON, Mark Edward HARISSON, Frank Van VEEN, SOEMARDI, Lailan SYAUFINA, and Guangyu WANG</p> <p>Fire Regime and Post-Fire Plant Community Dynamics in Tropical Peat Ecosystems of Central Kalimantan, Indonesia</p>	
	<p>Daryono PREHATEN*, Suryo HARDIWINOTO, Harry SULISTYO, JOHANSYAH, Handojo H NURJANTO, Arom FIGYANTIKA, Nesty P ROMADINI, & Eny FARIDAH</p> <p>Carbon Sequestration of Sequential Rehabilitation Planting in the Methanol Park Arboretum, Bontang, East Kalimantan</p>	
	<p>Ganis LUKMANDARU*, Awanda Sifa MAHARANI, Ela Putri SUHANTA, Widyanto Dwi NUGROHO, WIDIYATNO, Yogi FERIAWAN, Fanany Wuri PRASTIWI, Aris WIBOWO, & Diana PUSPITASARI</p> <p>Effect of Thinning on the Chemical Properties of Clonal Teak Trees</p>	
	<p>Muhamad Thoriq Akbar YUSUF, Wahyu WARDHANA*, Dwi Tyaningsih ADRIYANTI, SENAWI, Atus SYAHBUDIN</p> <p>Terrestrial Laser Scanning for Three-Dimensional Tree Architecture: Application in Jati Mega (<i>Tectona grandis</i> L.f.)</p>	
14:40—15:00	Coffee Break	
15:00—15:50	<p>Ambar KUSUMANDARI*, Hatma SURYATMOJO, Ghalbi Mahendra PUTRA, & Nurika Arum SARI</p> <p>Land Suitability and Capability Analysis for Evaluating the Land Use in Achieving Sustainable Land Management in Banyumanik, Gunungkidul</p>	Rhomie ARDIANSYAH
	<p>Qingqing YANG</p> <p>Climate and Vegetation Factors Determine the Probability of Tropical Forest Fires in Hainan Island During the Dry Season</p>	
	<p>RAWANA, Agus PRIJONO, Adi WIJAYANTO, Nanda Satya NUGRAHA, Hastanto Bowo WOESONO, Didik Surya HADI, Karti RAHAYU</p> <p>Analysis of Bird Species Diversity at Selo Resort, Mount Merbabu National Park</p>	



	Dwiko Budi PERMADI*, Muhammad Danang ANGGORO, and Fais RAHMAN Risk Framing and Institutional Legitimacy: Cultural Lenses to Understand Oil Palm Governance in Tesso Nilo National Park, Indonesia
	Taufik Tri Hermawan*, Muhammad Danang Anggoro, Kristiani Wajar Wianti, & Daris Fahmaa Sutata Stakeholder Mapping on Indonesian Community Based Protected Area, Baros Mangrove Ecosystem Essential Area Case Study
15:50—16:10	Tea break
16:10—16:40	Closing ceremony • Conference resume • Poster competition award
16:40—18:00	Free time
18:00—18:30	Gather and depart to the Faculty of Forestry, Universitas Gadjah Mada, Yogyakarta, Indonesia
18:30—20:00	Gala dinner at UC Hotel, Universitas Gadjah Mada, Yogyakarta, Indonesia
20:00	Return to UC Hotel
	Free time

April 21st 2026, Tuesday

Time	Session	Host
06:00—07:00	Breakfast	
07:00—08:30	Gather and depart to Wanagama Eco Edu Forest	
08:30—09:30	Visiting Wanagama Museum and refreshments	
09:30—12:00	Field excursion to Sendang Ayu Spring	
12:00—13:00	Field excursion to Jati Mega, superior clonal teak plantation, at Wanagama Compartment 13	
13:00—14:30	Lunch break	
14:30—16:00	Trip to Malioboro Street	
16:00—18:00	Shopping and sightseeing at Teras Malioboro	
18:00—19:00	Dinner at Angkringan	
19:00	Return to UC Hotel (Free time)	

April 22nd 2026, Wednesday

Time	Session	Host
06:00—07:00	Breakfast	
07:00—08:00	Trip to Mount Merapi National Park	
08:00—11:00	Visiting Kalikuning Park, Mount Merapi National Park	
11:00—12:00	Trip to Borobudur Temple	
12:00—13:30	Lunch break at Sekar Kedaton Restaurant	
13:30—14:30	Sightseeing at Borobudur Temple	
14:30—16:30	VW Tour, visiting “pati aren” making, mask painting, and visiting the making of traditional rice crispy snack “rengginang.”	
16:30—18:00	Trip to the dinner venue	
18:00—19.30	Dinner at Mushroom Restaurant	
19:30	Return to UC Hotel (Free time)	



April 23rd 2026, Thursday

Time	Session	Host
06:00—08:00	Breakfast	
06:00—10:00	Checking out from the UC Hotel, preparation for departure to the	
10:00—11:30	Trip to Wanadelima fruit Garden	
11:30—12:30	Tour at Wanadelima Garden	
12:30—13:00	Trip to PT Naturindo	
13:00—16:30	Tour to PT. Naturindo Fresh Kulon Progo <ul style="list-style-type: none"> • Lunch • Herbal garden visit • Lunch at Tajana • Practicing making “jamu” • Traditional massage (separate individual payment) 	
16:30—17:15	Trip to Resto Ingkar Janji	
17.15—19:00	Sunset View, Dinner at Ingkar Janji Resto, and Farewell Party	
19.00—20:00	Retreating to Swiss-belhotel Preparation for check out and departure the next morning	

April 24th 2026, Friday

06:00—07:30 Breakfast and Departure to the home country. All participants will transfer to the Airport by hotel shuttle

Note for excursion

- It is recommended to wear long sleeves and long pants to protect against insects (mosquitoes, etc.), especially in forest areas. If you plan to walk on the forest floor, please wear leech socks or long, thick socks. For paved areas, comfortable walking shoes or sneakers are sufficient.
- The weather is generally hot and humid, so wear light, breathable clothing. Sudden tropical rain (short heavy showers) is common. Please bring a raincoat or an umbrella if possible.
- The sun can be very strong. Please use sunscreen, a hat, and sunglasses, and drink water frequently.



Keynote Speech

April 19th 2026, Sunday

Keynote1	Satyawan PUDYATMOKO	Conservation Strategies to Secure Viable Population of Elephant in Sumatra
Keynote2	Shigemitsu SHIBASAKI	Conservation of Forestry Heritage in Japan
Keynote3	William Virgil BLEISCH Paul ESHOO etc.	Can forest tourism and indigenous forest culture be integrated to support protection of threatened wildlife?
Keynote4	Wawan SUJARWO	Forest Culture in Bali: Harmonizing Spirituality, Tradition, and Conservation through <i>Tri Hita Karana</i>
Keynote5	Mui-How PHUA	Rebalancing Forest Recreation in the Crocker Range Biosphere Reserve: Advancing Community-Based Ecotourism through Participatory GIS

April 20th 2026, Monday

Keynote6	bing WANG	Chinese Forest Ecosystem Research Network: Construction, Contributions, and Applications
Keynote7	Ho Sang KANG	From Reforestation to Forest Welfare: Korea's Integrated Policy Model for Public Health, Social Inclusion, and Regional Revitalization
Keynote8	Upul SUBASINGHE	Thirty Years in the Canopy: Bridging the Divide between Forest Science and Cultural Wisdom
Keynote9	Ming-Jer TSAI Chiang WEI	Cross-Sector Forest Guardianship: A Culture-Centered Framework for Sustainable Management Integrating Corporate Social Responsibility, University Social Responsibility, and Smart Forestry
Keynote10	Hui ZHANG	How to solve the living challenge during performing forest healing

Oral Presentation

April 19th 2026, Sunday

O01	Ni Putu Diana MAHAYANI Erny POEDJIRAHJOE Frita KUSUMAWARDANI Ryan Adi SATRIA Reza PAHLEVI	Functional Trait-Based Assessment of Ecosystem Service Outcomes for Forest Rehabilitation
O02	Hui FU Guang FU Xuena WAN	The Mountain-Sea Synergy Model: University-Rural Collaboration for Forest Rural Revitalization in China
O03	Syifa NABILA Eny FARIDAH Daryono PREHATEN	The Effect of Nutrient Availability and Water Deficit on <i>Acacia decurrens</i> (J. C. Wendl) Willd. Seedling Growth
O04	Adita Fauzan F. WARDANA Sri RAHAYU Handojo Hadi NURJANTO	Diversity and Role of Macrofungi in Cemoro Sewu Track of Lawu Mountain, Magetan, East Java, Indonesia
O05	Ratih Madya SEPTIANA Nunuk SUPRIYATNO Dwiko Budi PERMADI Intan PRATIWI Khoirunisa RAHMATIKA	Wanagama Healing Forest Hazard Risk Assessment: Balancing Traditional Healing Practices and Public Health Safety
O06	Nesty Pratiwi ROMADINI Sapto INDRIOKO Eny FARIDAH WIDIYATNO	Light and Nutrient Availability Drive Chlorophyll and Leaf Nutrient Traits in <i>Dipterocarpus gracilis</i> Blume Seedlings
O07	Amelia Amru NAJAH Emma SORAYA	Dynamics of Mangrove Forest on Protected Areas of Ujungpangkah, Gresik, Indonesia: 10 Years of Evidence from Remote Sensing

O08	Hendry RINDUAN Hero MARHAENTO Ambar KUSUMANDARI Hatma SURYATMOJO Muhammad Chrisna SATRIAGASA	Uncertainty analysis of satellite rainfall input data in hydrological model using Generalized Likelihood Uncertainty Estimation (GLUE) method
O09	Ziyadatil INAYAH Tomy LISTYANTO	Protection of Mahogany Wood (<i>Swietenia macrophylla</i>) from Dry Wood Termite (<i>Cryptotermes cynocephalus</i>) Using Permethrin Dipping Treatment
O10	Gathan Bhadra ADIYATMA Ris Hadi PURWANTO	Tree Species Diversity and Carbon Storage Potential across Urban Green Open Spaces in Yogyakarta, Indonesia
O11	Rhomi ARDIANSYAH Kaharuddin KAHARUDDIN Retno Nur UTAMI Stevie NISSAUQODRY Viola CANTIKA	The Development Level of Nature Tourism Destinations in the Special Region of Yogyakarta
O12	Huaiyue LIANG Huengyi ZHUO Fengjiao TAO	From barren dunes to coastal forest, green transformation in the past 30 years in Changjiang, Hainan island, China
O13	HERMUDANANTO Ratih Madya SEPTIANA Nunuk SUPRIYATNO Febriyanto Ismu NUGROHO	Community-Based Environmental Education Parks for Conserving Forest Diversity and Local Ecological Knowledge in Central Java, Indonesia
O14	Agus AFFIANTO San Afri AWANG Dwi LARASWATI Slamet RIYANTO Wahyu Tri WIDAYANTI Tri ATMOJO Muhammad Abdul Rahman SUBRATA	Toward a decade of the implementation of the social forestry program in Indonesia
O15	Johanes Pramana Gentur SUTAPA	Culture and Biomass Energy development
O16	Hatma SURYATMOJO Kristin Banyu Risang HOB0	Traditional Knowledge and Community-Led Watershed Conservation in Coffee-based Agroforestry Systems in the Upstream Area of the Merawu Watershed

April 20th 2026, Monday

O17	Woro LARAS Muhammad Ali IMRON Sena Adi SUBRATA	Belambangan Biosphere Reserve supports wildlife corridors: evidence from population genetics of Rusa deer (<i>Cervus timorensis</i>) in Java, Indonesia
O18	Jingjing WANG Xiaoyan LIN Bingsun WU Zixun CHEN Yongyi LIANG	Effects of Geographical and Climatic Factors on the Intrinsic Water Use Efficiency of Tropical Plants: Evidence from Leaf 13C
O19	Gunawan NUGRAHANTO Mohammad NA'IEM Sapto INDRIOKO Eny FARIDAH WIDIYATNO SURYANAJI Padang JAYANTO Pujo SUMANTORO	Genetic variation of <i>Pinus merkusii</i> based on microsatellite markers to support the breeding of high-resin-yield
O20	MUSYAFA	The Role of Soil Macrofauna in the Decomposition Process of Mahogany Litter in the Wanagama Educational Forest, Yogyakarta, Indonesia
O21	Rizky Arif Cahyono Ananto Triyogo WIDIYATNO	Identification of Stem Borer Pests and Damage Description in Clove Plants (<i>Syzygium aromaticum</i> L.)
O22	SUBENO Anggoro WIBISONO Atus SYAHBUDIN	Wildlife Diversity in the Fragmented Forest Area on the North Slope of Mount Lawu, Ngawi Regency, East Java Province, Indonesia

O23	Fiqri ARDIANSYAH Sri RAHAYU Muhammad Ali IMRON Mark Edward HARISSON Frank Van VEEN SOEMARDI Lailan SYAUFINA Guangyu WANG	Fire Regime and Post-Fire Plant Community Dynamics in Tropical Peat Ecosystems of Central Kalimantan, Indonesia
O24	Daryono PREHATEN Suryo HARDIWINOTO Harry SULISTYO JOHANSYAH Handojo H NURJANTO Arom FIGYANTIKA Nesty P ROMADINI Eny FARIDAH	Carbon Sequestration of Sequential Rehabilitation Planting in the Methanol Park Arboretum, Bontang, East Kalimantan
O25	Ganis LUKMANDARU Awanda Sifa MAHARANI Ela Putri SUHANTA Widyanto Dwi NUGROHO WIDIYATNO Yogi FERIAWAN Fanany Wuri PRASTIWI Aris WIBOWO Diana PUSPITASARI	Effect of Thinning on the Chemical Properties of Clonal Teak Trees
O26	Muhamad Thoriq Akbar YUSUF Wahyu WARDHANA Dwi Tyaningsih ADRIYANTI SENAWI Atus SYAHBUDIN	Terrestrial Laser Scanning for Three-Dimensional Tree Architecture : Application in Jate Mega (<i>Tectona grandis</i> L.f.)
O27	Ambar KUSUMANDARI Hatma SURYATMOJO Ghalbi Mahendra PUTRA Nurika Arum SARI	Land Suitability and Capability Analysis for Evaluating the Land Use in Achieving Sustainable Land Management in Banyumanik, Gunungkidul
O28	Dwiko Budi PERMADI Muhammad Danang ANGGORO Fais RAHMAN	Risk Framing and Institutional Legitimacy: Cultural Lenses to Understand Oil Palm Governance in Tesso Nilo National Park, Indonesia
O29	Qingqing YANG	Climate and Vegetation Factors Determine the Probability of Tropical Forest Fires in Hainan Island During the Dry Season
O30	RAWANA Agus PRIJONO Adi WIJAYANTO Nanda Satya NUGRAHA Hastanto Bowo WOESONO Didik Surya HADI Karti RAHAYU	Analysis of Bird Species Diversity at Selo Resort, Mount Merbabu National Park
O31	Taufik Tri HERMAWAN Muhammad Danang ANGGORO Kristiani Wajar WIANTI Daris Fahmaa SUTATA	Stakeholder Mapping on Indonesian Community Based Protected Area, Baros Mangrove Ecosystem Essential Area Case Study

Poster Presentation

P01	Haruo SAITO	Characteristics of Wild Edible Plants in Japan
P02	Akio FUJIWARA	An Initiative to Hold Classical Music Concerts in the Forest to Help Local Residents Appreciate the Cultural Benefits of the Local Natural Environment
P03	Asaki KINJO Soshi AIBA Masashi KONOSHIMA Ikuo OTA	Current Management Practices and Resident Awareness Regarding Mangrove Forests in Okinawa Island, Japan
P04	Koji NAKAGAWA	Visualizing Forest Culture in the Hira Mountain Foothills: An Analysis of Citizen-Selected Resources in Walking Maps

