JIRCAS
International
Symposium
2023

Innovations to **Enhance the resilience of tropical forests** and **Sustainability of the forest industry**

Proceedings

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United Nations University
Tokyo, Japan

Organized by : Japan International Research Center for Agricultural Sciences (JIRCAS)
In cooperation with : Ministry of Agriculture, Forestry and Fisheries (MAFF),
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JIRCAS

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JIRCAS International Symposium 2023
U Thant International Conference Hall
United Nations University
Tokyo, Japan,
November 17, 2023

Opening Remarks

KOYAMA Osamu
President, JIRCAS

Distinguished participants, good afternoon. It is my great honor to open the JIRCAS International Symposium 2023, organized under the auspices of the Ministry of Agriculture, Forestry and Fisheries and the Forestry and Forest Products Research Institute.

On behalf of JIRCAS, the organizer, I would like to thank today's distinguished guests, Mr. KOSAKA Zentaro, Deputy Director-General of the Forestry Agency, and Dr. NAKASHIZUKA Tohru, Director General of the Forestry and Forest Products Research Institute; today's keynote speakers, Prof. KITAJIMA Kaoru, Vice Dean of the Graduate School of Agriculture, Kyoto University, and Dr. Sonya Dewi, Director of Asia Program of CIFOR-ICRAF; and all the distinguished speakers for the two sessions for their strong support and enormous contribution to this symposium. I would also like to thank all of you who are attending today's symposium, both online and on-site here, for generously taking your precious time to join us.

Tropical forests, which account for an estimated 40-50% of terrestrial vegetation, contribute to the stabilization of the global system through their ability to absorb and store carbon, a vital function for the survival of human society in the face of the climate crisis, as well as through their multiple functions, including biodiversity, disaster prevention, water resource conservation, timber production, and even cultural formation. However, the relentless overexploitation of natural resources and the conversion of tropical forests to farmland continue unabated.

Deforestation and forest degradation caused by human economic activities contribute to global warming through the release of carbon stored in trees and soils, and to the loss of biodiversity through the destruction of ecosystems. And these feedback loops may result in the malfunction of global climate and environmental control system, potentially leading to the disruption of the entire "Earth system". In recent years, international conferences and negotiations on climate change countermeasures and biodiversity conservation have emphasized the need for resource management that strengthens the climate and environmental regulation functions of tropical forests, as well as the need for rules to control deforestation associated with the forest industry. The functions and resources of tropical forests are indispensable assets to our society, therefore their conservation is important. However, the socioeconomic activities associated with industries using tropical forests are equally important.

I believe achieving both is the key for preventing deforestation and forest degradation. To this end, we need to create holistic and inclusive innovations that will lead to both the conservation of the environment and the realization of sustainable forest and forest-related industries. This is the reason

why we selected the title of this year's symposium.

JIRCAS plays a central role in international collaboration in agriculture, forestry, and fisheries research, and aims to contribute to the achievement of the SDGs through the development of technologies to address various challenges in the Asia, Africa, and Latin America regions. As a part of these efforts, we are promoting international collaborative research and cooperation in tropical forests and forest industry, mainly in the Asian region. We are conducting research projects which include social implementation of research results for the people who live on tropical forests, for example, the projects titled "Evaluation of genetic resources for strengthening productivity and adaptability of tropical forests", or "Strengthening tropical forest resilience based on management and utilization of genetic resources capable of climate change adaptation", or "Sustainable replantation of oil palm by adding value to oil palm trunk through scientific and technological innovation" and so on.

In today's symposium, distinguished tropical forest researchers from Asia and around the world will present and discuss the opportunities and challenges of balancing tropical forest resilience and forest industry sustainability. This year marks the 50th anniversary of Japan-ASEAN Friendship and Cooperation, and we hope that focusing on tropical forests in Asia will lead to innovations from ASEAN countries that can contribute to our common goal. Furthermore, this year marks the 30th anniversary of JIRCAS's reorganization. JIRCAS started using the current name in October 1993 when it was reorganized from its predecessor, the Tropical Agriculture Research Center. The Forestry Division in JIRCAS was structured at that time, so this symposium is being held in this commemorative year.

I sincerely hope that with the active participation of all the attendees, this international symposium will become a place for valuable information exchange and lively discussion. Together, let's move towards a future where tropical forests thrive, and sustainable industrial practices ensure the well-being of local people who live on tropical forests and our planet.

Welcome Remarks

KOSAKA Zentaro

Deputy Director-General, Forestry Agency, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan

只今ご紹介に預かりました林野庁次長、小坂善太郎でございます。

本日、国際農林水産業研究センター（JIRCAS）主催により国際シンポジウム 2023「強靭な熱帯林と持続的な産業の共存を実現するイノベーションに向けて」が開催されるにあたり、歓迎のあいさつを述べさせて頂きます。

はじめに、本日、御列席の皆様方におかれましては、日頃より、熱帯林を中心とした様々な地域において持続可能な森林経営に資する研究、技術開発及び技術協力に格別の御尽力・御協力をいただき、敬意を表するとともに、感謝申し上げます。JIRCAS において、森林・林業分野のシンポジウムを開催するのは今回が初めてであると伺い、とても嬉しく思います。

国際農林水産業研究センター（JIRCAS）におかれては、熱帯及び亜熱帯地域での農林水産業に関する技術向上のための試験研究等を業務とする中、気候変動対策や資源循環、環境保全といった分野での技術開発等に取組まれていると承知しております。

気候変動や生物多様性保全といった喫緊の国際的課題に対して、炭素の吸収・貯蔵源であり、生き物の住処でもある森林の存在が益々重要となっております。本来、再生可能である森林資源は、計画的に取り扱うことで、持続可能に利用できる存在です。しかしながら、過度な利用等により、特に熱帯林を中心に森林の減少･劣化が進行している状況にあります。このため､気候変動枠組条約締約国会合（COP）等の場においても熱帯林の減少・劣化への対策について議論され、多くの国・機関が途上国において地域住民の生計向上への支援を含めた対策を講じているなか、本日のシンポジウムのテーマである「強靭な熱帯林と持続的な産業の共存を実現するイノベーションに向けて」は時宜を得たものであり、多くの関係者の参考になるものと期待を寄せるところです。