P05	Ningxin CAI Seiji ISHIBASHI Haruo SAITO Akio FUJIWARA	The Significance of Giant Trees to the Japanese People and the Factors Contributing to Their Formation
P06	Yuko SHIBATA Mieko AIKAWA Wan LI	The Educational Effect of the 'Wreath-Making Workshop' Utilizing Surplus Forest Products: Activities for Faculty and Staff at the University of Tokyo Tanashi Forest
P07	Yue LIANG Hui FU	Comparative Study on Forest Culture Perception among Multiple Groups on Nature Education Trail: A Case Study of Yinggeling in Hainan, China
P08	Yixi MA Mingjiang MAO Wenfeng GONG	An Integrated Framework for Identifying Nonlinear Drivers and Peaking Pathways of Land-Use Carbon Emissions: A Case Study of Hainan Island, China
P09	Damit NUR ATIQAH AG Mui-How PHUA	Spatial and Temporal Patterns of Nature-Based Tourism Demand in Sabah, Malaysia Across COVID-19 Periods
P10	Aldila PARAMITA Kirana RADITYA	Forest Healing as an Emerging Post-COVID-19 Ecotourism Strategy: Assessing Ecological and Socio-Tourism Potential in Gunung Merapi National Park, Indonesia
P11	Puji Lestari Ayu Diyah Setiyani	An Individual-Based Model for Assessing the Effect of Initial Population Density on Kauri Dieback Disease Dynamics in <i>Agathis australis</i>
P12	Sri RAHAYU Kenneth Puliafico KENNETH	<i>Uromycladium falcatarium</i> , the <i>Falcataria mollucana</i> Rust Fungus – Potential Biosecurity Threat for Some Leguminosae in the Pacific Islands
P13	Diananda Vianokta AZZAHRA MUSYAFA Dwi Tyaningsih ADRIYANTI	Butterfly Diversity in the Eastern Green Open Space Area of Gadjah Mada University
P14	Galuh ANGGARA Sri RAHAYU Handojo Hadi NURJANTO	Macro fungi in Urban Forest of Universitas Gadjah Mada and Their Potential Uses as Medicinal Fungi

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Conservation Strategies to Secure Viable Population of Elephant in Sumatra

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Indonesia harbors approximately 793 mammalian species representing 17 orders, 58 families, and 241 genera, accounting for about 12% of global mammal diversity, second only to Brazil. Several flagship large mammal species in Indonesia, including the Sumatran elephant, Sumatran tiger, three Orangutan species, and two Rhinoceros species, are currently under severe threat. All of these species are classified as Critically Endangered on the IUCN Red List of Threatened Species, indicating an extremely high risk of extinction in the wild without systematic conservation programs and strong protection measures. Habitat loss and fragmentation due to forest conversion for agriculture, settlements, and infrastructure development represent the primary drivers of population decline. Additional pressures include poaching and escalating human–wildlife conflict. Field observations indicate that a substantial portion of large mammal habitat occurs outside formally protected areas, including production forests, protected forests, and non-forest landscapes with adequate vegetation cover. Large mammals typically require extensive home ranges, and their habitats often comprise mosaics of forested and non-forested areas that provide sufficient resources and connectivity. Loss of vegetation cover can thus render suitable habitats unsuitable or completely non-functional. This study examines the effects of habitat loss and fragmentation on Sumatran elephant populations. Historically, elephant habitats in Sumatra were distributed across 44 habitat blocks; recent assessments by the Forum Konservasi Gajah Indonesia indicate that fewer than half—only 21 blocks—remain. Some of the remaining blocks are highly fragmented and support only very small, isolated populations that face a high risk of local extinction. To mitigate these risks, the government has initiated programs to expand and reconnect fragmented habitats. Comprehensive surveys of all remaining habitat blocks were conducted to estimate population size, habitat extent, and spatial relationships among fragments. Using spatial ecology approaches combined with multistakeholder collaboration, strategies were developed to improve habitat connectivity across fragmented landscapes. Habitat mapping results indicate that most blocks cannot be connected to others. For such isolated blocks, priority actions include habitat restoration, enhancement of carrying capacity, and reduction of human–elephant conflict. Where connections among blocks are feasible, ecological corridors are being developed, often traversing production forests and non-forest landscapes. Effective implementation requires collaboration among concession holders, local governments, and communities, with corridor design and spatial configuration agreed upon collectively to ensure both ecological effectiveness and social acceptance. In cases where habitat and population sizes are extremely small, translocation may be the only viable conservation strategy.

Conservation of Forestry Heritage in Japan

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Background

Approximately two-thirds of Japan's land area (378,000 km²) is covered by forests. People in Japan have long maintained close relationships with forests and mountainous areas—not only as sources of construction and fuel materials, but also as spaces for hunting of wild animals, gathering of wild plants, education, tourism, and religious practices. Through these continuous interactions, diverse forms of forest culture have developed in Japan. The Japanese forest culture finds its symbolic expression in Horyu-ji Temple—established in A.D. 607 as the world's oldest wooden structure— and long-standing traditions of spiritual reverence for mountains. Since the beginning of the 21st century, efforts to conserve forestry-related remains and traditional forestry techniques—collectively referred to as “forestry heritage”—have intensified. This study aims to clarify the current status and challenges of conserving forestry heritage in Japan.

Changing Perspectives on the Cultural Value of Forests

In Japan, with the introduction of modern technologies in the late 19th century, traditional forestry techniques and lifestyles of mountain villages were often regarded as outdated and as obstacles to modernization. For example, timber rafting—once used to transport timber downstream—came to be viewed as hindering the construction of hydroelectric dams after the early 20th century. As hydroelectric development progressed, timber rafting declined and was replaced by forest railway systems and motorized transport by the end of the 1950s.

Japanese society reached a turning point between the late 1950s and the 1960s. The energy transition drastically reduced the demand for fuelwood, which had been a key income source for mountain communities. Simultaneously, rapid economic growth led to the outmigration of young people to urban areas. Large-scale dam construction further submerged many mountain settlements. As a result, depopulation of mountain communities accelerated, and traditional forest culture rapidly declined. Paradoxically, as concerns over cultural loss emerged, efforts to document and preserve disappearing traditions began at the grassroots level and later expanded into national policy.

Furthermore, since the late 20th century, there has been a growing movement to conserve technologies introduced in the 19th and early 20th centuries as modernization heritage. In the

field of forestry, the Japanese Forest Society launched the Forestry Heritage selection project in 2013 and has since selected 53 sites, focusing primarily on forest railways.

Current Status and Challenges in Conservation

A questionnaire survey was conducted among the Forestry Agency, prefectural forestry departments, and cultural property divisions to assess the presence and conservation status of forestry heritage. While only about one-third of respondents reported active utilization, their use was primarily limited to local education, with few examples developing into tourism initiatives. Regarding the challenges of conservation, several key issues were identified: first, the advancing depopulation of mountain communities leading to a shortage of successors; second, a low level of awareness and interest in forestry heritage even among local residents, as many sites lack official designation as cultural properties; and third, the difficulty of securing maintenance funds due to the aging of facilities such as forestry museums.

Nevertheless, several notable cases demonstrate successful conservation and utilization. These include the restoration of forestry heritage as tourism resources, such as tourist forest railways in the Kiso region and log rafting tourism in Kitayama Village. Other cases involve indirect utilization of remains, such as ecotours along former forest railway routes in Tsugaru and Yakushima Island. A common feature of these cases is a bottom-up approach driven by local communities rather than strong national initiatives. Municipal governments have also supported maintenance through public funding. However, even these successful cases face long-term challenges. Restoration and maintenance of large-scale structures require substantial financial resources, often beyond the capacity of local governments. Additionally, when forestry heritage is located within protected areas such as national parks, conservation policies tend to prioritize natural values, often neglecting cultural aspects.

Conclusion

To date, the conservation of forestry heritage in Japan has largely depended on bottom-up efforts by local residents and enthusiasts. However, given ongoing depopulation and fiscal constraints faced by municipalities, this approach has clear limitations. Stronger institutional and financial support is required, and conservation policies should integrate cultural values alongside natural values.

Can forest tourism and indigenous forest culture be integrated to support protection of threatened wildlife?

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Can forest tourism and indigenous forest culture be integrated to support protection of threatened wildlife?

Introduction: Between 2024 and 2026, the Biodiverse Landscapes Fund Lower Mekong Landscape programme supported efforts to improve conservation management planning in Virachey National Park in northeast Cambodia. Robust surveys of mammals using camera trapping and remote audio recorders demonstrated that the highest richness of mammal species occurred not in the center of the Core Zone of the park, but along the Cambodia-Lao border in a range of low mountains that are sacred to local Brao and Kavet ethnic minorities. Many of these communities have organized Community Protected Areas (CPAs) within the park under a government mechanism that gives them some responsibility for protection and also recognition of their rights for sustainable use of the forests. Planning for development of ecotourism in Virachey National Park by CPAs was organized by IUCN, including participatory workshops and market analysis. This led to the conclusion that marketing the deep connections between local people and nature would be the most effective strategy to attract visitors. It seems that many visitors come in search of an adventure in the wild that also provides an authentic experience of harmony between humans and nature.

Indigenous forest culture may be a key draw to attract tourists to forest parks and protected areas. By highlighting the deep social and cultural connections between local communities and their forest environments, tourism programmes can share these natural ecosystems as cultural landscapes in ways that may also benefit visitors' mental and physical well-being. However, many questions remain.

- Will forest tourism be a sustainable use of forest ecosystems?
- What are the impacts, positive and negative, of tourism on forest ecosystems and their biodiversity?
- How can tourism policy support conservation of ecological and cultural diversity in forest landscapes?

Trekking through a landscape of fear: We examined these questions in a model system of community-based ecotourism that had been operating in the Nam Ha National Protected Area in northern Lao PDR since 1999, when the Nam Ha Ecotourism Project under UNESCO supported creation of trekking and kayaking routes for guided tours through forest habitats in the Protected Area in Luang Namtha Province. The Project created a model system of community-based ecotourism that celebrates local culture and intact forest ecosystems. The service providers are locally owned businesses, and guides are local ethnic minority people who share their intimate knowledge of the forests and the culture of the local communities on the forests. Most visitors are Europeans, who come to trek and kayak into the protected area's intact natural forests. They tend to be sympathetic to conservation and respectful of regulations.

In addition to providing economic benefits, the Ecotourism Project also hoped to achieve

positive gains for conservation of cultural and natural resources. After more than a decade of operation, the project was recognized as an economic success. It has encouraged local entrepreneurs, contributed to the provincial economy and shared benefits with local ethnic minority communities. There is also reason to believe it may have encouraged forest protection in the Controlled Use Zone of the Nam Ha Protected Area. We asked whether the project was also successful in promoting protection of charismatic wildlife and curbing unsustainable hunting. Specifically, did tourism create refuges for wildlife from hunting? Did it create incentives for conservation? Did it have net positive impacts?

Analysis of data from camera trapping collected from 2013 through 2018 at 58 stations indicated that wildlife was less diverse near trails used regularly for tourism. Modeling the association between distance to tourism and predicted species availability with Royce-Nichols multispecies models, the posterior predicted mean species richness of available medium and large mammals for stations more than 1 km from trekking trails and kayaking routes was 8.39 (SEM = 0.0425) species, while for those near tourism it was 4.58 (0.023). No species examined showed an increase in availability near tourism.

The models consistently indicated no support for the hypothesis that tourism created a refuge from fear of hunting. Instead, the data was consistent with the hypothesis that wildlife avoided trails used for trekking tourism, suggesting that, in this context of heavy hunting, tourism added to the landscape of fear experienced by wildlife.

Unsustainable hunting and eco-tourism co-exist in the Nam Ha Protected Area. At the time of the study, subsistence hunting was legal in the Controlled Use Zone of the Protected Area, but selling wildlife was illegal. Never-the-less, open sale of wildlife was common in Luang Namtha Province's markets. In regional markets, we found carcasses and body parts from the full array of species present in the protected area, including species that were globally threatened and/or protected under Lao wildlife law, such as Slow Loris, Large Indian Civet, macaques and Sunda Pangolin. This continued even after a Prime Ministerial decree called for active enforcement of the market ban.

By many accounts, the locally-based, community-focused nature tourism that the UNESCO project promoted has been a success. Yet we found no evidence that the active nature tourism sector had created any pressure to enforce the law on wildlife protection during the time of our study.

What then must be done? Since our study ended, the tourism sector in Luang Namtha has formed a tour operators' group and a tour guide group that have begun to lobby for increased protection, and the provincial Department of Forestry has stepped up enforcement with support from new donors, including enforcement on the ban on market sales of wildlife. Tourism could contribute more to cultural and biodiversity conservation goals. We recommend that local communities and the nature tourism sector should be enlisted as partners to support efforts to control illegal hunting. Regional tourism development strategies should integrate indigenous forest culture in a sustainable way, emphasizing respect for the forest and activities that showcase but do not harm wildlife and cultural diversity. Benefits for local communities, including profit sharing from tourism, should be matched by their participation in active control of hunting. Success could add wildlife encounters as a new tourism attraction. Promotion and protection of indigenous forest culture and wildlife conservation efforts should be integrated for the benefit of both.

Forest Culture in Bali: Harmonizing Spirituality, Tradition, and Conservation through *Tri Hita Karana*

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Forest culture in Bali represents a profound integration of spirituality, tradition, and ecological stewardship, fundamentally shaped by the Hindu philosophical framework of *Tri Hita Karana*—the harmonious balance between God, humanity, and nature. This paper explores how Balinese communities have developed a complex socio-cultural system through centuries of interaction with forest ecosystems, viewing forests not merely as physical resources but as sacralized landscapes (*palemahan*) embedded with spiritual significance and cultural identity. Through case studies of sacred forests such as the Ubud Monkey Forest (*Mandala Suci Wenara Wana*) and Sangeh Monkey Forest, where temples coexist with protected trees and wildlife under customary law (*awig-awig*), this study demonstrates how traditional ecological knowledge (TEK) manifests in sustainable management practices, including the protection of watershed forests supporting the UNESCO-recognized Subak irrigation system, the preservation of medicinal plants (*taru premana*) by traditional healers (*balian*), and the maintenance of forests as sources for ceremonial materials. The ritual calendar reinforces this relationship, most notably through *Tumpek Uduh*, a day of devotion to plants, while customary regulations restrict forest use during sacred periods such as Nyepi. Specific local examples further illustrate this living forest culture: the Tenganan Pegriingsingan village conserves forests as a spiritual duty; the Trunyan village maintains a unique burial tradition under a sacred *Taru Menyan* tree; and the salak agroforestry system in Sibetan Village has been designated a FAO Globally Important Agricultural Heritage System (GIAHS). Despite mounting threats from tourism development and land conversion, Balinese communities are strengthening their customary institutions and developing culture-based ecotourism as adaptive strategies, demonstrating how deeply held cultural values can create effective, resilient, and spiritually-grounded conservation models. This examination of Bali's forest culture offers valuable insights for integrating traditional knowledge into contemporary environmental management and climate change mitigation efforts worldwide, affirming that protecting nature is fundamentally a cultural and spiritual imperative.

Keywords: Bali, customary law, forest culture, sacred forests, socio-ecological resilience, traditional ecological knowledge, *Tri Hita Karana*

Rebalancing Forest Recreation in the Crocker Range Biosphere Reserve: Advancing Community-Based Ecotourism through Participatory GIS

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Across tropical Asia, forests are not only reservoirs of biodiversity but also living cultural landscapes, where recreation opportunities, community livelihoods, and conservation futures are increasingly shaped by how people access and experience these environments. In the Crocker Range Biosphere Reserve, visitor demand is highly uneven, with some accessible substations attracting larger numbers of visitors, while remote areas remain underutilised.

To rebalance recreation opportunities, participatory geographic information systems (PGIS) were applied to engage local communities in identifying and mapping attractions and co-designing ecotourism strategies. This collaborative process contributed to the establishment of a Community Conserved Area, advancing community-based ecotourism, and reinforce conservation outcomes. By linking local knowledge with planning tools, this approach offers a practical pathway to sustain recreation services while enhancing the social and ecological benefits of biosphere reserve landscapes.

Chinese Forest Ecosystem Research Network: Construction, Contributions, and Applications

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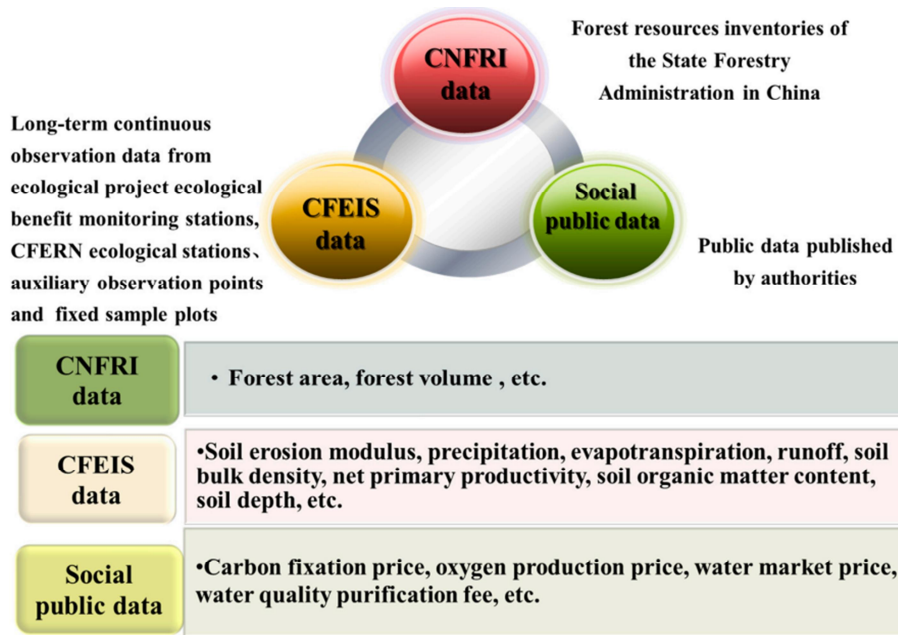
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Abstract:

Chinese Forest Ecosystem Research Network (CFERN), established under the National Forestry and Grassland Administration, is one of the world's leading long-term ecosystem observation networks. It comprises over 100 forest ecosystem research stations distributed across different climatic regions in China. CFERN is dedicated to studying forest ecosystem dynamics, including formation, structure, productivity, hydrological and nutrient cycles, and energy utilization under both natural and human-influenced conditions. Its goal is to provide scientific insights into ecosystem succession and biogeochemical cycles, thereby supporting national ecological conservation policies and sustainable forest management.