さて、日本においては、かつて、過度な伐採により森林が荒廃し、大規模な山地災害や水害に見舞われた経験から、全国で国土緑化運動が推進され世界有数の１千万ヘクタールの人工林資源を有するまでになりました。現在はその人工林資源が利用期を迎える中､2050 年カーボンニュートラルに寄与する｢グリーン成長」の実現に向けて､「伐って、使って、植えて、育てる」森林資源の循環利用に取り組んでいます。

このような知見を活かして、我が国は熱帯地域を中心に森林・林業分野の海外技術協力や二国間クレジット制度（JCM）の下での REDD ＋活動等に取り組んでいるところです。
また、我が国は「合法伐採木材等の流通及び利用の促進に関する法律」（通称：クリーンウッド法）を 2019 年に施行しましたが、本年、合法性確認の義務付け等を実施する法改正を行い、合法木材の利用促進に向けた、更なる取り組みを強化したところです。

本日のシンポジウムでは、京都大学の北島薫教授と、CIFOR-ICRAF の Sonya Dewi アジア担当部長より基調講演を頂き、その後の各セッションでは、国際農研、森林総研、IGES に加え、マレーシア森林研究所、インドネシアのガジャマダ大学からも研究者の方にご参加いただき、それぞれの熱帯林保全の研究成果についてご発表頂くとともに、パネルディスカッションが行われると伺っております。

皆様の研究に対する日頃の取り組みに対し、改めて敬意を表しますとともに、本シンポジウムでの成果が、熱帯林の保全と持続可能な利用に向けた活動に繋がっていくことを願うところです。

結びに、本日の国際シンポジウムの盛会と参加者の皆様方のご活躍を祈念いたしまして、私からのご挨拶とさせていただきます。

I am KOSAKA Zentaro, Deputy Director-General of the Forestry Agency.

Today, I would like to offer my welcome greetings to the International Symposium 2023, “Innovations to enhance the resilience of tropical forests and sustainability of the forest industry,” which is being hosted by the Japan International Research Center for Agricultural Sciences (JIRCAS).

First of all, I would like to express my respect and gratitude to all of you in attendance today for your continued efforts and cooperation in research, technological development, and technical cooperation that contribute to sustainable forest management in various regions, particularly in tropical forests.

I am aware that JIRCAS is engaged in experimental research to improve technologies related to agriculture, forestry, and fisheries in tropical and subtropical regions, and is working on technological development in the fields of climate change countermeasures, resource recycling, and environmental conservation. I am greatly pleased to hear that JIRCAS holds a symposium on forest and forestry fields for the first time today.

Forests are becoming increasingly important as carbon absorption and storage sources, and as habitats for living organisms in the face of urgent international challenges such as climate change and biodiversity conservation. Essentially, forest resources are inherently renewable and can be used sustainably if they are handled in a planned manner. However, excessive use and other factors have led to a situation where forests are being reduced and degraded, particularly in tropical forests. For this reason, measures to combat the decline and degradation of tropical forests have been discussed at the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) and other fora, and many countries and organizations are taking measures in developing countries, including providing support to improve the livelihoods of local people.

The theme of today's symposium, “Innovations to enhance the resilience of tropical forests and sustainability of the forest industry,” is timely and will hopefully be of interest to many stakeholders.

In the past, Japan experienced large-scale mountain disasters and flood damage as a result of excessive logging, which led to the national greening campaign, and the country now has some of the world's largest planted forest resources up to 10 million hectares. As these planted forest resources are now reaching the end of their useful life, we are working on the recycling of forest resources as “harvesting, using, planting and tendering” with the aim of realizing ‘green growth' that will contribute to carbon neutrality by 2050.

Using this knowledge, Japan is now engaged in overseas technical cooperation in the forest and forestry sectors, particularly in tropical regions, and in REDD+ activities under the Joint Crediting Mechanism (JCM).

In addition, Japan enacted the Act on the Promotion of Use and Distribution of Legally-harvested Wood and Wood Products (commonly known as the Clean Wood Act) in 2019, and this year, the law was amended to make it mandatory to confirm legality and to further strengthen efforts to promote the use of legally harvested wood.

At today's symposium, Professor KITAJIMA Kaoru of Kyoto University and Dr. Sonya Dewi, Director of Asia Programme, CIFOR-ICRAF, will deliver the keynote speeches, followed by sessions. In addition to researchers from JIRCAS, the Forestry and Forest Products Research Institute (FFPRI), and the Institute for Global Environment Strategies (IGES), researchers from the Forest Research Institute Malaysia (FRIM) and the University of Gadjah Mada, Indonesia, will present their research results on tropical forest conservation and participate in the panel discussion.

I would like to once again express my respect to your daily efforts in research, and I hope that the results of this symposium will lead to activities for the conservation and sustainable use of tropical forests.

In closing, I would like to wish you all the best for today's International Symposium and for the success of all the participants.

Welcome Remarks

NAKASHIZUKA Tohru (ASANO Toru)

Director General, Forestry and Forest Products Research Institute (FFPRI), Japan

このたびは、「JIRCAS 国際シンポジウム 2023　強靭な熱帯林と持続的な産業の共存を実現するイノベーションに向けて」の開催、おめでとうございます。また、FRIM、UGM、それから CIFOR-ICRAF からもこのシンポジウムでの貴重なご講演をいただくこと、ありがとうございます。

いうまでもなく、熱帯林は高い生物生産性と生物多様性をもち、世界の資源や環境を考える上で、非常に重要な役割を果たしています。木材をはじめとする森林の様々な資源は、化石燃料や鉱物と違って再生可能な資源です。また、IPCC の報告書などに見るように、森林は二酸化炭素の吸収による温暖化の効果的な緩和策だけでなく、ヒートアイランド現象や温暖化によって極端化する気象災害などに対する適応策としても重要視されています。さらに、生物多様性の保全では熱帯林がとくに重要な役割を果たしていますし、昨年の暮れに採択された昆明 - モントリオール枠組みでは、森林のもつさまざまな生態系サービスを生かした「自然を基盤とした社会問題の解決（Nature based solution）」も、農業や健康など、これまでにない広がりで大きく注目されています。当然、策持続可能な熱帯林の利用やレジリエンス確保の問題は、ローカルにもグローバルにも大きな社会的な要請となっているわけです。