CFERN follows rigorous national and industry standards for site construction, observation indicators, measurement protocols, data management, and application. Standardized observations enable the coupling of three data sources: forest resource inventories, eco-station long-term monitoring, and socio-economic datasets. A distributed valuation approach is applied at provincial levels, stratified by forest type, origin (natural vs. plantation), and stand age (young, middle-aged, pre-mature, mature, over-mature). Fourteen indicators across eight categories of forest ecosystem services are quantified. Additionally, to assess flagship species conservation value in national parks, an improved energy-based method (Odum's energy theory) is used, incorporating species endangerment index, endemic index, energy transformity, national energy-money ratio, and population proportion. CFERN supported three national assessments (2009, 2014, 2019) corresponding to the 7th, 8th, and 9th National Forest Resource Inventories, with total forest ecosystem service values of 10.01, 12.68, and 15.88 trillion RMB per year, respectively. The 2019 value represented 17.64% of China's GDP. As an application of CFERN's data and methodology, the annual conservation values of flagship species in China's first five national parks were quantified: Three-River-Source National Park (25.244 billion RMB), Giant Panda National Park (76.922 billion RMB), Northeast Tiger and Leopard National Park (28.588 billion RMB), Hainan Tropical Rainforest National Park (1.507 billion RMB), and Wuyishan National Park (0.861 billion RMB).

CFERN has established a robust, standardized, multi-scale observation and valuation system for forest ecosystem services. Its achievements include distributed service evaluation, global change interaction research, carbon-nitrogen-water cycle coupling, and biodiversity-ecosystem functioning analysis. The successful application to flagship species conservation in national parks demonstrates CFERN's critical role in quantifying ecological assets and supporting China's ecological civilization. Future efforts will further integrate long-term observations with policy-relevant ecosystem service assessments.



From Reforestation to Forest Welfare: Korea's Integrated Policy Model for Public Health, Social Inclusion, and Regional Revitalization

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Abstract:

Korea's forest policy has undergone a paradigm shift from a reforestation-oriented approach to an integrated forest welfare system that delivers social, environmental, and economic benefits. Historically, Korea's forest policy focused on restoring degraded landscapes through large-scale tree planting. However, recent policy developments emphasize "Forests for People," expanding the role of forests as a platform for enhancing the quality of life and social well-being. The current system adopts a life-cycle approach, providing customized services from prenatal care to end-of-life stages, including forest education, therapy, and recreation programs. This inclusive model ensures accessibility for all citizens, particularly vulnerable groups. From a regional development perspective, forest welfare contributes to revitalizing rural and forest communities, which account for approximately 43% of the national territory. Policies promote forest tourism, local entrepreneurship, and community-based economic models, including flagship projects such as long-distance forest trails and specialized forest villages. These initiatives generate significant economic spillover effects while enhancing regional attractiveness and population inflow. Furthermore, Korea's forest welfare system is supported by an innovative governance framework based on public-private partnerships and ESG financing mechanisms. In conclusion, Korea's forest welfare policy represents a holistic and scalable model that integrates environmental resources with social policy objectives. It offers valuable insights for countries seeking sustainable solutions to aging populations, mental health challenges, and regional inequality, and has the potential to serve as a global standard for forest-based welfare systems.

Keywords: Forest welfare, social prescription, forest therapy, ESG, public health, rural revitalization, reforestation, Republic of Korea

Thirty Years in the Canopy: Bridging the Divide between Forest Science and Cultural Wisdom

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Abstract

In the late 1800s, Sri Lanka was thought to be a green country because almost 60% of its land was covered by primary forests. By 2020, this number dropped to just 18%. As a scientist who has spent more than 30 years walking these high canopies, I have seen this decline not only as a result of increasing population and industrialization, but also as a deep wound to our shared soul. During the rapid development, the word "how" became more important in modern forestry that deals with sustained yields and carbon metrics, and the word "why" was forgotten.

To deal with the problems that come with losing forest cover, we need to move from a mindset of sustained yield to the sustainable management principles. But we can't fully use our precious forests in a way that is good for the environment without also including our ancient forest culture. For hundreds of years, our landscapes were not controlled by spreadsheets but by a fragile social-ecological clockwork. The Wel Vidane (irrigation headman), the Gamarala (village head), the Vedarala (traditional doctor), and the Kapu Mahattaya (spiritual leader) were the real guardians of balance. They believed that life should be shared, with half coming from the village and half from the forest. Kandyan homegardens, one of the most famous agroforestry systems in the world, where the hearth and the grove are one, were very important at that time. It is a living, breathing proof of how smart our ancestors were. It copies the forest's own multi-layered structure to provide food and medicine in a never-ending, harmonious cycle.

The forest cover is going down very quickly, and the efforts to protect it fully also caused problems that drove people away from the forest. This might have upset the balance between culture and resource use. Because Sri Lanka has lost money in the past few years because of global pandemics and a historic economic crisis, the policy makers need to look back at our heritage to find a way to move forward.

A new way of living together is the key to the future of Asian forestry. Payments for Ecosystem Services can help turn precious biodiversity back into a living asset by bringing back traditional pilgrimage routes as high-value spiritual and cultural tourism. Thereby, we are not just protecting trees; we are also restoring a heritage where tourism based on nature, religion, and spirituality can help the economy stay strong.

Cross-Sector Forest Guardianship: A Culture-Centered Framework for Sustainable Management Integrating Corporate Social Responsibility, University Social Responsibility, and Smart Forestry

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The Experimental Forest of National Taiwan University (NTUEF), established in 1902 as the predecessor of the Tokyo Imperial University Forest in Taiwan, has been a cornerstone of Taiwanese forestry. Guided by four core missions—academic research, teaching and internship, resource conservation, and demonstration management—NTUEF has become a model for forest management in Taiwan. Due to historical factors, numerous communities and tribes reside within and adjacent to our jurisdiction. These local residents have relied on forestry and agriculture for generations, and many traditional territories of neighboring indigenous tribes overlap with our managed areas. Beyond land management, preserving local mountain village cultures and indigenous traditions has become an integral part of our forest management strategy. Since the initiation of the "Community Forestry Project" in 2010, the "Mutual Prosperity Project" in 2015, and the "University Social Responsibility (USR) Project" in 2018, NTUEF has integrated resources from academia, government, and industry. In recent years, the introduction of Smart Forestry technology has propelled forestry culture into a new era. Moving forward, we aim to integrate forestry into communities, exploring the profound interaction between people, land, and forests. By linking nature, biodiversity, and ecosystem services, we strive to achieve sustainable forest management. Currently, these initiatives have yielded significant results. We look forward to attracting more corporate resources to play a vital role in long-term environmental protection, traditional knowledge transmission, and ecological sustainability. Our goal is not only to fulfill the UN objectives for Indigenous Peoples and Local Communities (IPLCs) but also to showcase Taiwan's unique contributions to global ecological sustainability.

How to solve the living challenge during performing forest healing

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Forest healing has been widely assumed effective for improving health condition for human being. Thus forest healing has been performing in many countries across the whole world. It should be noted that the first, also the most important step for performing long-term forest healing is establish good living house with enough electricity and water supply thereby to let forest healing participants can live long in the forest. Generally forest with high health improving ability is located in very remote place, so it is very hard to set up this kind of living house. As a result, currently all forest healing activity is short-term, while only long-term forest healing can provide effective outcome for improving physical health. For solving this problem, we have developed a new type of moving house which can automatically produce electricity and drinking water. Specifically, the electricity is made of solar energy which can be saved in the battery for later use. The drinking water is from the air water (also can be called drip water). Finally by using our developed new type of moving house, long-term forest healing activity can be fulfilled which in turn can push forest healing research to a new step.

Functional Trait-Based Assessment of Ecosystem Service Outcomes for Forest Rehabilitation

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This study evaluates the long-term success of forest rehabilitation in the Wanagama Forest, Indonesia, by analysing tree functional traits rather than traditional taxonomic metrics to better assess ecosystem services outcomes. An inventory of tree species was conducted across three rehabilitation compartments of mixed three species, Compartment 5, 13, 16. Functional traits—including maximum height, wood density, root type, and successional species category—were analyzed using community-weighted mean (CWM), functional richness, and functional dispersion to identify distinct community assemblage. The study identified three divergent ecological strategies driven by environmental gradients and disturbance histories. Compartment 13 employs a resources acquisition strategy (fast growth) with high specialization and a broad niche volume, maximizing efficiency and regulating services. Compartment 16 utilizes a resources conservative strategy, characterized by high specialization and narrow niche volume, prioritizing long-term carbon regulation and resilience over rapid growth. Compartment 5 adopts a generalis strategy with high homogeneity, focusing on local stability through functional redundancy. In conclusion, after 60 years of rehabilitation, the Wanagama Forest demonstrates high functional diversity. The variation in trait composition suggests that different plots provide specialized ecosystem services, ranging from rapid biomass accumulation to stable, long-term carbon storage.

Keywords: functional traits; forest rehabilitation; community-weighted mean; ecosystem services; Wanagama Forest.

The Mountain-Sea Synergy Model: University–Rural Collaboration for Forest Rural Revitalization in China

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Abstract

Forest rural communities lie at the intersection of ecological conservation, cultural heritage, and rural development. Against the backdrop of China's rural revitalization strategy and ongoing national park development, this study examines how universities can leverage research and talent to foster sustainable development within these communities. Taking the “Harmonious and Beautiful Mountains and Seas” (HBMS) rural revitalization platform, established by at Hainan University, as a case study, this paper analyzes its operational mechanisms from an innovative governance perspective. We identify three core values—Nurturing Culture, Rural Brilliance, and Constructing Meaning—and explore mechanisms for enhancing community resilience and brand-oriented pathways within national park forest rural communities. The resulting Mountain-Sea Synergy Model is not a one-size-fits-all solution but a practical governance framework centered on multi-stakeholder collaboration mediated by universities. Its core value manifests across three dimensions: cultural revitalization (including forest-related traditions and indigenous ecological knowledge), youth empowerment, and the construction of community meaning. While grounded in the Chinese context, this model offers replicable insights into endogenous development for forest rural communities under ecological conservation constraints, contributing to the broader Asian discourse on forest culture and community resilience.

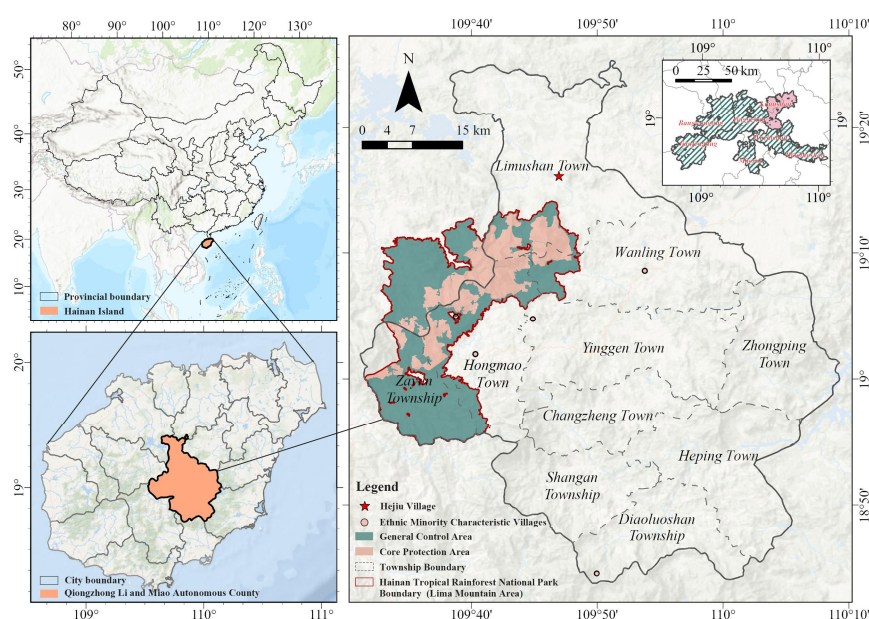


Figure 1. Location of study area.

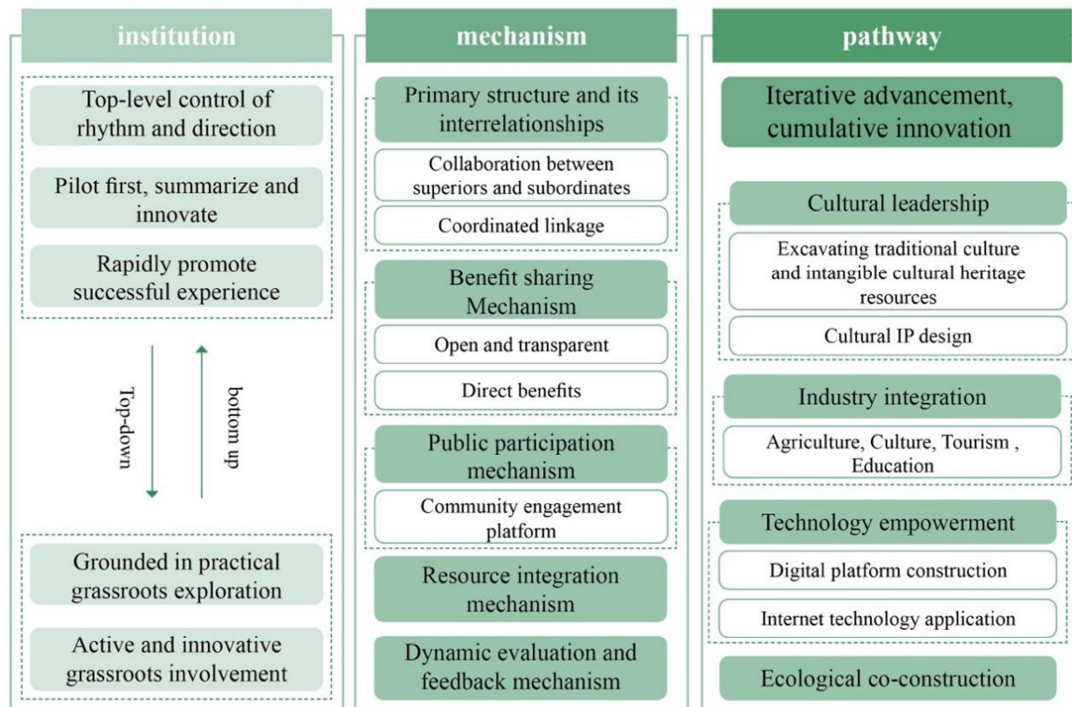


Figure 2. The HBMS Model Framework.

The Effect of Nutrient Availability and Water Deficit on *Acacia decurrens* (J. C. Wendl) Willd. Seedling Growth

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Abstract

The 2010 eruption of Mount Merapi acted as a natural scarification agent for *Acacia decurrens* seeds, enabling vigorous germination and dominance. Consequently, *A. decurrens* is considered to possess invasive potential despite its economic uses. This study aimed to assess *A. decurrens* seedlings' response to nutrient availability and water stress through fertilization and watering treatments. The experiment was conducted at Klebengan Greenhouse and Tree Physiology and Forest Soil Laboratory, Faculty of Forestry UGM, using a split-plot design. Watering treatments (main plot) included daily, every 4 and 7 days, while NPK fertilization doses (sub-plot) comprised 0, 1.5, and 3 g, each with five replications. After transplanting, seedlings received intended treatments and were observed for eight weeks. Measured parameters included seedling height, stem diameter, leaf number & color, root and shoot biomass. Data were analyzed using ANOVA and DMRT for mean comparison. The results showed that watering gave no significant effect on seedling height and diameter. However, it significantly affected shoot and root biomass, with the highest observed under daily watering, while no significant differences were found between seedlings watered every 4 and 7 days. These findings indicate that *A. decurrens* are relatively tolerant to drought. Regarding nutrient requirements, the best growth was achieved with 1.5 g of NPK, suggesting that seedlings do not require high nutrient inputs for optimal growth. Thus, although seedling growth tended to decline under stress conditions, *A. decurrens* exhibited growth characteristics similar to those of invasive species, highlighting the need for proper management.