私自身も、かつてタイやマレーシアの熱帯林で研究をしてきましたが、持続可能な利用に関しては、自然科学的な研究だけでなく、人文社会学的な分野との融合研究、さらにはさまざまなステークホルダーも参加した超学際的な（trans-disciplinary）の必要性を強く感じました。今日のシンポジウムは、まさにそうした方向での構成となっており、活発な議論ができるのではないかと期待しています。

森林総研は JIRCAS と 1970 年代 TARC の時代から人事交流を含めた緊密な協力関係を持ちながら研究をさせていただいています。今後ともこの協力関係を続けてゆきたいと願っておりますし、それを通じて熱帯諸国の森林・林業研究者との共同研究も深めたいと考えております。

本日のシンポジウムの開催をお祝いすると同時に、今後のますますの、研究所間、あるいは国と国の間の共同研究の発展を祈念し、ご挨拶とさせていただきます。

Congratulations on holding the "JIRCAS International Symposium 2023: Innovations to enhance the resilience of tropical forests and sustainability of the forest industry." I would also like to thank FRIM, UGM, and CIFOR-ICRAF for their valuable presentations at this symposium.

Needless to say, tropical forests have high biological productivity and biodiversity, and play an extremely important role in considering the world's resources and environment. Various forest resources, including wood, are renewable resources, unlike fossil fuels and minerals. In addition, as seen in IPCC reports, forests are regarded as important not only as an effective mitigation measure

against global warming by absorbing carbon dioxide, but also as an adaptation measure to the heat island phenomenon and weather disasters that are becoming more extreme due to global warming. Furthermore, tropical forests play a particularly important role in biodiversity conservation, and under the Kunming-Montreal Framework, which was adopted at the end of last year, "nature-based solutions" that make use of the various ecosystem services provided by forests are attracting a great deal of attention due to their unprecedented expansion in agriculture, health, and other fields. Naturally, the issues of sustainable use of tropical forests and ensuring resilience have become major social demands both locally and globally.

I myself have previously conducted research in the tropical forests of Thailand and Malaysia, and I strongly felt the need for not only natural science research but also interdisciplinary research with the humanities and social sciences, as well as a trans-disciplinary approach in which stakeholders also participated. Today's symposium is structured in exactly this direction, and I expect that we will be able to have lively discussions.

The Forestry and Forest Products Research Institute has been conducting research with JIRCAS since the TARC era in the 1970s, maintaining a close cooperative relationship, including personnel exchanges. We hope to continue this cooperative relationship in the future, and through this, we hope to deepen our joint research with forest and forestry researchers in tropical countries.

I would like to congratulate you on the opening of today's symposium, and at the same time, I would like to conclude my remarks by praying for the further development of joint research between institutes and between countries.

Keynote Speeches

Climate Change, Fire and Forest Resilience

KITAJIMA Kaoru

Professor, Graduate School of Agriculture, Division of Forest and Biomaterials Science, Kyoto University, Japan

Dr. KITAJIMA Kaoru has held faculty positions at Kyoto University, Japan (2013-present) and the University of Florida (1997-2013). She received her B.Sc. from the University of Tokyo and her M.Sc and Ph.D. from the University of Illinois. Her research interests encompass the ecology of seedling regeneration of tropical trees, responses of forest trees to climate and other environmental factors, and ecosystem functions of plant and microbial diversity in tropical forests. She is a member of the Science Council of Japan (Chair, Integrative Biology Committee) and has been elected as President of the Ecological Society of Japan (2024-2026).

ABSTRACT

Multiple SDGs hinge upon tropical forests. To ensure sufficient food and nutrition for all, we must achieve nature-positive production landscapes through both sustainable agriculture and natural forest conservation. Forests continue to be central to mitigation and adaptation responses to climate change, as well as to the conservation of biological and cultural diversity. Reports from the Intergovernmental Panel on Climate Change (IPCC), the Scientific Group of the UN Food Systems Summit, and the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) support these key points for sustainability but also conclude huge uncertainty associated with forest conservation[1, 2]. Many factors underpin this uncertainty. Biologically, there is much uncertainty about whether forest trees will continue to respond positively to increases in atmospheric CO_2 concentration and warmer temperature regimes. Even larger uncertainty exists in relation to fire risks.

We have a limited understanding of historical fire regimes in many tropical forests, which differ among biogeographical regions, edaphic factors, vegetation characteristics, and the historical interaction of people with forests. Tropical rain forests, which historically never burned, are now burning in Asia and South America due to human-driven fragmentation and degradation of forests and also because of climate-change-related intensification of heat and drought. Historically and currently, tropical forests with extended dry seasons have been lost earlier and more rapidly than rain forests, as drier forests are easy for people to exploit with the use of fire. Because trees are smaller and less dense in drier forests, they have lower carbon sequestration, both in terms of rate and pool size. Yet, tropical dry forests provide multitudes of ecosystem services, including biodiversity conservation, resource basis to support traditional ecological knowledge, soil conservation, and water regulation. The latter two factors are critical at the watershed and regional levels for the sustainability of the production landscape. It is urgent that we understand the adequate ecosystem fire regimes of remaining natural forests, which hinge heavily on the evolutionary ecological characteristics of tree species that dominate each ecosystem. A scientific understanding of forest fire regimes is urgently needed to provide adequate policy advice to local and national governments, not only to sustain critical ecosystem services provided by the forests but also for landscape-level sustainability of food, water, and energy provisioning.

[1] IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 896 pp. https://doi.org/10.1017/9781009157988.

[2] Hodson, E., Niggli, U., Kitajima, K., Ral, L., Sadoff, C. Boost nature-positive food production: a paper on Action Track 3. UN Food Systems Summit Scientific Group Report. https://sc-fss2021.org/wp-content/uploads/2021/04/Action_Track_3_paper_Boost_Nature_Positive_Production.pdf

2023.11.17 JIRCAS International Symposium

Climate Change, Fire, and Forest Resilience

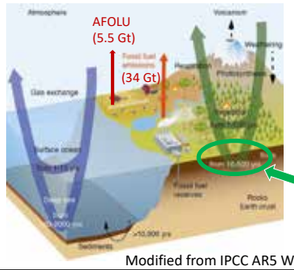
Kaoru Kitajima
Professor, Graduate School of Agriculture, Kyoto University
Member, Science Council of Japan, Part 2: Life Science
Lead Author, IPCC Special Report on Climate Change and Land (2017-19)

Forests are particulalry important for conservation of biodiversity and reducing climate change impacts.

WHY?

- **Forests are home to more than 80 per cent of all terrestrial species of animals, plants and insects.**
- **Forests are the most cost-effective way to fight climate change**
  - Forest-based climate change mitigation and adaptation actions, if fully implemented, could reduce greenhouse gas emissions by 15 Gt (gigatons) of CO_2 per year by 2050, which is necessary in order to keep the climate warming within +2°C.
- **The biggest threat to forests is … agriculture** (agriculture, forestry and other land use change, AFOLU)
  → how do we ensure sufficient food and adequate nutrition for all people on the planet while protecting biodiversity and climate?

Conserving natural forests is central to nature-based solutions



Global CO_2 budget
(SRCCL Ch. 2, Table 2.3, 2019)

- CO_2 emission by fossil fuel burning is 34 Gt per year
- Agriculture, forestry and other land use (AFOLU) activities cause net CO_2 emission of ca. 5.5 Gt per year
- Natural forests counter with net CO_2 uptake of 11.7 Gt per year

Modified from IPCC AR5 WG1 Fig.FAQ.6.2.1

Tropical forests, which occupy 45% of all forest areas, conduct 2/3 of the global forest photosynthesis

Global GPP (Gt CO_2 / yr)

40.8

8.3

9.9

(Beer et al. 2010. Science)

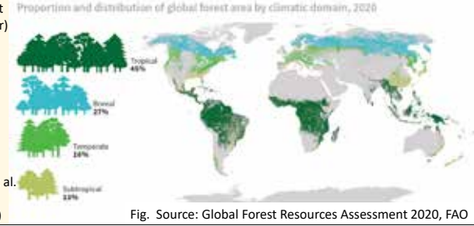
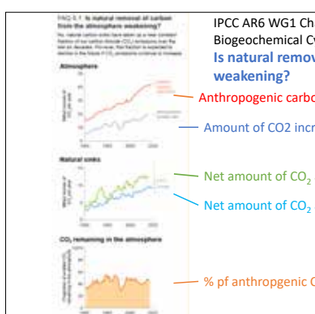


Fig. Source: Global Forest Resources Assessment 2020, FAO



IPCC AR6 WG1 Chapater 5 "Global Carbon and other Biogeochemical Cycles & Feedbacks"

Is natural removal of carbon from the atmosphere weakening?

Anthropogenic carbon emission per year

Amount of CO2 increase in the atmosphere per year

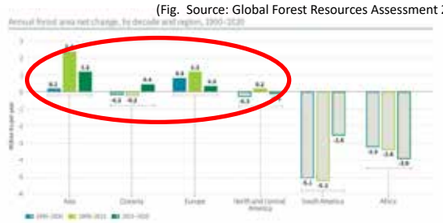
Net amount of CO_2 absorbed by land

Net amount of CO_2 absorbed by sea

Future?

% pf anthropgenic CO_2 emission remaining in the atmosphere

Global FRA 2020: Deforestation continues especially in South America and Africa
(Fig. Source: Global Forest Resources Assessment 2020, FAO)



- 240 million of the world poor live in developing countries depend on forests.
- Deforestation accounts for 25% of greenhouse gas emissions.

Even where reforestation and afforeestration are accmulating land carbon stocks, fire can burn up all tha carbon captured in a matter of day or two.

Key drivers of forest cover loss differ among regions

Philip G. Curtis et al. Science 2018;361:1108-1111

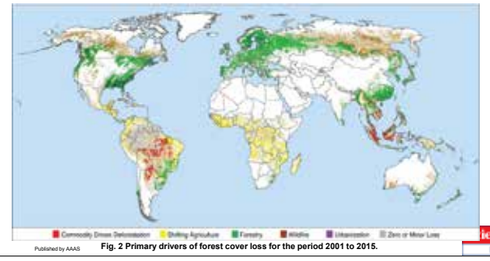


Fig. 2 Primary drivers of forest cover loss for the period 2001 to 2015.

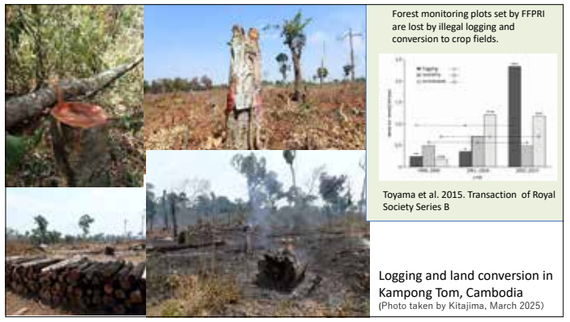
Intact peat swamp forests are wet and unlikely to burn, but degradation, fragmentation, water drainage can make them more likely to burn.

Photo source: https://fondationfranklinia.org/en/borneo-peat-swamp-forests/

Fire-driven forest loss has doubled in the last 20 years!

Source : http://WRI.org (download on 2022.8.17)

Two Decades of Fire-Driven Loss



Forest monitoring plots set by FFPRI are lost by illegal logging and conversion to crop fields.

Toyama et al. 2015. Transaction of Royal Society Series B

Logging and land conversion in Kampong Tom, Cambodia
(Photo taken by Kitajima, March 2025)

Eventual fates
→ Several years of growing cassava by small holders
→ Land tenure to the small holders
→ Land purchase by the commercial commodity developers (e.g., for rubber plantations)

2019

Climate change

The Negative Spiral

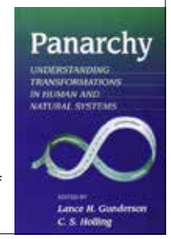
Forest loss & soil degradation

Agriculture, fragmentation, fire

How can we stop this negative spiral?
How to ensure regional resilience?

Ecological Resilience?