Keywords: *Acacia decurrens*, drought stress, fertilization, growth, root nodules

Diversity and Role of Macrofungi in Cemoro Sewu Track of Lawu Mountain, Magetan, East Java, Indonesia

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High-altitude tropical ecosystems, such as those found on Mount Lawu, particularly at the Cemoro Sewu Track, Plaosan District, Magetan regency, East Java, harbor a rich but undocumented diversity of macrofungi and their ecosystem role. Macrofungi play a critical role in forest health through nutrient cycling and symbiotic relationships. This study investigates the genus, diversity, and ecological functions of macrofungi along the Cemoro Sewu track in Magetan, East Java. Data collection was conducted using a line transect along the track, with a 1 m buffer on each side, from 1900 m asl to 3100 m. asl Macrofungal specimens were identified based on morphological characteristics, including pileus shape, color, gill attachment, and substrate preference. A total of 28 genera belonging to 16 families were identified. The most dominant groups belonged to the Basidiomycota phylum, particularly within the orders Agaricales and Polyporales. The diversity index ranges from 0,8 to 1,6. While the abundance value ranged from 0.0098 to 0.7586 individuals/m², it was dominated by *Hygrocybe*, which has a role as a decomposer. All the macrofungi in the area we serve as saprobes (decomposers) and ectomycorrhizal fungi. The abundance of *Hygrocybe* indicates the health of the ecosystem at the Cemoro Sewu Track, Plaosan District, Magetan Regency, East Java.

Keywords: Cemoro Sewu Track, Lawu Mountain, *Hygrocybe*, Saprophytes, Mycorrhiza

Wanagama Healing Forest Hazard Risk Assessment: Balancing Traditional Healing Practices and Public Health Safety

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One of the benefits of forests for humans is forest therapy (healing forest). Wanagama Healing Forest (WHF) has a tracking path that becomes accessible for forest-healing activities. Tracking needs to be considered for security and safety to ensure visitors feel safe and comfortable. Objectives are to (1) identify the hazard risk in tracking of WHF, (2) assess exposure pathways and risk levels for users and practitioners, and (3) recommend culturally sensitive risk-management strategies that preserve traditional practices while reducing health risks. Methods combine qualitative and quantitative approaches: participatory ethnobotanical surveys and semi-structured interviews with healers and users; observational assessments of hazards; and a structured risk assessment using Hazard Identification, Risk Assessment, and Risk Control (HIRARC) in the tracking path. The research was conducted on a tracking trajectory in Wanagama Healing Forest. Tracking track and safety, as well as physical condition, in accordance with SNI 9006:2021 for Forest Tourism for Health Therapy. The study results indicate that the criteria affecting visitor safety are wind speed and storage, whereas the dominant criteria affecting visitor insecurity are temperature. If, based on the physical site, the tracking path is suitable for the development of a promotive orientation with an increase in the unsafe segment, then, for the spiritual site criteria, it is suitable for the development of curative, preventive, rehabilitative, and palliative orientations with an increase in the unsafe segment. Furthermore, risk assessment and control using HIRARC revealed that the dominant high-risk category was tripping over a stone. The dominant moderate risk is the fall of dead trees. The dominant low risk is being punctured/scratched by plant thorns. Control efforts are eliminating sources of potential hazards, changing unsafe segments, building and repairing infrastructure, providing warning boards, and using personal protective equipment (PPE)

Keyword: Healing Forest, Wanagama, Risk assessment, HIRARC

Light and Nutrient Availability Drive Chlorophyll and Leaf Nutrient Traits in *Dipterocarpus gracilis* Blume Seedlings

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Understanding the physiological responses of *Dipterocarpus gracilis* seedlings to nursery environmental conditions is essential for improving seedling quality and supporting conservation and reintroduction programs of this threatened dipterocarp species. This study aimed to evaluate the effect of light intensity and fertilization on relative chlorophyll content (SPAD) and leaf nutrient status of *D. gracilis* seedlings. The experiment was conducted for 90 days using completely randomized design with two factors: shading level (30% and 60%) and NPK fertilizer doses (0 g and 1 g per seedling). Physiological parameter measured included relative chlorophyll content using a SPAD meter and leaf nutrient concentrations including organic carbon (C), nitrogen (N), phosphorus (P), and potassium (K). The result showed that shading and fertilizer significantly affected relative chlorophyll content. Seedling grown under 60% shade exhibited higher SPAD values (40,88) compared with those under 30% shade (32,14). NPK fertilization also increased SPAD value; however, no significant interaction between shading and fertilization was observed. Leaf nutrient analysis indicated that neither shading nor fertilization significantly affected leaf C, N, P and K concentration. These findings suggest that *D. gracilis* seedling exhibit physiological acclimation to varying light condition through adjustments in chlorophyll content and gas exchange dynamics, while maintaining relatively stable nutrient status. Such physiological plasticity is important for optimizing nursery management practice to produce high-quality seedlings for conservation and restoration programs.

Keyword:

Dipterocarpus gracilis; chlorophyll content; leaf nutrient status; shade response; fertilizer

Dynamics of Mangrove Forest on Protected Areas of Ujungpangkah, Gresik, Indonesia: 10 Years of Evidence from Remote Sensing

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Abstract

Achieving the United Nations Sustainable Development Goals (SDGs) requires countries to establish targets for the protection, conservation, and restoration of coastal ecosystems, including mangrove forests, by 2030. Mangroves play a critical role in coastal protection, carbon sequestration, and the support of local livelihoods, yet they remain vulnerable to degradation from both natural and anthropogenic pressures. Reliable monitoring of mangrove dynamics is therefore essential to evaluate the effectiveness of conservation and rehabilitation efforts. Satellite remote sensing provides historical and current information on mangrove distribution and dynamics, serving as essential baseline data for designing effective conservation and management policies. In Indonesia, one of the efforts to support this target is the designation of Essential Ecosystem Areas (EEA) aimed at maintaining ecological functions while supporting local livelihoods. One of the EEA is The Ujungpangkah Mangrove (MUP) in Gresik Regency, covering approximately $\pm 1,554.27$ hectares, was designated in 2020. This study aims to quantify changes in mangrove cover and density within the EEA MUP using time-series data analysis. This research utilizes the Modular Mangrove Recognition Index (MMRI) from 2015 to 2024 to identify changes in mangrove cover and density. Five change classes were identified: revegetation, densification, stable, degradation, and deforestation. Disturbance and recovery analyses derived from LandTrendr outputs were used to assess the magnitude and duration of changes. Additionally, identification and trajectory analyses for each change class were conducted to model mangrove dynamics.

The results indicate the success of mangrove rehabilitation, reflected by the largest area of revegetation compared to other change classes. The management of EEA MUP has contributed to increasing mangrove cover and density, with consistent recovery processes detected during 2020–2024. The increase in average magnitude indicates significant recovery, particularly between 2020 and 2022, although disturbances were still detected until 2023. The trajectory patterns reflect natural vegetation dynamics that do not necessarily indicate degradation. The dominance of the stable forest class since 2015 indicates the effectiveness of EEA management in maintaining mangrove density. Nevertheless, localized deforestation persists due to coastal abrasion and land conversion.

Keywords: Essential Ecosystem Area, Mangrove, LandTrendr, MMRI.

Uncertainty analysis of satellite rainfall input data in hydrological model using Generalized Likelihood Uncertainty Estimation (GLUE) method

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The uncertainty analysis is an analysis conducted to estimate the range of variability in the expected results of a model. One source of uncertainty in hydrological models is rainfall input data. This study aims to evaluate the uncertainty of satellite rainfall data in the Hydrologiska Byråns Vattenbalansavdelning (HBV) hydrological model using the Generalized Likelihood Uncertainty Estimation (GLUE) method. The uncertainty analysis was conducted in the Upper Bogowonto Watershed, Central Java. The results of the study showed that bias correction significantly reduced the bias in satellite rainfall data. The reference model using field observation data demonstrated good performance, with $R^2 = 0.64$ and $KGE = 0.80$ for the calibration period and $R^2 = 0.63$ and $KGE = 0.78$ for the validation period. The GLUE analysis revealed that the range of input data uncertainty covered 60% of the observation data during the calibration period and 63% during the validation period. High uncertainty occurred during peak flow and tended to be lower during low flow. The GSMaP satellite data were considered the best rainfall input data for the hydrological model in the Upper Bogowonto Watershed.

Protection of Mahogany Wood (*Swietenia macrophylla*) from Dry Wood Termite (*Cryptotermes cynocephalus*) Using Permethrin Dipping Treatment

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Mahogany (*Swietenia macrophylla*) wood from community forests is widely utilised in construction and furniture manufacturing due to its aesthetic qualities and strength. However, its moderate natural durability (class II–III) makes it susceptible to dry-wood termite infestation. Preservative treatment is therefore required to enhance its resistance. Permethrin, a synthetic pyrethroid insecticide, demonstrates strong insecticidal properties and potential for wood preservation. This study investigated the effects of permethrin concentration and dipping duration on the protection of mahogany against dry wood termites (*Cryptotermes cynocephalus* Light). Mahogany samples (5 × 5 × 5 cm) were immersed in 36.8% permethrin solution. A completely randomised factorial design was employed to test two factors: permethrin concentration (0.5%, 1.5%, 2.5%) and dipping duration (1, 3, 5, 7 minutes). Following treatment, samples were air-dried and exposed to 50 termites in a glass tube for 30 days. Preservative absorption, retention, termite mortality, weight loss, and degree of wood damage were measured. Data were analysed using analysis of variance (ANOVA) at a 5% significance level. Permethrin concentration significantly affected absorption, while dipping duration influenced retention. No significant interaction was observed between the two factors. Treatment with 0.5% permethrin for 1 minute effectively protected mahogany from termite attack.

Keywords: dipping method, dry wood termiticide, mahogany, permethrin.

Tree Species Diversity and Carbon Storage Potential across Urban Green Open Spaces in Yogyakarta, Indonesia

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Abstract

Urban green spaces are increasingly recognized for their role in climate mitigation and urban ecosystem functioning. However, quantitative evidence on carbon storage and biodiversity in rapidly growing cities of the Global South remains limited. This study assesses the spatial distribution of urban green open spaces in Yogyakarta, Indonesia, estimates their carbon storage, and examines the relationship between tree species diversity and carbon storage. Urban green spaces were classified into public and private categories and analyzed using spatial and field-based vegetation data. The total extent of green open space reaches 764.99 ha, representing 23.5% of the city area. Although this proportion approaches Indonesia's national target of 30%, public green open space accounts for only about 5.1%, while the majority consists of privately managed green areas owned by institutions and other landholders. Vegetation surveys conducted across nine green space categories recorded 65 tree species. Aboveground biomass was estimated using allometric equations and converted to carbon stock following IPCC guidelines. Total carbon stock was estimated at 87.95 t C ha⁻¹, equivalent to 322.77 t CO₂ ha⁻¹. Tree species diversity showed a weak but positive relationship with carbon storage ($R^2 = 0.0609$ for Simpson; $R^2 = 0.076$ for Shannon), indicating that carbon accumulation in urban green spaces is more strongly influenced by vegetation structure and tree biomass than by species diversity alone. These findings highlight the importance of improving vegetation structure and expanding urban green space to strengthen the climate mitigation role of urban landscapes.

Keywords: Urban green space, Carbon stock, Tree diversity, Biomass, Urban ecology

The Development Level of Nature Tourism Destinations in the Special Region of Yogyakarta

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Abstract

This applied study evaluates the development levels of forest tourism attractions compared to non-forest natural destinations to guide and optimize emerging community-based tourism initiatives. In the Special Region of Yogyakarta, Indonesia, forest tourism faces intense competition and geographical challenges, such as remote locations and limited accessibility. To address this, the research was conducted in three stages: (1) data collection on development variables across nine attractions in the North (Tlogo Putri Kaliurang, Bunker Merapi, Ledok Sambu), West (Dramaga Waduk Sermo, Kalibiru, Waduk Sermo Camping Ground), and South (Gunung Api Purba, Hutan Pinus Pengger, Mangunan Fruit Garden) regions; (2) analysis and mapping of their development levels; and (3) dissemination of the findings to the Banyumanik community to support their local forest tourism project. Results indicate that nature-based tourism remains the primary choice for visitors, capturing a 68.15% preference rate due to its intrinsic appeal. However, non-forest natural attractions (e.g., Ledok Sambu, Waduk Sermo Camping Ground, and Gunung Api Purba) exhibit higher development levels than forest-based sites. Forest attractions ranked second overall. The study concludes that while forest tourism possesses superior natural appeal, it requires targeted improvements in facilities and accessibility to enhance its regional competitiveness and attract higher visitor numbers.

Keywords: forest tourism, tourism development level, community-based tourism, accessibility, nature tourism.

From barren dunes to coastal forest, green transformation in the past 30 years in Changjiang, Hainan island, China

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Abstract

At the coastline of Hainan island, China, there is a remarkable green transformation which should be known worldwide, from the largest coastal desert in Hainan island to 12.6 square kilometer forest within three decades. In this rural area of China, it was conducted only by the hands of local female volunteers without any mechanical assistance in 20th century. Their innovative planting methods include inter-planting of *Casuarina equisetifolia* with wild pineapple (*Pandanus tectorius*), 40 centimeter deep planting with red-soil nourishment. Here by demonstrating their unique planting method and process, a possible solution is introduced for coastal green transformation and desertification prevention, especially for tropical developing country.

Community-Based Environmental Education Parks for Conserving Forest Diversity and Local Ecological Knowledge in Central Java, Indonesia

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Forest Diversity

Forest diversity and local culture are closely interconnected in community landscapes where ecological knowledge and environmental stewardship are transmitted across generations. Strengthening environmental awareness among younger generations is therefore essential for sustaining biodiversity conservation at the local level. This paper reports on the development of an Environmental Education Park as a community-based initiative to promote local biodiversity conservation and environmental learning. The program was implemented by the Laboratory of Forest Harvesting, Faculty of Forestry, Universitas Gadjah Mada, in Compartment 32 of the Tlogotuwung Forest Education and Tourism Area, Special Purpose Forest Area (KHDTK) Getas-Ngandong, Blora Regency, Central Java, Indonesia. The initiative involved more than 100 elementary school students from SD Negeri 1 Getas and SD Negeri 1 Tlogotuwung, teachers, local community members, and university volunteers. Activities included participatory site surveys, collaborative planning, and the planting of locally adapted tree species such as *Calliandra*, *Indigofera*, jackfruit, avocado, and other native fruit trees that are culturally and ecologically important to local communities. The results indicate that the program enhanced environmental knowledge among students, strengthened community participation in biodiversity conservation, and fostered collaboration between academic institutions, local communities, and supporting organizations. By integrating environmental education with locally valued tree species and community participation, the Environmental Education Park contributes to conserving forest diversity while reinforcing local cultural connections to forest resources. This initiative demonstrates how community-based environmental education can serve as a practical approach to linking forest biodiversity conservation with local cultural values and sustainable environmental stewardship.

Keywords: forest diversity; environmental education; community participation; local ecological knowledge; biodiversity conservation

Toward a decade of the implementation of the social forestry program in Indonesia

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Abstract

Social Forestry (SF) has been launched as a national policy program to achieve forest sustainability and improve communities' livelihoods by granting local communities legal access to forest resources. SF was launched in 2016 by the Ministry of Environment and Forestry (MoEF). The ministry has set a target of allocating 12.7 million hectares of state forest land for this program. This study aims to review the progress of social forestry implementation towards its first decade of implementation. This study relies on secondary data, including official statistics on social forestry (GoKUPS) issued by the ministry, documents, credible media sources, and scientific literature. The results show that, to date, the state forest lands allocated for social forestry have reached around 8 million hectares, with approximately 1,4 million groups of forest farmers receiving benefits. According to the scheme, the community forestry scheme (*hutan kemasyarakatan*) ranks highest among the schemes. However, few forest farmer groups have successfully created their business groups. Only approximately 16,000 forest farmer groups have established their businesses, and very few (around 130 groups) have achieved the highest predicate/category (platinum). Most of their businesses are based on non-timber forest products, with coffee dominating across the regions in Indonesia. This indicates that social forestry needs to be fostered not only through the granting of permits but, more importantly, in its business operation to realize its economic benefits for local communities.

Keywords: Social Forestry, Smallholders, Community Forestry, Community-based Forest Management, Small and Medium Enterprises

Culture and Biomass Energy development

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Biomass energy, derived from organic materials like wood and municipal waste, is the oldest energy source, used for heating and cooking since the discovery of fire. Currently, interest in the use of biomass for energy is increasing. The reason is that increasing fossil fuel utilization has resulted in environmental problems and climate change.

Biomass is one of the potentially renewable energy types, especially plant biomass. Biomass as fuel is a carbon-neutral material, as the other replanted plants will absorb back the emissions produced by the material utilization during their growth. This carbon cycle is why many consider biomass a carbon-neutral form of energy, which lowers the release of greenhouse gas and has fewer environmental impacts.

Several national policies have been put in place to develop biomass as an energy source and to promote large-scale biomass utilization for energy. Key conversion processes such as direct combustion, gasification, pyrolysis, anaerobic digestion, and fermentation are studied, along with their environmental and economic implications

For example, biomass densification through pelletizing is becoming the priority of various stakeholders, as pellets can be developed into a practical renewable energy resource.

The future of biomass energy development in the world depends on the culture, environmental awareness, and continued technological advancements, research, and policy support. As technology improves and economies of scale are achieved, and the cost of biomass energy decreases, Biomass will be a more competitive energy option

Keywords: Biomass, Renewable energy, Densification, pelletizing.

Traditional Knowledge and Community-Led Watershed Conservation in Coffee-based Agroforestry Systems in the Upstream Area of the Merawu Watershed

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Introduction

Over the last 30 years, intensive farming and forest conversion in the Upper Merawu Watershed region have significantly increased land degradation and landslide vulnerability¹. Climate-Smart Agroforestry (CSAF) emerges as one of a strategic solution, integrating ecological, economic, and social dimensions to enhance farmer resilience while restoring environmental health through sustainable soil and water management^{2,3}. In Binangun and Leksana Villages, agroforestry has been practiced throughout generations since 1980, combining coffee plants with leguminous shade trees. While this system offers substantial potential for carbon sequestration⁴, erosion control⁵, and economic stability⁶, comprehensive studies regarding its specific contribution to climate mitigation in this region remain limited. Therefore, this research aims to: (1) evaluate the soil and water conservation strategies implemented by the local community and (2) identify the factors influencing conservation practices among farmers.

Methodology

The research was conducted in Binangun and Leksana Village, Banjarnegara, located in the upstream area of the Merawu Watershed. Data collection was done in January - May 2025 through a census interview involving 30 farmers. This study utilized structured questionnaires to identify Soil and Water Conservation (SWC) strategies, then verified through aerial drone photography and field ground checks. Descriptive qualitative analysis was employed to evaluate the implementation of these conservation strategies as a local knowledge and adaptation to climate change.

Results and Discussion

1. *Integrated Soil and Water Conservation Practices within Coffee Agroforestry Systems*

Farmers in Binangun and Leksana Villages have integrated vegetative, technical, and agronomic SWC techniques within their coffee agroforestry systems (Figure 1). Beyond serving as a production system, coffee agroforestry also functions as the core community-based conservation strategy. These integrated practices demonstrate a strong connection between agroforestry management and local conservation knowledge rooted in farmers' experiences. This system also reflects farmers' understanding of ecological processes and their efforts to maintain long-term land productivity.

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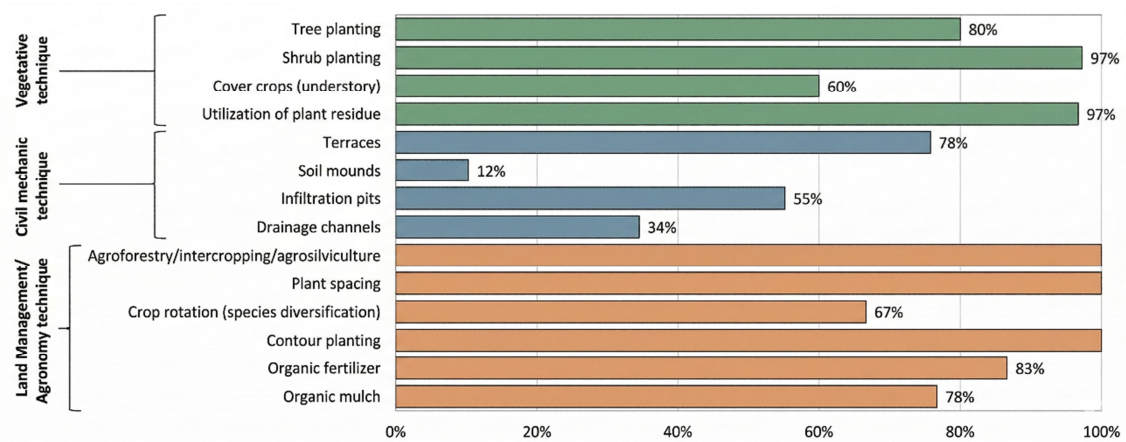


Figure 1. Soil and water conservation strategies practiced within the coffee agroforestry system in Binangun and Leksana Villages

2. Factors Influencing Farmers’ Adoption of Conservation Practices

Farmers’ adoption of conservation practices in Binangun and Leksana Villages is shaped by a combination of economic considerations, environmental conditions, and socio-institutional influences. Most farmers (80%) maintain shade trees (mostly Sengon (*Albizia chinensis*) and Nangka (*Artocarpus heterophyllus*)), which has other functions as “long-term savings” for financial security while regulating the microclimate for coffee quality. Farmers also manage a diverse multi-strata system to enhance soil fertility and reduce erosion. The steep terrain (30–60% slopes) also encourages 76% of farmers to maintain terraces, while 55% used the infiltration pit to capture runoff, trap sediment, and recycle organic mulch into the soil. These practices are further reinforced by local knowledge, where coffee agroforestry is regarded as a hereditary legacy that integrates economic livelihoods with ecological sustainability. Institutional support from the Farmer Group and agricultural extension has strengthened this system through knowledge exchange and training programs since 2003. However, this study also reveals an emerging trade-off, as economic pressure and labor shortages are prompting some farmers to shift toward intensive vegetable monocultures that provide faster financial returns but offer lower watershed protection.

Conclusion

The coffee agroforestry system demonstrates how local wisdom and community practices can support effective soil and water conservation in the Upper Merawu Watershed. By integrating vegetative, mechanical, and agronomic strategies, farmers have created a resilient blueprint for integrated SWC that doesn’t sacrifice land productivity for environmental stability. This system can serve as a resilient model for conservation in upstream areas. However, the long-term viability of this system depends on addressing the changing climatic conditions, economic pressures, and labor constraints that threaten to shift toward less sustainable intensive farming.

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Belambangan Biosphere Reserve supports wildlife corridors: evidence from population genetics of Rusa deer (*Cervus timorensis*) in Java, Indonesia

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The conservation of genetic diversity within a biosphere reserve is a crucial objective that necessitates the establishment of landscape connectivity. However, the assessment has been limited in recent years to few studies in facilitating the gene exchange. Here we reported the population genetics of an endemic Rusa deer (*Cervus timorensis*) in Belambangan Biosphere Reserve (BBR), Indonesia. Therefore, this study aimed to assess variation, population structure, and genetic admixture using microsatellite markers and non-invasive genetic samples. Feces samples were collected from Baluran, Meru Betiri, Alas Purwo, and Bali Barat national parks in 2022. DNA was also amplified at seven microsatellite loci, and amplicon length served as an allele identity. The results provided valuable information on genetic variations, as demonstrated by the absence of linkage disequilibrium between loci, high values of polymorphic content, and neglected heterozygote deficit. Furthermore, the genetic diversity of the deer was low to moderate ($H_e=0.28-0.59$; $H_o=0.02-0.34$, and $N_a=1.86-3.43$) due to population declines as evidenced by the bottleneck test. The presence of genetic exchange was evident by the sharing of alleles across all subpopulations, which indicated low levels of differentiation ($F_{ST}=0.15$). Migration and admixture also contributed to the preservation of genetic diversity and served as mechanisms to prevent the loss of alleles. Meanwhile, the exchange restored the genetic diversity of the deer species after experiencing a population decline. This initiative served to enhance the reserve as a conservation genetic area. Therefore, it is imperative to promote the exchange by ensuring that there is adequate landscape connectivity within the BRR.

Keywords: cervids, molecular, landscape, forests, endemic, conservation

Effects of Geographical and Climatic Factors on the Intrinsic Water Use Efficiency of Tropical Plants: Evidence from Leaf ¹³C

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Abstract: Understanding the water use efficiency (WUE) and adaptation strategies of plants in high-temperature and rainy areas is essential under global climate change. The leaf carbon content (LCC) and intrinsic WUE of 424 plant samples (from 312 plant species) on Hainan Island were measured to examine their relationship with geographical and climatic factors in herbs, trees, vines and ferns. The intrinsic WUE decreased with increasing altitude and relative humidity (RH) and wind speed (WS), but increased with increasing latitude, MAT and rainy season temperature (RST), indicating that geographical and climatic factors affect the intrinsic WUE. Stepwise regression suggested that in tropical regions with high temperature and humidity, the change in plant intrinsic WUE was mainly driven by WS. In addition, the main factors affecting the intrinsic WUE of different plant functional types of plants are unique, implying that plants of different plant functional types have distinctive adaptive strategies to environmental change. The present study may provide an insight in water management in tropical rainforest.

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Genetic variation of *Pinus merkusii* based on microsatellite markers to support the breeding of high-resin-yield

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Abstract

Superior materials for developing high-resin-yield pine were obtained from *Pinus merkusii* mother trees. These trees were selected through the breeding of subline populations from seedling seed orchards and pine plantations in East Java and Sulawesi, Indonesia. Selection has been shown to reduce genetic variation. Therefore, subline populations are expected to manage kinships. We evaluated the genetic variation in progeny-tested subline populations of high-resin-yield *P. merkusii* using four microsatellite markers. The research revealed high genetic variation within each subline population (mean $H_E=0.409$; range=0.392–0.425). However, the Sumedang, East Java, and Sulawesi subline populations exhibited high inbreeding potential, as indicated by their high F_{IS} values (0.133–0.332). The genetic differences among the observed populations were low (F_{ST} 0.011), indicating closed relatedness among populations. Progeny-tested subline populations of high-resin-yield *P. merkusii* can maintain genetic diversity and have the potential for development as orthets for vegetative propagation. Furthermore, after evaluation and final roguing, the converted progeny test into a seed orchard can produce genetically improved seeds. In the future, it will be essential to increase the outcrossing rate in the subline populations and infuse genetic material from other populations in order to maintain genetic resources and broaden the genetic base.

Keywords: progeny test, breeding program, subline population, productivity.

The Role of Soil Macrofauna in the Decomposition Process of Mahogany Litter in the Wanagama Educational Forest, Yogyakarta, Indonesia

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Abstract

Mahogany is a forestry plant that has high economic value. This wood has a beautiful color and is widely used as a building material and furniture making material. Soil fertility is determined by three components: physical, chemical, and biological components of the soil. Soil macrofauna is one of the biological components of the soil that can play an important role in the process of litter decomposition. This study aims to determine the type and abundance of soil macrofauna in mahogany stands and their role in decomposing litter both physically and chemically. The abundance of soil macrofauna was studied using the hand-sorting method. The study of the role of soil macrofauna in decomposing litter was conducted using litter bags with a mesh size of 0.5 mm (no access to soil macrofauna) and 5 mm (with access to soil macrofauna) filled with litter and then placed on the mahogany forest floor. Physical decomposition was observed by weighing the litter every two months. In the laboratory, the ability of soil macrofauna to decompose litter was determined by keeping the animals and providing mahogany litter. C and N analysis was conducted on the remaining litter and feces. The results of the study showed: 1. The abundance of soil macrofauna (decomposers) such as Oligochaeta, Isopoda, Isoptera and millipede in mahogany stands in Wanagama Forest is still low. 2. The role of soil macrofauna in the field in the decomposition process of mahogany litter is relatively small because the macrofauna population is also relatively small. 3. *Spirobolus* sp has the potential to be developed as a decomposer in mahogany stands.

Keywords: Soil macrofauna; mahogany litter; decomposition; C/N ratio;

Identification of Stem Borer Pests and Damage Description in Clove Plants (*Syzygium aromaticum* L.)

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Abstract

Clove (*Syzygium aromaticum*) holds significant economic value, particularly in community forests, yet it is susceptible to attacks by stem borers. Research has focused on identifying pest species, notably stem borers, which damage clove stems considerably. The study aimed to identify the species and obtain their biological characteristics and the damage they cause. Observation of damage to clove trees is carried out in the community clove forest located in Borobudur District, Magelang Regency. Sample plots measuring 20 x 20 m² were established, and the clove plants were categorized by growth stage: saplings, poles, and mature trees. The findings confirmed that *Notopheus* sp. is the primary clove stem borer (CSB). The characteristic symptoms observed on the surfaces of clove tree stems include attack holes and wood powder (frass). Internal damage in the stems is indicated by upward tunneling that forms galleries. A total of 215 clove trees at various growth stages were examined, consisting of 94 pole-stage, 36 sapling-stage, and 85 tree-stage individuals. The infestation area in the clove forest was 50.23%, with the highest incidence in the tree stage at 69.9%, followed by the pole stage at 55.1% and the sapling stage at 4.2%. Notably, damage intensity varies by growth stage, with the tree stage (28.8%), pole stage (20.7%), and sapling stage (0.8%). The data analysis reveals a positive correlation between stem diameter and the number of borer holes ($R^2=0.1123$), suggesting that other factors may also influence the occurrence of attacks.

Keywords: Clove Stem Borer, Damage Assessment, Growth Stage, *Notopheus* sp.

Wildlife Diversity in the Fragmented Forest Area on the North Slope of Mount Lawu, Ngawi Regency, East Java Province, Indonesia

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Abstract

The northern slopes of Mount Lawu lack data on biotic, physical, and socioeconomic potential. Most of the land on the eastern slopes of Mount Lawu has been converted to plantations and agriculture. Biotic potential exploration is primarily aimed at identifying the faunal potential of the converted land in the area. This exploration of faunal potential is essential because fauna can serve as indicators of environmental damage. The specific objective of this research is to determine the distribution and diversity of fauna species on the northern slopes of Mount Lawu. The long-term goal is to provide a database on fauna, particularly in the Mount Lawu area, to inform area management.

The methods used in this study are the point count method for bird observations, the line transect method for mammal observations, and the Visual Encounter Survey (VES) with a transect design for observing the fauna. The collected data include species name, number of individuals/species, and position within the environment. The Shannon-Wiener diversity index is then used to determine fauna diversity. Distribution is analyzed by processing the coordinates of encounter points with fauna using ArcView 3.3.

The research identified 37 bird species, belonging to 25 families. The most dominant species were Sooty-headed Bulbul (*Pycnonotus aurigaster*) (37.40%), Striated Grassbird (*Megalurus palustris*) (12.99%), and Small minivet (*Pericrocotus cinnamomeus*) (11.02%). In the western forest patch, 27 bird species were identified, belonging to 19 families. 7 of them are protected bird species based on Law No. 32 of 2024 and Government Regulation No. 7 of 1999. In the eastern forest patch, 17 bird species were identified, belonging to 15 families. 3 of them are protected bird species. In the tea plantation area, 26 bird species were identified, belonging to 19 families. 4 of them are protected bird species. Across the entire research site, five mammal species were identified, belonging to five families, one of which is a protected species. Plantain squirrel (*Callosciurus notatus*) is the dominant species throughout the area. Field observations of herpetofauna identified 11 species across eight families. No protected herpetofauna species were found. Three endemic species were found: one endemic to Indonesia, White-lipped Frog (*Hylarana chalconota*), and one endemic to Java, Javan Torrent Frog (*Huia masonii*). The bird diversity index across all study sites was 2.45, indicating moderate diversity. The western forest patch had a diversity index of 2.35, the eastern forest patch a value of 2.01, and the tea plantation area a value of 2.26. Mammals had a diversity index of 0.72, indicating low mammal species diversity in the study sites. The herpetofauna diversity index across all study sites was moderate, at only 1.58. All identified bird species were distributed throughout the observation trails. Nearly all protected bird species could be found along these trails. A particularly interesting distribution pattern was that raptors, including the Bido serpent eagle, the black kite, and the Asian honeyeater, shared a common route between the western forest patch and the tea plantation area. Nearly all identified mammal species were distributed throughout the observation trails. Interestingly, the squirrel was found only in the forest patches, while the civet, the porcupine, and the garangan were more common in the tea plantation area. Herpetofauna was mostly found in the tea plantation area and the edges of the forest patches.