- C. S. "Buzz" Holling (1973) Resilience and stabilityof ecosystems. Annual Review of Ecology and Systematics 4: 1-24
- Holling et al. 2002 in Gunderson & Holling eds. 2002
- **Engineering resilience**: stability near an equilibrium steady state (assumption: single equilibrium state)
- **Ecological resilience**: the magnitude of disturbance that can be absorbed before the system changes its structure to another state (assumption : existence of alternate steady state)



Backside of Mt. Kinabalu National Park: unique and biodiverse forests on serpentine soils converted to cabbage fields with fertilizer input → export to megacities in the region

Logging and conversion of swamp forests: logging → loss of soil carbon
（Photo taken by Kaoru Kitajima, 2010, buffer zone forests near Gnung Palung National Park, West Kalimantan ）

Holling et al. (2002)
Caricature of the four myths of natur

A: Nature flat
B: Nature Balance
C: Nature Anarchic
D: Nature Resilient

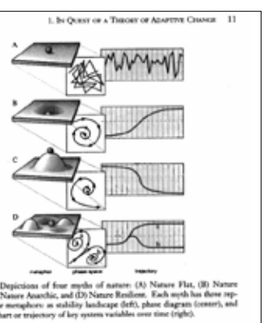
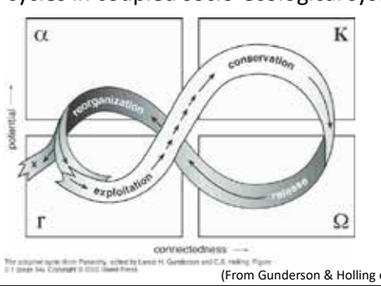


Figure 1-1. Depictions of four myths of nature: (A) Nature Flat, (B) Nature Balanced, (C) Nature Anarchic, and (D) Nature Resilient. Each myth has three representations or metaphors: as stability landscape (left), phase diagram (center), and time-course chart or trajectory of key system variables over time (right).

(From Gunderson & Holling eds. 2002)

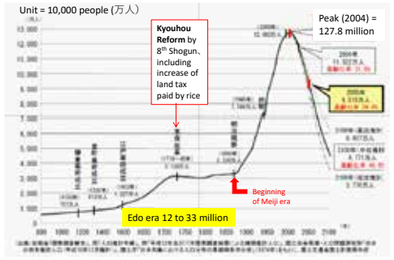
Adaptive cycles in coupled socio-ecological systems



(From Gunderson & Holling eds. 2002)

Long-term trend of total population in Japan

(From Yoshinori Hiroi 's article on http://webronza.asahi.com/science/articles/2012061100008.html)



During Edo era – accessible forests were logged out repeatedly, resulting in loss of top soil & acidification on hills.

→Only sparse growth of pine trees that can tolerate such environment
→Sand piling up in riverbed causing frequent flood
→Sandy beach and threat of flying sand burying agricultural fields

Emergemce pf strict rules by Shogun and local government.

Forest conservation and development of Japan's original planted forests

(http://matome.naver.jp/odai/2141821702648546201)

Fire regimes = frequency & intensity of fire

FIRE RESILIENT FORESTS

- **Seasonal dry forests** → frequent fire → less accumulation of fuel → dominance of trees that survive fire with thick burk, coexistence with grass and other herbaceous vegetation
- **Ever wet forests** → less frequent fire accumulation of fuel → intense fire → stand replacement of trees with sertoninous cones

FIRE NON-RESILIENT FOREST

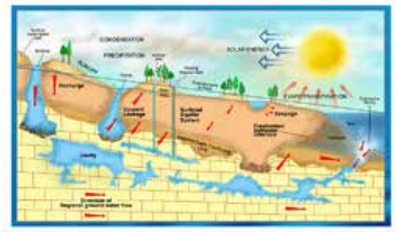
- **Very wet forest** → never burns (no fire-adapted species)

anthropogenic changes (forest isolation, SOIL degradation, drainage, climate-change driven heat & drought) and fire sources (field burning)

-- > CATASTROPHIC BURN & PERMANENT REGIME SHIFTS?

FIRE REGIMES IN FLORIDA

Background: made of limestone bedrock topped by sand deposits → Florida aquifer with underground river that runs from north to south



明治末の集落と里山。場所は現在の山梨県甲州市塩山

Village and satoyama near the end of Meiji era in the area that is currently Shioyama, Koushuushi, Yamanashi.

http://watashinomori.jp/study/basic_01-2.html

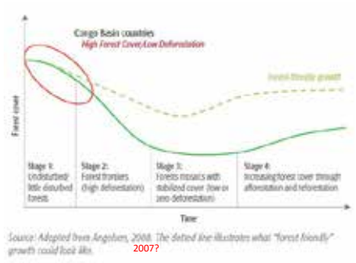
Spodosol example: State Soil of Florida: Myakka Series

A horizon: White-grey sand (Some consider it "E" horizon, the zone of strong eluviation)

B horizon: accumulation of clay and organic matter, and iron oxide in some soils.

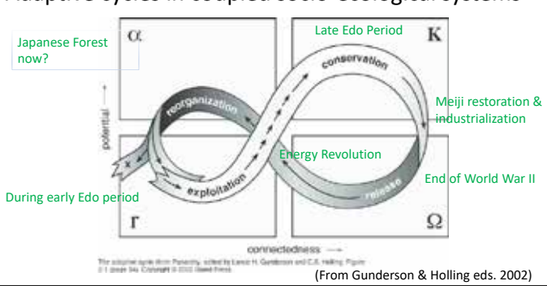
http://soils.usda.gov
http://www.fao.org

Pine Sandhill dominated by *Pinus palustris* (longleaf pine) in North-Central Florida: ecosystem maintained by frequent low-intensity fire to maintain open understory (historically 92 million acres → now only 2 million acres)



http://profor.info/node/2163

Adaptive cycles in coupled socio-ecological systems



(From Gunderson & Holling eds. 2002)

Alternative states in a savanna in Zimbabue

In Miombo-savannah continuum, experimental suppression of fire and access by large herbivores cause shifts to closed forest.