Kata kunci : Diversity, Wildlife. distribution, Forest patch, Lawu mountain

Fire Regime and Post-Fire Plant Community Dynamics in Tropical Peat Ecosystems of Central Kalimantan, Indonesia

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Tropical peat ecosystems play an essential role in maintaining floral diversity, providing wildlife habitat, regulating hydrological processes, and serving as significant carbon pools. However, wildfires have become a serious threat to these ecosystems, particularly during El Niño events. Sebangau National Park represents the largest inland peat ecosystem in Central Kalimantan, Indonesia. Despite its status as a conservation area, this national park has experienced repeated wildfires between 2003 and 2023, making it increasingly vulnerable to ecosystem degradation. Following wildfire disturbances, healthy ecosystems possess the capacity to recover naturally through ecological resilience. In addition to releasing substantial carbon emissions, fire disturbances may also alter ecosystem structure through changes in plant community dynamics. Understanding ecosystem responses to fire disturbances is therefore essential for national park management, particularly as part of strategies aimed at maintaining peatland sustainability.

This study aimed to evaluate plant community dynamics under different fire disturbance regimes, specifically fire frequency and time since the last fire. Ecosystem responses through natural succession following fire disturbances were assessed using plant inventories combined with silvicultural and ecological analyses. A total of 33 nested vegetation inventory plots (20 × 20 m) were established using a stratified sampling approach across Sebangau National Park. All plant life stages, including seedlings, saplings, poles, and trees, were recorded during the inventory. Plant community patterns across different fire scenarios were analyzed using diversity indices, similarity indices, Non-metric Multidimensional Scaling (NMDS), Permutational Multivariate Analysis of Variance (PERMANOVA), and Similarity Percentage Analysis (SIMPER).

The results indicate that fire frequency strongly influences plant community composition at the seedling stage, while time since the last fire significantly at the seedling to tree stages (p-value: 0,05). Plant communities in burned peat ecosystems exhibit distinct structural characteristics and species dominance compared to those in unburned peat ecosystems.

Keywords: Fires, Tropical Peat, Plant Communities, Diversity, Tree Species

Carbon Sequestration of Sequential Rehabilitation Planting in the Methanol Park Arboretum, Bontang, East Kalimantan

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Abstract

The Methanol Park Arboretum in Bontang has undergone a systematic ecological restoration process initiated in 2016 and executed in annual phases through 2025. This sequential approach is designed to mitigate industrial carbon emissions while restoring local ecosystem functions within a fragmented landscape. The primary objectives of this study were to quantify the total carbon stock accumulated across the 5.6 hectares rehabilitation area and to evaluate the sequestration efficiency of various planting cohorts, ranging from early pioneer stands to recent enrichment plantings.

The research employed a systematic sampling method, establishing 22 nested plots across the 5.6 hectares site to capture the structural diversity of the vegetation. Each nested plot consisted of 20x20 m for trees, 10x10 m for poles, 5x5m for saplings, and 2x2m for seedlings. Data analysis followed the guidelines provided by the Intergovernmental Panel on Climate Change (IPCC), utilizing allometric equations to estimate above-ground biomass (AGB) based on diameter at breast height (DBH) and wood density. Carbon stock was subsequently calculated by applying a carbon fraction factor of 0.47 to the total biomass. Statistical comparisons between planting years were conducted using regression analysis to determine the correlation between stand age and carbon density.

The results indicated a significant increase in carbon storage, with total carbon stocks reaching approximately 485.20 Mg C across the entire 5.6-hectare area. Older stands from the 2016–2018 cohort, dominated by *Paraserianthes falcataria* and *Acacia mangium*, exhibited the highest carbon densities (85.40 Mg C/ha), while younger enrichment plots featuring *Alstonia scholaris*, *Shorea sp.*, and *Cerbera manghas* showed promising growth rates. In conclusion, the sequential rehabilitation strategy has effectively transformed the arboretum into a substantial carbon sink, with an average annual sequestration rate of 8.60 Mg C/ha/year. These findings demonstrate that phased planting and species diversification are critical for achieving long-term carbon stability and structural complexity in industrial rehabilitation projects.

Keywords: Carbon Sequestration, Sequential Rehabilitation, IPCC Guidelines, Arboretum, Biomass Allometry

Effect of Thinning on the Chemical Properties of Clonal Teak Trees

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Superior teak clones (Jati Plus Perhutani) has been developed by the Perhutani Enterprise (state-owned company) through breeding program in various locations. Thinning at the proper spacing is one way to boost the productivity of forest plantations. The purpose of thinning is to lower stand density, which lessens competition. The objective of this research was to examine the impact of thinning and within-tree variation (axial and radial position) on the chemical properties of clonal teak. The wood chemical properties were investigated on 20-year-old trees planted in Ngawi, East Java. Results showed that thinning treatment significantly affected the extractive and cellulose content. The levels of cellulose and hexane soluble extract increased with thinning treatment. However, the amount of soluble extract of sapwood obtained from thinned stand was lower than those of wood from non-thinned stand. The axial direction factor affected the pH values and cell wall components whereas the radial direction affected the extractive contents and cell wall components. The amounts of cellulose and lignin contents decreased, while the hemicellulose content increased from the bottom to the top. The heartwood gave significantly lower values than the sapwood in lignin content and higher in cellulose and hemicellulose contents. This result suggests that thinning might improve the durability and strength properties of teak clone.

Terrestrial Laser Scanning for Three-Dimensional Tree Architecture : Application in Jate Mega (*Tectona grandis* L.f.)

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Abstract

As a ground-based LiDAR technology, Terrestrial Laser Scanning (TLS) offers exceptional spatial resolution for capturing fine-scale tree structural attributes. Despite these advantages, its capability to represent architectural elements of trees remains insufficiently evaluated. This study aims to evaluate the capability of TLS in reconstructing trees in three dimensions based on Halle's tree architectural theory. The research was conducted in the Jati Mega stand, Plot 13, KHDTK Wanagama. Point cloud data were acquired using a Trimble SX-10 TLS with a four-station scanning configuration around each tree to minimize occlusion. The acquisition produced high-density data of approximately 11,000 points m⁻². Structural reconstruction was conducted using the L₁-Tree algorithm based on the L₁ Median. To enhance leaf phyllotaxis identification, wood-leaf classification was performed using the LeWoS algorithm in a fully automated configuration. The findings of this study show that the main stem, branches, and twigs of *Tectona grandis* can be reconstructed. Six tree architectural elements with visual and geometric characteristics were successfully represented through the TLS-based model, including axis growth, axis form, growth rhythm, branching rhythm, branching pattern, and leaf distribution. However, physiological elements such as growth limitation, and flowering position could not be modelled. The results confirm that TLS provides a reliable means of analyzing tree architectural models, although it remains limited in capturing physiological aspects.

Keywords: Terrestrial Laser Scanning (TLS), Point Cloud, 3D Tree Modelling, L₁-Tree, Tree Architecture, Stem and Branching

Land Suitability and Capability Analysis for Evaluating the Land Use in Achieving Sustainable Land Management in Banyumanik, Gunungkidul

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Abstract

Banyumanik sub village is an area that has been geomorphologically shaped by the solutional process of karst rock, and it features various land uses. Improper land management based on these characteristics can lead to land degradation, primarily through erosion and sedimentation. Erosion depleted the land of nutrients, diminishing the soil layer and resulting in critical land areas. This study aims to assess the current land uses, analyze land reserves and capabilities, and provide recommendation for land use aligned with these capabilities and reserves. The research employs survey techniques and map overlay using ArcGIS software. Sampling points were determined through random sampling. Analysis of land capability and suitability utilized the guidelines from the Indonesian Minister of Environment Regulation Number 17 of 2009 and overlay maps. The analysis revealed five types of land use in Banyumanik, covering a total area of 177.22 hectares. The land capability was classified into three categories: Forest (Class V), Residence (Class I), Rained Rice (Class III), Field Land (Class V) and Shrub (Class III). Based on this classification, the use of Forest Land, Residence, Rained Rice and Shrub is appropriate. However, the use of Field Land is deemed unsuitable as it falls under Class V. To improve land usage in Banyumanik, Field Land should be integrated with tree species, such as Teak (*Tectona grandis*) within an agroforestry system.

Keywords: erosion, conservation, agroforestry, teak, forest.

Risk Framing and Institutional Legitimacy: Cultural Lenses to Understand Oil Palm Governance in Tesso Nilo National Park, Indonesia

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Abstract

The rapid expansion of oil palm plantations within Tesso Nilo National Park in Riau, Indonesia, represents one of the most critical governance challenges in the management of protected areas in Southeast Asia. Originally designated to conserve lowland forest ecosystems and protect key species such as the Sumatran elephant (*Elephas maximus sumatranus*), the park has experienced extensive land-use change, with a significant proportion of its area converted into oil palm plantations by both companies and smallholders. This paper applies the Cultural Theory of Risk, developed by Mary Douglas and Aaron Wildavsky, to analyze how different actors frame risks, benefits, and legitimacy regarding oil palm cultivation within the national park. Using a qualitative analytical approach grounded in a literature review, policy analysis, and the interpretation of governance dynamics, the study examines how cultural perspectives shape institutional responses and stakeholder behavior. The analysis identifies four dominant cultural archetypes — hierarchist, individualist, egalitarian, and fatalist — that influence how actors perceive environmental risks and justify land-use practices. Government institutions tend to adopt a hierarchical perspective emphasizing conservation rules and regulatory enforcement, including resettlements of the people, while local farmers and their industrial processing networks often frame oil palm cultivation through an individualist lens that prioritizes livelihood security and economic opportunity. Civil society organizations typically adopt egalitarian narratives emphasizing environmental justice and ecological protection, whereas marginalized groups may display fatalistic attitudes due to limited access to decision-making processes. These divergent cultural frames contribute to persistent conflicts and undermine the legitimacy of conservation governance in the park. The study argues that effective governance of protected areas requires recognizing these plural cultural perspectives and integrating them into more inclusive institutional arrangements. By incorporating cultural risk framing into policy design, conservation strategies may better reconcile ecological objectives with local socio-economic realities in contested forest landscapes.

Climate and Vegetation Factors Determine the Probability of Tropical Forest Fires in Hainan Island During the Dry Season

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Abstract

Forest fires are a significant global ecosystem disturbance, profoundly impacting biodiversity, carbon cycling, and socio-economic security. Understanding the seasonal patterns of forest fire occurrence is crucial for developing effective prevention and control strategies. However, research on the seasonal dynamics of forest fires in the tropical forests of China's Hainan Island remains scarce, and understanding of the underlying driving mechanisms, particularly in relation to the distinct dry and rainy seasons, is still insufficient. This study aims to analyze the patterns of forest fire occurrence in Hainan Island from 2000 to 2022 across both dry and rainy seasons. We classify the drivers of tropical forest fires into seasonal and non-seasonal factors, utilizing random forests and partial dependence plots to identify the driving mechanisms under different seasonal patterns. We construct predictive models for tropical forest fires using emerging machine learning algorithms and traditional logistic regression for both the dry and rainy seasons, examining the models' applicability. Results show that tropical forest fires in Hainan Island are primarily concentrated from January to May, peaking in April, with a lagged effect relative to the dry season months (November to April of the following year). Monthly average temperature and precipitation are common drivers of fire occurrence probability in both seasons. However, during the dry season, the significant drivers also include the Normalized Difference Vegetation Index (NDVI). The predictive accuracy of the random forest model consistently surpasses that of the traditional logistic regression model in both seasons. Additionally, our models accurately depict forest fire probability maps, highlighting risk areas in Hainan Island during both seasons. Our findings provide new insights for wildfire prevention strategies in tropical regions.

Analysis of Bird Species Diversity at Selo Resort, Mount Merbabu National Park

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ABSTRACT

Birds play a crucial role in maintaining ecosystem functions and serve as key indicators of environmental quality. Understanding avian diversity within protected areas is essential for effective conservation management. This study aimed to analyze bird species diversity, conservation status, and feeding guild composition at two hiking trails within Selo Resort, Mount Merbabu National Park (TNGMb), Central Java, Indonesia. Field observations were conducted from June to July 2025 using a combined point count and line transect method along the Selo trail (approximately 1,636 m a.s.l.) and the Gancik trail (approximately 1,850 m a.s.l.). Observation points were established at 200-meter intervals with a 50-meter radius and a 10-minute observation period at each point to avoid double counting. Species diversity was calculated using the Shannon–Wiener index (H'), evenness index (E), and dominance index (C). A total of 39 bird species comprising 146 individuals were recorded along the Selo trail, yielding a Shannon–Wiener index of 3.040, an evenness index of 0.894, and a dominance index of 0.063, indicating a highly diverse, evenly distributed community with no dominant species. In contrast, the Gancik trail recorded 31 species with 119 individuals, with a Shannon–Wiener index of 2.395, an evenness index of 0.814, and a dominance index of 0.126, suggesting moderate diversity with a tendency toward dominance by certain species, particularly the Pygmy Wren-Babbler (*Pnoepyga pusilla*) and the Striated Grassbird (*Megalurus palustris*). Feeding guild analysis revealed that the Selo trail supported a wider range of guilds, including insectivores, frugivores, granivores, carnivores, and nectarivores, whereas the Gancik trail was predominantly composed of insectivores and granivores. The presence of the Black Eagle (*Ictinaetus malayensis*), a nationally protected apex predator, along the Selo trail indicates a relatively intact food chain. Differences in diversity between the two trails are attributed to variations in vegetation complexity, altitude, and levels of human disturbance. These findings suggest that the Selo trail functions as a core conservation habitat requiring strict protection, while the Gancik trail may benefit from habitat rehabilitation and regulated ecotourism development. This study provides baseline data to support biodiversity management and sustainable ecotourism planning within Mount Merbabu National Park.

Keywords: *bird diversity; Shannon–Wiener index; feeding guild; conservation; Mount Merbabu National Park*

Stakeholder Mapping on Indonesian Community Based Protected Area, Baros Mangrove Ecosystem Essential Area Case Study

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Abstract

Based on Indonesian Law No. 5 of 1990 concerning the Conservation of Biological Diversity and Their Ecosystems, all conservation areas in Indonesia are state-based protected areas, meaning these areas are located on state land and managed by the government. However, in actual practice, there are also areas with functions similar to conservation areas managed by other parties (*Non-state actors*). In the new conservation law (Law 32 of 2024), these are known as preservation areas. One such example is the Baros Essential Ecosystem Area in Bantul Regency, Special Region of Yogyakarta. Baros was designated as an Essential Ecosystem Area based on the Decree of the Governor of the Special Region of Yogyakarta No. 247/KEP/2022. The designation of the Baros essential ecosystem area was a long process involving many parties. The involvement of these various parties is interesting to study in depth. This research aims to map the parties involved in the management process of the Baros ecosystem area from the initial stage, development stage, consolidation stage, and maturity stage.

This research uses a qualitative research approach. Data collection was carried out by conducting interviews with managers and related parties, as well as tracing secondary data. Data analysis was performed using the Institutional Development Framework method and a stakeholder mapping approach.

The research results indicate that there were 11 influential stakeholders in the initial management stages of the Baros Mangrove Ecosystem Area, including government agencies, communities, donors, and non-governmental organizations. In the subsequent stages, namely the development and consolidation stages, the number of stakeholders involved in the management of the area decreased to only 9 stakeholders. The current management institution of the Mangrove essential ecosystem area has not yet reached the mature stage, so stakeholder mapping was only carried out at the initial, development, and consolidation stages. Non-Governmental Organizations were only present in the initial stages of the management of the Baros Mangrove essential ecosystem area; the involvement of NGOs disappeared as the management stages progressed. The government, at the central, provincial, district, and village levels, was present in all stages of management, although through different agencies. Likewise, the community, which is a key player in the management of the Baros Mangrove essential ecosystem area, was present in all stages of management.

Characteristics of Wild Edible Plants in Japan

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Introduction

In the modern Japanese diet, wild edible plants rarely appear. Additionally, nearly all agricultural products distributed in Japan originate from plants native to regions outside Japan.

The Japanese archipelago, with its warm and humid climate, boasts rich vegetation. Many plants survived the Ice Age, and Japan is considered to have high plant species diversity among mid-latitude regions. The people living on the Japanese islands have utilized various plants found in their surroundings for food, building a unique food culture.

This study aims to provide an overview of wild edible plants once consumed in Japan and clarify their characteristics.

Materials and Methods

The source material used was the "Complete Collection of Dietary Habits in Japan". This compilation gathers information obtained through oral interviews about dietary practices from around 1920 to 1930. For each prefecture, 3 to 7 survey locations were designated.

From this material, wild edible plants consumed at each location were extracted and tabulated by species. For species identified as edible, analysis focused on their life forms and habitat environments.

Results and Discussion

66 wild edible plant species were identified. The top ten species by frequency are listed in the table. Among these, woody plants accounted for 13 species, while herbaceous plants overwhelmingly dominated with 53 species. Only one vine species was identified. Focusing on the growth environments of herbaceous plants, many preferred open areas like grasslands, whereas woody plants tended

Standard Japanese Name	Scientific name	frequency (%)
Fuki 蕨	<i>Petasites japonicus</i>	76.6
Warabi 蕨	<i>Pteridium aquilinum</i>	74.3
Zenmai 薇	<i>Osmunda japonica</i>	57.1
Yomogi 蓬	<i>Artemisia princeps</i>	49.4
Udo 独活	<i>Aralia cordata</i>	43.3
Seri 芹	<i>Oenanthe javanica</i>	41.0
Taranoki 楡	<i>Aralia elata</i>	33.3
Nobiru 野蒜	<i>Allium macrostemon</i>	22.2
Mitsuba 三葉	<i>Cryptotaenia japonica</i>	20.7
Tsukushi 土筆	<i>Equisetum arvense</i>	19.2

Source: "Complete Collection of Dietary Habits in Japan"

to be species appearing in the early stages of succession. This suggests that human disturbance, which created vegetation environments near human settlements, significantly contributed to the formation of a culture utilizing wild plants as food. Furthermore, all herbaceous plants were perennials. Consequently, it is considered unlikely that domestication occurred from wild plants in Japan.

An Initiative to Hold Classical Music Concerts in the Forest to Help Local Residents Appreciate the Cultural Benefits of the Local Natural Environment

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Introduction

Modern Japanese lifestyles, whether urban or rural, no longer require direct interaction with forests. As a result, many people today have likely lost the basic knowledge and skills that were once essential for entering forests for various purposes—such as gathering, traveling, or obtaining fuel—which were commonly possessed by people in the past. Furthermore, communities where people used to work together to utilize forests—sharing knowledge and skills with one another in the process—are rarely seen today. Forests intended for communal use have nearly disappeared except in very few regions, and even where they do exist, their utilization has become rather inactive. These factors are thought to be part of the reason why, despite the presence of many nearby forests with the potential to be used for various activities, their utilization by local residents has not progressed significantly.

Using a portion of the forests managed by Fuji Iyashinomori Study Center, the University of Tokyo Forests, we have created a space and system that enables a series of ongoing experiences. In this framework, local residents propose ideas and develop plans, collaborate with university forest staff to carry out forest management tasks, and create and utilize spaces where they can enjoy various forest-based activities. These activities, which involve local residents, can be described as a social experiment aimed at fostering knowledge and skills related to forest management, as well as communities that collaboratively utilize forests, through the ripple effects they generate in the region, and at verifying the effectiveness of these efforts.

A Record of Six Classical Music Concerts Held in a Forest Setting

In 2019, we built a wooden open-air terrace in front of the Iyashinomori Lecture Room using larch wood harvested from the university forest. We envisioned the space as a place for people to relax during forest walks, enjoy meals and coffee among the trees, or host art exhibitions and music concerts. A series of fortunate coincidences led to the decision to hold a concert on that open terrace within the forest, featuring a string trio from the NHK Symphony Orchestra "Classic Encourage" who were seeking performance opportunities after concerts were suddenly canceled due to the COVID-19 pandemic. This project was made possible by the trust built over time among the Fuji Iyashinomori study center, local residents, the local government, and other stakeholders. Believing it would serve as a good test case for activities involving local residents and utilizing nearby forests, we continued to hold this event six times in total from 2020 to 2025, making small adjustments and improvements each year.

- **August 30, 2020:** Led by the Iyashinomori-no-kai, we prepared the forest venue so that the general public could enjoy the concert safely and comfortably. Under the local government's health promotion point system, participation in this concert was designated as an eligible event, and visitors arriving by car were directed to the village office parking lot. The Omotenashi Club, a group of local youth, provided light refreshments and coffee at the venue early in the morning. Despite challenging conditions such as morning dew and rapidly changing humidity as the sun rose, the NHK Symphony Orchestra String Trio delivered exquisite music. The audience fully enjoyed both the refreshing early-summer forest atmosphere and the sublime music. Approximately 200 people attended, 100 survey

forms were collected, many guests brought their dogs (approximately 20), and total donations reached 219,800 yen.

- **June 27, 2021:** To encourage participation from Yamanakako Village residents and facilitate the event as a village-organized project, we held an Afternoon Concert at the outdoor music stage Theater Hibiki and an Twilight Concert on the forest terrace—the same location as in 2020—on the same day. The afternoon concert raised 116,000 yen in donations, while the twilight concert raised 74,000 yen. Although many guests attended the twilight concert, darkness made it difficult to handle outdoor registration and collect feedback forms. We also invited local elementary and junior high school students to participate in an instrument experience program. Packing so many events into a single day caused staff to be spread too thin, making operations quite challenging.

- **July 26–30, 2022:** Based on the previous year's reflections, we titled the event "Classical Music and Forest Time in the Iyashinomori." Performers stayed in Yamanakako Village for five days, allowing multiple programs to be carried out with ample time while using remaining hours to deepen interactions with local residents. Sponsorship funds raised were 66,800 yen for the Evening Concert and 101,000 yen for the Early Bird Classic Concert in the forest, with 45 and 69 survey responses collected respectively.

- **July 11–16, 2023:** Continuing from the previous year, the event was held under the title "Artist in Residence, YAMANAKAKO 2023," with performers carrying out multiple projects during their six-day stay. During this period, performers experienced hunting guided by local fishermen and forest walks around the research institute led by a University of Tokyo researcher. Despite poor weather, nearly 100 participants attended the Lakeside Bonfire Concert, with donation revenue totaling 84,000 yen. A visiting performance at Nishikatsura Children's Center attracted an audience of 80 children and was very lively, with questions flying back and forth. An instrument-playing workshop was also held for local elementary and junior high school students. The Early Bird Classic Concert in the Forest drew approximately 200 attendees, with donation revenue amounting to 179,000 yen.

- **July 12–15, 2024:** To streamline operations, we focused on two projects: school visiting performances and the Early Bird Classic Concert in the Forest. The visiting performances at local schools were very well-received, with strong demand from the schools for continuation. The Early Bird Classic Concert attracted approximately 200 attendees, 100 questionnaires were collected, and sponsorship revenue totaled 199,050 yen.

- **July 11–14, 2025:** The event was implemented with further efforts to streamline operations compared to the previous year. With the sponsorship of a local bakery that had expressed willingness to help in the previous year's survey, bread was distributed and sold at the Early Bird Classic Concert in the Forest venue. Attendance exceeded 300 people, donations totaled 336,500 yen, and 126 surveys were collected. The village office parking lot was completely full, and it appears that word of mouth from repeated events has effectively spread awareness of the Early Bird Classic Concert in the Forest.

Summary

By repeatedly implementing similar events while making adjustments, we were able to run the Early Bird Classic Concert in the Forest smoothly, and the number of attendees increased significantly. However, since the venue is a forest with limited capacity and insufficient nearby parking, it is becoming difficult to continue holding the event at the same location. Returning to the original purpose of the project—sharing the know-how for organizing such events with local residents—it is believed necessary to continue the initiative not only in the university forest but also by utilizing various other forests within Yamanakako Village, while involving a diverse range of stakeholders.

Current Management Practices and Resident Awareness Regarding Mangrove Forests in Okinawa Island, Japan

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Introduction

Mangrove forests have gained increasing importance as sources of timber and non-timber forest products, as well as for their role in carbon sequestration (blue carbon). In many developing countries where mangroves are widespread, concerns have emerged about overuse, including large-scale logging for firewood and conversion for aquaculture. On the other hand, few studies depicted the current state of mangroves in developed countries.

Okinawa Island, one of the few subtropical regions in Japan, hosts mangrove forests across the island. Previous studies in Okinawa have primarily examined customary uses of mangroves and their management as tourism resources. However, no research has comprehensively described the current state of mangrove management across the entire island. By examining the case of Okinawa Island, which includes mangrove forests in tourist destinations and urban areas, valuable insights could be gained for developing countries experiencing economic growth.

This study clarifies the present state of mangrove conservation and management on Okinawa Island by examining 51 sites across 19 municipalities. It investigates how the location and size of mangrove forests relate to the intentions and practices of the groups responsible for their management, to provide recommendations for improved management in regions experiencing urban growth. Data was collected primarily through interviews conducted between October 2025 and January 2026. We visited community centers near mangrove forests and asked residents whether management activities were being carried out. Where such activities were identified, we further inquired about their frequency, content, and associated challenges. The Specified Nonprofit Corporation ManGlobal provided location data for mangrove forests.

Results

The figure illustrates the status of management activities across the surveyed mangrove forests. Regular management activities were confirmed in 5 sites (9.8%). At 13 sites (25.5%), interview indicated that occasional management activities were carried out, rather than regularly. No evidence confirming the implementation of management activities were obtained for 28 sites (54.9%). Surveys could not be conducted at 5 sites (9.8%) due to factors such as the absence of nearby settlements or the inability to verify the presence of mangroves.

The average area of mangrove forests in sites where management were confirmed was 2.39 (\pm 3.22) ha, which was substantially larger than the average area of 0.59 (\pm 0.77) ha in sites where management could not be confirmed. These results suggest that smaller mangrove forests are less likely

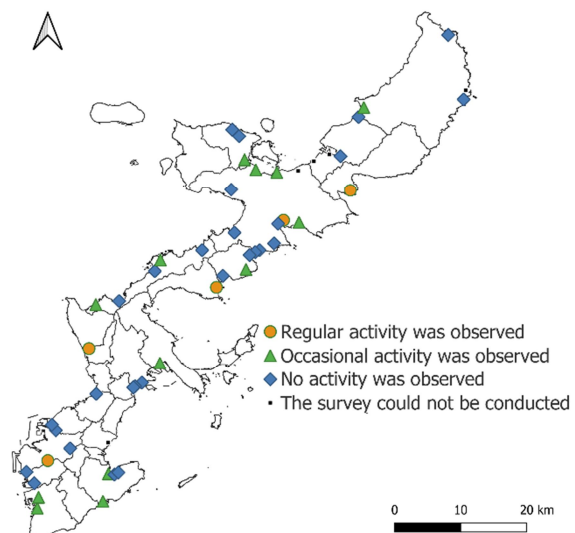


Figure: Location of Mangrove Forests
Prepared by presenters from National Spatial Planning and Regional Policy Bureau, MLIT of Japan, and Specified Nonprofit Corporation ManGlobal.

to be subject to active management.

Regarding perceptions of mangrove forests, positive views were reported in 23 sites (45.1%), negative views in 4 sites (7.8%), mixed opinions in 4 sites (7.8%), and expressions of disinterest in 15 sites (29.4%). Interview responses indicated that mangroves are valued as important natural environments and are utilized in some areas for tourism and environmental education activities. Conversely, concerns were raised about the accumulation of garbage within mangrove areas and the obstruction of waterways caused by mangrove growth and sediment deposition. There were documented cases of sapling removal and the felling of mature trees to prevent the expansion of mangrove habitats, as well as several instances of clear-cutting.

Examples of management activities were identified in Area A in the southern part of the island, Area B in the central region, and Area C in the northern region. In Area A, mangrove forests are located within wetland ecosystems and are managed to maintain habitats for waterfowl. Volunteer members conducted activities approximately once a month, including litter removal and the selective removal of excess saplings to maintain ecological balance.

The representative of the organization responsible for managing Area A expressed concerns regarding the long-term continuity of these activities, given their heavy reliance on volunteer participation. They also pointed to the absence of clear legal or institutional guidelines for mangrove management and emphasized the need to develop structured post-planting maintenance plans to ensure sustainable management.

In Area B, mangrove forests are situated along river systems, with the prefectural government designated as the responsible administrative authority. However, no management activities by the prefecture were observed during the survey. Instead, cleanup activities within the mangrove forests were undertaken by a local business that operates kayak tours in the area. The representative of this organization indicated an intention to plant additional mangroves to expand forest cover. Nevertheless, because the prefecture holds formal administrative authority over the site, the organization has been unable to proceed with planting activities, highlighting constraints associated with administrative jurisdiction and procedural requirements.

In Area C, the mangrove forests are located along river systems and are designated as National Natural Monuments. Within these forests, canoe tours and guided observation tours are conducted, and a nonprofit organization has been actively promoting mangrove management initiatives. The organization has established site-specific guidelines for observation activities and collects environmental cooperation fees to support conservation efforts and preserve the natural environment. At the same time, some residents expressed concerns that the natural monument designation has restricted traditional practices, such as harvesting crabs for food. Others noted that the increase in tourism has reduced the availability of quiet spaces within the village, indicating emerging tensions between conservation, tourism, and local livelihoods.

Discussion

In Okinawa Island, more than half of the surveyed mangrove forest sites, predominantly small, were found to have no active management in place. In approximately 30% of the areas, residents expressed little to no interest in mangrove forests, and in some cases, negative perceptions were reported. These findings suggest that certain mangrove forests are regarded less as valuable ecosystems and more as undesirable vegetation within local communities.

In sites where management activities were being implemented, interview indicated a reliance on volunteer, raising concerns regarding the long-term sustainability of such efforts. Respondents also noted that management initiatives were sometimes hindered by the complex organizational structures of responsible bodies. In areas where mangroves were promoted for tourism, residents experienced partial restrictions on access. To support management activities in areas willing to engage in conservation, it is essential to clearly define the responsible managing authority and to establish or streamline relevant administrative procedures. Furthermore, when promoting mangrove utilization for tourism, it is necessary to create forums for dialogue and consensus-building with residents to ensure inclusive and sustainable management practices.

Visualizing Forest Culture in the Hira Mountain Foothills: An Analysis of Citizen-Selected Resources in Walking Maps

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The Hira Mountain foothills, located in Otsu City, Shiga Prefecture, Japan, have developed a rich forest culture shaped by long-term interactions between people and the surrounding environment. This culture includes coppice woodland management, stonework techniques, terraced rice fields, mountain worship, and plant-based daily practices. This study aims to clarify the structure of forest culture in the region and to examine how citizen groups select and present forest-related resources in their walking maps.

Using the Otsu City Historical and Cultural Master Plan, forest-related local resources—primarily non-designated cultural properties—were identified and categorized. The results revealed a wide distribution of forest culture elements, such as shishigaki stone fences, woodland areas, terraced fields, stone-lined waterways, and shrines associated with mountain beliefs. However, some districts with rich cultural elements were not fully represented in administrative inventories.

Analysis of walking maps created by local citizen groups, including Hira no Satobito and Hira Satoyama Club, showed that selected items tended to emphasize visually recognizable and narrative-rich landscape features, such as terraced fields, woodland paths, shrine approaches, and stonework rivers. These choices reflect experiential values—visibility, storytelling potential, and compatibility with walking routes—rather than the overall distribution of resources. Additionally, community-generated materials such as the Furusato E-byobu—a locally produced pictorial record presented in the form of a traditional Japanese folding screen (byōbu), which is a multi-panel decorative screen historically used in Japanese interiors—contain oral traditions related to forest use, plant gathering, and mountain spirits, highlighting intangible aspects of forest culture that administrative documents often overlook.

The findings indicate that forest culture in the Hira foothills is only partially captured by existing documentation, and that citizen-led and administrative perspectives differ in their recognition of local resources. To support the preservation and transmission of forest culture, it is essential to integrate resident-based knowledge with formal resource inventories and develop mechanisms for systematic documentation and shared understanding.



Figure The Furusato E-byobu contains oral traditions related to forest use in the Hira Mountain.

The Significance of Giant Trees to the Japanese People and the Factors Contributing to Their Formation

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Trees that grow over a long period of time are a symbol of nature. Not only do they play a vital role in the conservation of the natural environment - by enhancing the landscape and providing nesting sites for wild birds and animals - but they also hold significant academic value as research material for palaeoclimatology and related fields, as they serve as a record of past climatic and environmental conditions. Furthermore, the practice of venerating giant trees as ‘sacred’ is considered one of the most primordial forms of human belief. Stories of great trees that sustain humanity can be found all over the world. On the other hand, the fact that giant trees are distributed throughout country, that many of them are objects of worship or are associated with legends and folklore, and that they are deeply connected to local communities is said to be a characteristic unique to Japan. In this study, we examined how such a connection between giant trees and humans has come to be formed in Japan. In this study, in order to examine giant trees in the context of their connection to human society, we analysed 140 trees, primarily those designated as National Natural Monuments by the Agency for Cultural Affairs, as representative examples of giant trees of high cultural value. Furthermore, we conducted field surveys on a total of 10 trees - comprising seven National Special Natural Monuments and three additional trees of major giant tree species found in the Kanto region - to verify the site conditions of the target trees, gather information on local folklore, and observe visitor behaviour.