Convesion of tropical forests, in paricular peat swamp forests, to agricultural development result in rapid loss of soil C. [photos taken by K. Kitajima in 2010: natural peat swam forests in Gnung Palung National Park (above). When such peat swamp forests are converted by draining water into canal, it results in rapid loss of soil organic matters (right)]

Burn compartments with contrasting land use history and management

Frequent cold-season (winter) burns

Growing-season (summer) burns

Colonization by evergreen oaks change the fire regimes: oak leaves are difficult to burn, they compete for light to prevent regeneration of pine, but when it burns, the fire becomes too intense.

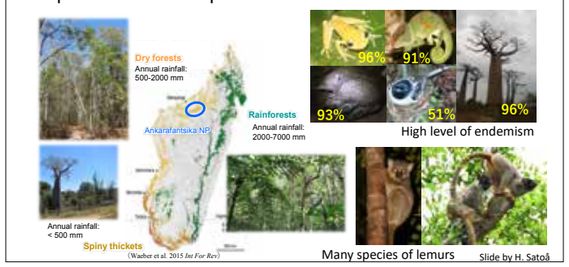
Degraded pine sandhill

One year after burn

Biodiversity hotspots (which are also hotspots of indigenous cultures)

Image source: Conservation International

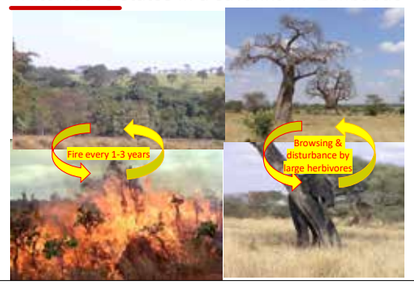
How unique are the forests in Madagascar, compared to other tropical forests of the world?



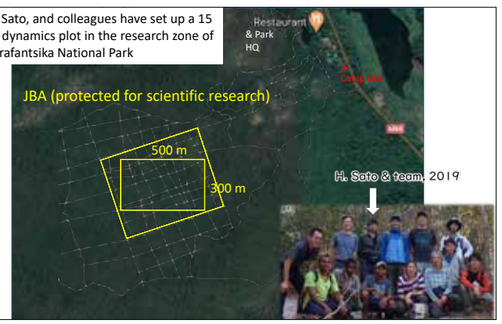
Original fire regimes of forests and savannas

- **Fire dependent forests**: need frequent low intensity fires (every 1-5 years)
- **Fire tolerant forests** with intermediate frequency and intensity of burn (every 5-20 years)
- **Stand-replacement forest**: intense fire with 30-50 intervals result in death of all plants, with the dominant tree species with adapation to dispers seeds to the ashed land (with serotinous cones & fruit that open in response to the heat, etc.)
- **Forest that historically never experienced fire**: e.g., rain forests

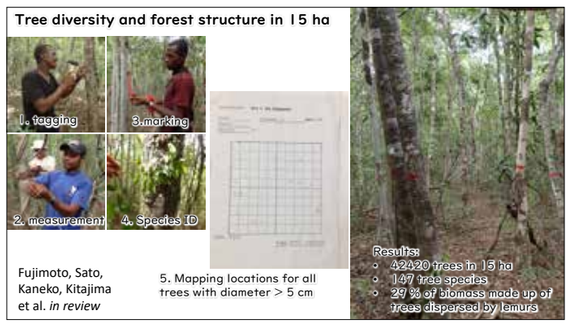
Alternative states in a savanna in Zimbabue



Kitajima, Sato, and colleagues have set up a 15 ha forest dynamics plot in the research zone of the Ankarafantsika National Park



Tree diversity and forest structure in 15 ha



Fujimoto, Sato, Kaneko, Kitajima et al. *in review*

5. Mapping locations for all trees with diameter > 5 cm

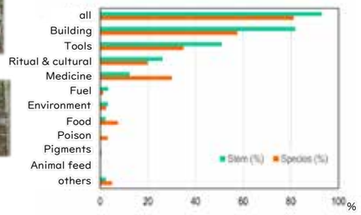
This forest supports the traditional use by local people

Tree species info from 15 ha plot

Ethonobotanical interviews

Healers Shermans

Traditional ecological knowledge: 82% of 160 woody species, 93% of stems in 15 ha are used by people



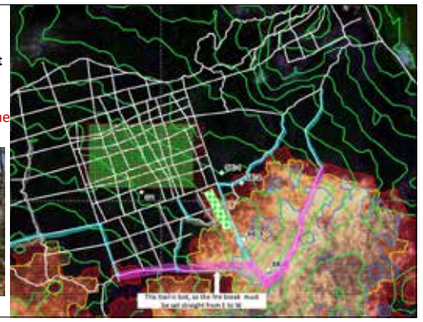
Unpublished data by H. Sato, K. Kitajima, et al.

Need to consider landscape-level conservation

Epilogue:
What I was doing over two weeks last month (Sept, 2023)

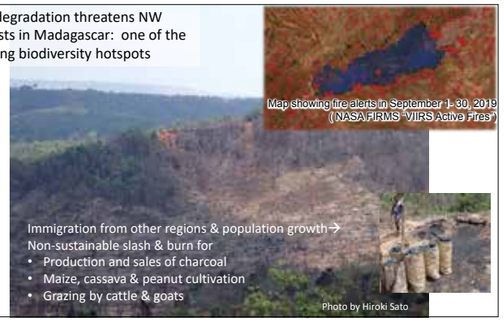
Planning fire break line with local assistants

Alfa and Rova

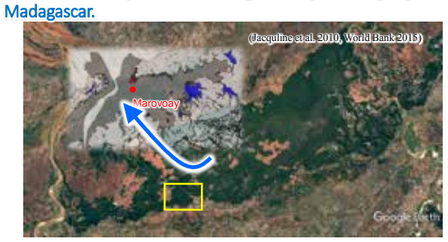


Drone view of the completed fire break three weeks later (Rova with 5 local villagers x 5 days/ week x 3 weeks)

Forest degradation threatens NW dryforests in Madagascar: one of the remaining biodiversity hotspots



Remaining forests in the Ankarafantsika National Park supply clean water to Marovay, the second largest rice producing region in Madagascar.