The analysis revealed that, as giant trees designated as National Natural Monuments are more prevalent in densely populated prefecture, they are recognised as possessing significant cultural value for human society. It was also found that giant trees designated as National Special Natural Monuments are often located at higher altitudes or in areas with good visibility, rather than in nearby settlements. Trees growing in open, unobstructed locations serve as landmarks visible from afar; over time, they became an indispensable part of people’s consciousness. It is likely that the image of these trees overlooking settlements from on high came to be associated with deities watching over people’s lives, leading to their deification. It is also entirely plausible that people who held a deep reverence for these giant trees built shrines and temples, thereby increasing the likelihood that the trees would be preserved and remain standing.

The sheer scale of giant trees - their trunk circumference, height and the extent of their canopy - creates a visual sense of pressure and overwhelming grandeur, and they are regarded as symbols of powerful vitality. Furthermore, their variously changing forms are accepted as evidence of nature’s wondrous creativity, leading people to feel an even greater sense of awe and mystery towards these giant trees. Furthermore, the mystique of giant trees has been further enhanced by the way their distinctive shapes are captured and linked to images from everyday life, and by the fact that legends and folklore matching their form and immense size have been passed down to posterity.

The Educational Effect of the 'Wreath-Making Workshop' Utilizing Surplus Forest Products: Activities for Faculty and Staff at the University of Tokyo Tanashi Forest

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The University of Tokyo Tanashi Forest (UTTF), established in 1929 and located in Nishi-Tokyo City, is an urban experimental forest affiliated with the Graduate School of Agricultural and Life Sciences (GSALS) at the University of Tokyo. Since 2012, UTTF has held an annual 'Wreath-Making Workshop' for faculty and staff as part of its outreach efforts. The workshop pursues two purposes: (1) to raise participants' awareness of The University of Tokyo Forests and UTTF, and (2) to foster a closer connection with forests and trees among university staff. The program includes guided forest walk led by UTTF staff in the morning, followed by a Wreath-Making Workshop in the afternoon using surplus materials such as fallen branches, leaves, fruits and so on collected in the forest that are normally not put to use.

This study examined participant registration lists from 2012 to 2025, records of workshop outcomes, the reflections and improvements, and feedback from sent by participants after the workshops. Over 13 years, a total of 510 participants registered for the workshops, drawn from a wide range of faculties within The University of Tokyo. That suggested purpose (1) has been satisfactorily achieved. Furthermore, many positive reactions about the guided tour in the morning and the Wreath-Making Workshop indicate that purpose (2) was also largely achieved. However, as awareness of the workshop increased within the university and the number of participants increased, working space, materials supply and the instructors' number and so on are challenged.



participants and materials



beautiful wreaths

Comparative Study on Forest Culture Perception among Multiple Groups on Nature Education Trail: A Case Study of Yinggeling in Hainan, China

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Abstract

In global practices of co-building national parks with communities, “community” is often simplified into a homogeneous participant. However, recent research reveals profoundly divergent cultural connections to forest landscapes among different groups within the same community. This oversight not only renders co-building efforts superficial but may also exacerbate cultural discontinuity and environmental inequity. The YingGe Ling section of Hainan Tropical Rainforest National Park, home to South China's best-preserved tropical rainforest, serves as an ideal case study for examining this issue. As a daily contact zone where diverse groups interact with the forest, the YingGe Ling Nature Education Trail fulfills multiple functions: it is a weekend destination for families with children, an outdoor classroom for primary and secondary school teachers, a recreational spot for tourists, and a practical field for experts. Along this trail, the needs, behaviors, and perceptions of different groups intertwine, forming a microcosm of human-forest relationships. Systematically identifying these diverse voices and translating them into actionable language for nature education trail planning represents a core challenge in integrating forest culture into regional development strategies.

This study aims to challenge the theoretical assumption of community homogeneity. Using the YingGe Ling Nature Education Trail as a specific case study, it compares and analyzes the differences in how four groups, namely families with children, primary and secondary school teachers, adult tourists, and experts, establish cultural connections with the forest landscape, and explores the implications of these differences for trail planning. The research employs a mixed-methods approach combining questionnaire surveys with semi-structured interviews. The questionnaire design centered on four comparative dimensions: contact methods, cherished values, knowledge sources, and spatial projections. Corresponding items were tailored for each group, while concurrently conducting semi-structured in-depth interviews to generate interview data. Questionnaire data underwent descriptive statistics and cross-tabulation to compare choice distributions across dimensions among the four groups. Interview data employed thematic analysis to extract typical expressions related to forest connections, serving as qualitative corroboration and in-depth supplementation to quantitative findings.

Comparative findings reveal significant divergence in cultural connections to the forest among the four groups at YingGe Ling. Regarding contact methods: Children in parent-child families primarily engage through play-based exploration, with nearly 70% preferring

physical activities like running, jumping, and climbing, and over half enjoying task-based explorations such as treasure hunts. Educators focus on knowledge extraction, transforming the forest into curriculum resources. Adult visitors seek natural scenery and tranquil environments. The expert group centers on professional engagement, with most involved in curriculum development. Regarding valued attributes, parents prioritize the forest's educational value, placing sparking children's curiosity at the top. Teachers favor educational resource value, scoring highest on plant identification and biodiversity themes; visitors seek a balance between aesthetic and scientific value, valuing both scientific accuracy and tranquil experiences. Experts emphasize design value, viewing curriculum design and instructor teams as core competencies. Regarding knowledge sources, teachers heavily rely on textbook continuity, primarily needing pre/review worksheets and inquiry task manuals—creating a clear disconnect from visitors' strong interest in local knowledge like phenological changes, species-community relationships, and cultural connections. In spatial projections, parent-child families prioritize trail safety and fun. Teachers focus on traffic safety and teaching space suitability. Visitors seek tranquility and pristine natural conditions; experts prioritize activity hubs and course activity space design.

Research indicates that current path designs, oriented toward mass recreation and standardized education, often overlook these differentiated needs, marginalizing the cultural rights of specific groups. Based on this, this study proposes a segmented, adaptable framework for nature education path planning. By precisely identifying the cultural demands of different groups, it constructs differentiated spaces within the YingGe Ling area—including play exploration zones, research nodes, tranquil viewing points, and native environment trails. This approach fosters a harmonious coexistence between humans and nature where everyone participates, each finds their place, and cultural traditions thrive through living transmission. It offers a demonstrative Hainan solution for community co-governance in tropical rainforest national parks worldwide.

An Integrated Framework for Identifying Nonlinear Drivers and Peaking Pathways of Land-Use Carbon Emissions: A Case Study of Hainan Island, China

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Predicting Land Use Carbon Emission (LUCE) peaking pathways and their nonlinear drivers is crucial for regional low-carbon management. However, existing studies often overlook land carrying capacities and struggle to capture complex nonlinear mechanisms. This study proposes an integrated framework coupling Logistic-EKC prediction with XGBoost-SHAP attribution. It explicitly incorporates the physical limits of Development Intensity (DI) for prediction, while identifying nonlinear thresholds and interaction effects for data-driven cross-verification.

Applied to Hainan Island, results project an aggregate LUCE peak around 2038 (DI \approx 0.027) with significant spatial asynchrony. While some municipalities exhibit emission declines, core growth poles (e.g., Haikou) remain in the climbing phase, potentially delaying their peak to 2048. Attribution analysis reveals energy consumption, population, and DI as primary positive drivers, whereas forest coverage exerts stable suppression. Crucially, DI acts as a significant moderator; notably, fixed asset investment incurs higher marginal carbon costs in low-DI regions. This framework provides a verifiable evidence chain for LUCE peaking identification and supports threshold-oriented regulatory assessments.

Spatial and Temporal Patterns of Nature-Based Tourism Demand in Sabah, Malaysia Across COVID-19 Periods

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Abstract

Nature-based tourism is a key driver of sustainable development and local economies, particularly in biodiversity-rich regions such as Sabah, Malaysia. The COVID-19 pandemic, however, severely disrupted visitation patterns across the state's nature-based tourism sites. This study examines temporal and spatial demand patterns at 77 sites in Sabah across three periods: before, during, and after the pandemic. Specifically, it aims to classify sites according to demand levels and assess how visitation recovered over time. A total of 695 valid responses collected via social media were analysed. Hierarchical clustering was conducted to classify sites into high-, moderate-, and low-demand categories for each period. Changes in cluster membership between the pre-pandemic and post-pandemic periods were then analysed to evaluate site-level recovery patterns. Results show a marked decline in visitation during the pandemic, followed by gradual post-pandemic recovery. Most sites ($\approx 73\%$) were consistently classified as low-demand, 23% as moderate-demand, and 4% as high-demand. Recovery analysis indicates that 52 sites (68%) remained in the same demand category, 19 sites (25%) experienced a decline, and only 6 sites (8%) showed improvement by shifting to higher-demand clusters. High-demand sites, concentrated in the West Coast Division, exhibited stronger resilience compared to sites in other divisions, revealing a spatial-temporal imbalance in visitation. These findings underscore the need for targeted management strategies to promote balanced tourism growth and strengthen the resilience of Sabah's nature-based tourism sector.

Forest Healing as an Emerging Post-COVID-19 Ecotourism Strategy: Assessing Ecological and Socio-Tourism Potential in Gunung Merapi National Park, Indonesia

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In the post-COVID-19 era, nature-based tourism has gained substantial attention as visitors increasingly seek destinations that support physical and mental well-being. Forest healing has emerged as a novel ecotourism approach that integrates human health benefits with environmental conservation. This study assesses the potential of forest healing as a sustainable ecotourism strategy in Gunung Merapi National Park (TNGM), Indonesia, particularly in the Sapuangan area. The research employs a quantitative approach to analyze visitor trends alongside a literature-based assessment of the forest ecosystem. Visitor data indicate a 30% increase in tourist numbers in 2024, suggesting growing interest in forest healing experiences. Ecological observations reveal high vegetation density (80–93%) and favorable microclimatic conditions, with humidity levels ranging from 61% to 87%, which are conducive to forest-based therapeutic activities. The findings demonstrate that forest healing has strong potential to enhance visitor experiences, support biodiversity conservation, and contribute to local community welfare. However, its successful implementation requires integrated management, stakeholder collaboration, and clear policy support. Furthermore, this study highlights the need for future research on the measurable impacts of forest healing on both human health and ecosystem integrity. The development of innovative mechanisms, such as bio-credit schemes, is also recommended to strengthen conservation outcomes within forest-healing initiatives.

Keywords: Forest healing; Sustainable tourism; Ecosystem services; Visitor behaviour

An Individual-Based Model for Assessing the Effect of Initial Population Density on Kauri Dieback Disease Dynamics in *Agathis australis*

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Abstract

The increasing incidence of plant diseases caused by invasive pathogens poses a serious threat to the stability of global forest ecosystems. One such example is kauri dieback disease, caused by *Phytophthora agathidicida*, which affects *Agathis australis*. This study aims to evaluate the effect of initial population density on disease dynamics using a model-based approach developed on the NetLogo platform.

Simulations were conducted across ten initial density scenarios (100–1000 individuals) over a period of 1000 months to analyze changes in the number of healthy, host (infected), and dead individuals. The results indicate that initial density has a significant effect on the final population condition ($p < 0.05$).

The number of healthy individuals reached optimal values within the range of 300–400 trees, with the highest proportion of healthy individuals observed at a density of 300 trees. In contrast, higher densities (≥ 500 trees) resulted in a sharp decline in the number of healthy individuals and a significant increase in infected and dead individuals. These findings suggest that disease spread is density-dependent, where increased spatial interactions among individuals accelerate pathogen transmission. This study highlights the importance of regulating population density as a strategy for forest management and conservation of *Agathis australis* to minimize the long-term impacts of disease.

***Uromycladium falcatarium*, the *Falcataria moluccana* Rust Fungus – Potential Biosecurity Threat for Some Leguminosae in the Pacific Islands**

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Abstract

Uromycladium falcatarium is a rust fungus that causes an extremely damaging disease on sengon (*Falcataria moluccana*) in Indonesia. The rust gall fungus has spread across the commercial sengon plantations of Indonesia, Malaysia, and the Philippines, causing economically significant damage to timber production. The fungus causes growing tissues of sengon trees to form large twisted knots and gall on the leaf, stem, branch, and canopy, which can lead to the death of young trees and damage of all ages. Fungal spores can infect seeds, survive within the embryo or in tissue, and become seed-borne or seed-transmitted pathogens. On the other hand, *F. moluccana* is expected to become an extremely invasive weed across the entire Pacific Islands and needs to be suppressed or controlled intensively to prevent ecosystem change. The researchers conducted a series of experiments with this fungus on a suite of Fabaceae species from Hawaii, i.e., *Acacia chinensis*, *A. koa*, *A. koai*, *A. contorta*, *A. lebbbeck*, *Leucaena leucochepala*. Plants were exposed to fungal spores under laboratory, greenhouse and natural field conditions. Although several non-target test plants showed signs of initial infection in the laboratory there was no disease progression in any plants other than the target *F. moluccana*. Galls and spores were formed only on the target plants under deliberately inoculated pathogen conditions in the greenhouse. Field tests have not shown any signs of non-target impact. The results of these experiments suggest that this or other strains of *U. falcatarium* may be suitable candidates for further research as potential biological control agents. We also discuss how our study can help address concerns about the biosecurity threats posed by *Uromycladium* species. The lesson learned from past outbreaks anticipated the gall rust disease outbreak for the future.

Butterfly Diversity in the Eastern Green Open Space Area of Gadjah Mada University

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Abstract

Butterflies are one of the insects that can be found in almost all types of habitats, including green open space areas. Universitas Gadjah Mada is one of the educational institutions that provides the largest green open space area contribution to the Sleman area so that the biodiversity in UGM green open space area needs to be maintained. The diversity of butterflies is important to identify as one of the efforts to maintain this biodiversity because of its role as a pollinator. The purpose of this study was to determine the types, diversity, and abundance of butterflies in the eastern part of the UGM green open space area.

This study used the time search method for 45 minutes during sunny weather. Observations were carried out every month, starting from September to December 2024 in the eastern part of the UGM green open space area which has been divided into 8 locations based on its clusters. The parameters observed were the species name and the number of individual butterflies. The results of the observations were analyzed using the diversity index (H'), abundance index (D_i), dominance index (C), evenness index (E), and similarity index (IS).

Based on the identification results, 32 butterfly species were found which can be grouped into 20 genera and 4 families, namely Lycaenidae, Nymphalidae, Papilionidae, and Pieridae. Butterfly diversity is included in the moderate category ($H' = 1,63-2,43$) with the highest diversity index in the Ecological/Wisdom Park cluster. The total abundance index of each species in the UGM area ranged from the category of not abundant to abundant ($D_i = 0,1-38,3\%$). Species with the abundant category are *A. olferna*, *C. pomona*, *L. nina*, and *Zizina spp.*. The most abundant species is *C. pomona* and the least abundant species is *D. genutia*.

Macro fungi in Urban Forest of Universitas Gadjah Mada and Their Potential Uses as Medicinal Fungi

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Abstract

Macro fungi are important ecosystem component, containing carbohydrates, fibers, proteins, vitamins, and have enormous medicinal purposes. Earlier study on Lawu Mountain found that macro fungi can become alternative source of healthy food to increase human immunity. Another report found macro fungi growing in urban forest of UGM, but studies on their medical benefits have not been conducted yet. This research aimed to understand macro fungi which has medicinal fungi potential in urban forest of UGM. Literature review was done to identify the medicinal potential of macro fungi in urban forest of UGM. The result shows 15 fungus in urban forest of UGM can be natural source of medicine, Agaricus, Auricularia, Ganoderma, Mycena, Earliella, Microporus, Poria, Pycnoporus, Trametes, Schizophyllum, Stereum, Tremella, Pleurotus, Tricholoma, and Xylaria. This information indicates that UGM can become source of medicinal macro fungi which can be developed as source of high-quality fungal genetics through pharmaceutical research.

UGM is a green campus that puts forth biodiversity in its mangement actions. During COVID-19 lockdown, the extremely low intensity of human activities promoted the growth of macro fungi in urban forest of UGM. Earlier study on Lawu Mountain found that macro fungi can become alternative source of healthy food to increase human immunity. The study about documenting macro fungi in the urban forest of UGM as well as their potential for medicinal compound has not yet been conducted. Therefore, this research aimed to identify the genera and understand the potential medicinal fungi in urban forest of UGM. Complete survey in documenting the macro fungi and literature review were done to identify the genera and their potential medicinal compound. Among the 25 genera found in the urban forest of UGM, 15 of them have potential as medicinal fungi, i.e. Agaricus, Auricularia, Ganoderma, Mycena, Earliella, Microporus, Poria, Pycnoporus, Trametes, Schizophyllum, Stereum, Tremella, Pleurotus, Tricholoma, and Xylaria. This indicates that UGM is a suitable ecosystem for the growth of medicinal macro fungi which can be developed as source of high-quality fungal genetics through pharmaceutical research.

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