Slide courtesy of Hiroki Sato

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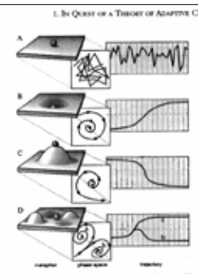

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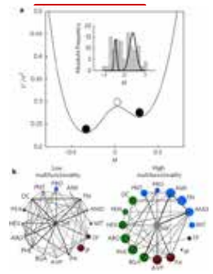
(From Gunderson & Holling eds. 2002)

Alternative states of dry lands in the world



Plant spatial patterns identify alternative ecosystem multifunctionality states in global drylands

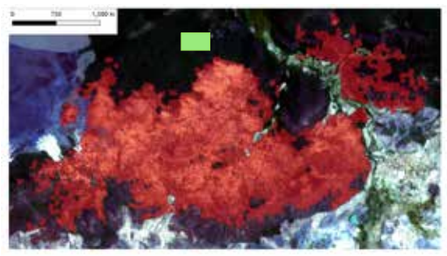
(2020)

DRYLAND ECOLOGY

Global ecosystem thresholds driven by aridity

(2020) Science

Our forest monitoring plot became threatened by a big fire that burned 1085 ha in just one week in October 2021



The first fire: some trees are alive, but lots of dead wood

burned trail unburned

Once burned, it is prone to burn again

After repeated fire, rapid desertification & soil erosion

Photos by Hiroki Sato

Key messages

- Globally, tropical forests are key for mitigation of climate change and carbon neutral
- Importance of proper understanding of fire regimes in many tropical forests, especially those in seasonally dry forests
- Under climate change, fire risk is increasing, especially in combination with forest fragmentation
- Shifts in fire regimes threatens biodiversity conservation and othger ecosystem services provided by the forest
- **Scientific understanding of fire regimes is a critical part of sustainable management of production landscapes**

Forests that historically never or rarely burned are now burning due to anthropogenic pressure excerbated by climate change.

Global Policy Developments and Initiatives on Tropical Forests and Sustainable Industries

Sonya Dewi

Director of Asia Programme, Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF), Indonesia

Dr. Sonya Dewi is the Director of Asia Programme at CIFOR-ICRAF. She is also a Principal Scientist in Landscape Ecology. During her more than twenty-five years of professional career as a scientist, she has sought the integration between conservation and development agendas at the landscape level and trade-off minimization between economic benefit and environmental degradation. She has conducted studies in several countries including Indonesia, India, Viet Nam, and Brazil. Land science has continuously been the basis of her multi-disciplinary research. She has used spatial analysis to develop empirical models and tools called LUMENS (Land use planning for multiple environmental services) to understand and project land use changes and their impacts on regional economy, ecosystem services, and biodiversity. She has been actively promoting the integration of climate change mitigation-adaptation and food security issues into the landscape and jurisdiction governance. LUMENS has been applied to support multi-stakeholder negotiations through facilitation, policy engagement, and capacity-strengthening programs in several districts and provinces in Indonesia. The tool has been used in the development of Green Growth Plans for six provinces in Indonesia and Viet Nam.

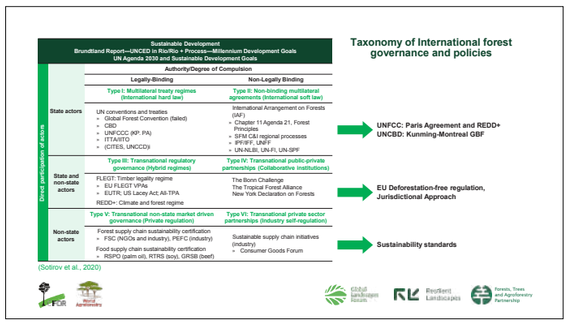
ABSTRACT

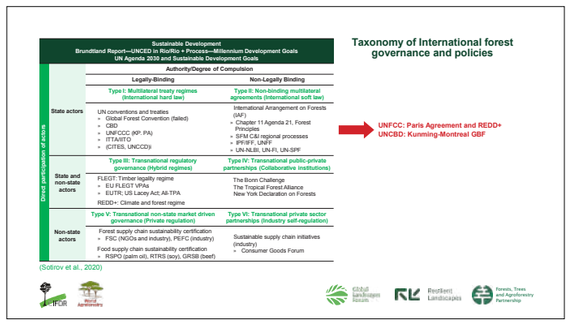
The volumes, diversities, and evolutions of global policies on tropical forests and sustainable agricultural industries are vast, so a systematic grouping is useful. Sotirov et al. (2020) used actors (state, non-state, and state and non-state) and degree of compulsion (legally binding and non-legally binding) to group global policies into six types. The talk will discuss only five global policies across actors, particularly those currently in major public discourses with high potential impacts.

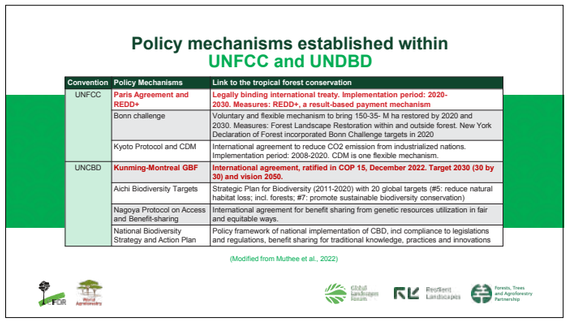
From state actors-legally binding policy group, we discuss the UNFCC's Paris Agreement and REDD+ and UNCBD's Kunming-Montreal Global Biodiversity Framework. The strengths and weaknesses of the Paris Agreement and REDD+ are primarily drawn from Muthee et al. (2022). To create transformation, policy and institutional framework needs to be supported by evidence-based decision-making, integrated approaches, multistakeholder inclusiveness at local and national levels, and investment and incentives for increased participation. As for Kunming-Montreal GBF, the National Biodiversity Strategy and Action Plan is a critical issue for countries to develop their policy framework for national implementation of CBD, including compliance with legislations and regulations, benefit sharing for traditional knowledge, practices and innovations. The IPBES Report emphasizes that relational as well as instrumental values of nature should guide the formulation.

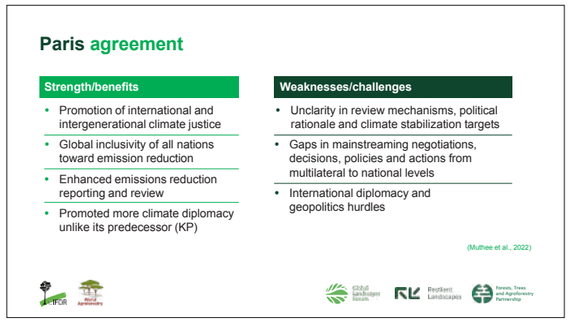
The EU Deforestation-free Regulation, a legally binding global policy applicable to state and non-state actors, was recently enacted to curb the expansion of agricultural land from forests for soy, beef, palm oil, wood, cocoa, coffee, and rubber production, providing a solution to deforestation and forest degradation problems by encouraging the EU to act as a responsible consumer. The crucial issue is the definition of forest and deforestation, which requires technical and institutional reviews and capacity strengthening to support smallholder farmers to comply. From the same group of actors but not under international hard law is the Jurisdictional Approach (JA) to sustainability. Three types of JAs are discussed by Seymour et al. (2020); the critical issues are lack of financing and technical capacity for evidence-based decision-making, silo governance, and lack of monitoring and evaluation (M&E) systems. A case study shows that, to some extent, the three types are interconnected and can be addressed in a phased approach to creating long-lasting (Dewi et al., 2023). The sustainability standard in the global value chain is voluntary and contributes to global commitment as preferential sourcing. Often, this becomes an exclusion tool for smallholders who lack the capacity to comply. The crucial issue is to embed diverse valuation, reduce inequity, and foster common but differentiated responsibility (CBDR) principles across various scales (Leimona et al., 2023).

We conclude that for global policies to be transformative, global policy and national sovereignty must be aligned; CBDR should be the basis of policy and actions, including external financing/incentives; multiple valuations of nature are necessary: instrumental and relational; the one-size-fits-all concept is recognized as not optimal (i.e., geopolitics, local contexts matter); multistakeholder governance such as JA is fostered with inclusive, integrated, and informed principles; and data, technical capacity, tools and transdisciplinary approach in the co-production of landscape/jurisdiction sustainable pathways are promoted.









REDD+

Strength/benefits

- Reduced (slowed down) carbon emissions compared to the baseline scenario.
- Increased funding for sustainable forests conservation and reducing agriculture, forestry, and other land-use sector emissions
- Promoting biodiversity habitats conservation
- Poverty reduction for the locals and indigenous communities

Weaknesses/challenges

- Lack of adequate frameworks for carbon emissions monitoring, measurement, reporting, and verification
- Unbalanced representation (mainly local and indigenous people) and human rights breach
- The legitimacy of the REDD+ development process
- Domestication of international and multilateral agreements at local and national levels
- Weak political support and governance structures (including insufficient policy and institutional frameworks at national and local levels)
- Weak monitoring, reporting and verification mechanisms at local and national levels
- Additionality, leakage/displacement of activities, BAU formulation, permanence, social safeguard are not adequately addressed

Crucial issue is: policy and institutional framework supported by evidence-based decision making, integrated approaches and multistakeholder inclusiveness at local and national levels; investment and incentives for increased participation

Kunming-Montreal GBF (Dec 2022 – COP 15)

- **23 global 2030 targets**
- **4 broad topics: biodiversity conservation and restoration, nature's contribution to people, access and benefit sharing and tools and solutions for mainstreaming and implementation**

Crucial issue is: National Biodiversity Strategy and Action Plan: Policy framework of national implementation of CBD, incl compliance to legislations and regulations, benefit sharing for traditional knowledge, practices and innovations and How IPBES Report can guide the process

- **Main target and goals**
  halt extinction of known threatened species and significantly reduce extinction risk
  - ❖ ensure at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration (Target 2)
  - ❖ ensure at least 30 per cent of terrestrial, inland water, and of coastal and marine areas are effectively conserved and managed (Target 3)
  - ❖ reduce the rates of introduction and establishment of other known or potential invasive alien species by at least 50 per cent, by 2030 (Target 6)
  - ❖ reduce pollution risks and impacts of pollution from all sources to prevent harmful impacts on biodiversity (Target 7)
  - ❖ minimise the impact of climate change and ocean acidification on biodiversity (Target 8)
  - ❖ mainstream biodiversity into decision-making across government and business (Targets 14 and 15)

Type of intervention	Challenges
Creation of external incentives	Slow realization of REDD+ finance and institutions for domestic allocation
	Lack of clarity on how to implement preferential sourcing and other performance-based incentives
	Few green investment transactions linked to jurisdictional performance
	Reluctance of national government to embrace domestic fiscal incentives linked to sustainability
Implementation within jurisdictions	Difficulty sustaining momentum through political transitions
	Lack of trust among stakeholder groups
	Tendency to focus on development objectives at the expense of environmental objectives
	Lack of capacity, data, and sometimes will, on the part of lower-level bureaucrats needed to integrate sustainability into planning
	Data constraints on spatial planning
Facilitation of connections across jurisdictions and levels	Heterogeneity of district interests and needs
	Misalignment of national policies across agencies and sub-national priorities
	Confusion and reporting burdens resulting from the proliferation of performance indicator frameworks

(Seymour et al., 2020)

Applications in Indonesia and Vietnam

Seven coproduction stages in developing Green Growth Plan with Land-Use Planning for Environmental Services (LUMENS).

(Dewi et al., 2023)

Taxonomy of International forest governance and policies

Sustainable Development Brundtland Report—UNCED in Rio/Rio + Process—Millennium Development Goals UN Agenda 2030 and Sustainable Development Goals		
Authority/Degree of Compulsion		
	Legally-Binding	Non-Legally Binding
Level of Governance	Type I: Multilateral treaty regimes (international hard law)	Type II: Non-binding multilateral agreements (international soft law)
State actors	UN conventions and treaties • Global Forest Convention (failed) • CBD • UNFCCC (KP, PA) • ITTA/ITO • (CITES, UNCCD)	International Arrangement on Forests (IAF) • Chapter 11 Agenda 21, Forest Principles • SFM C&I regional processes • IPF/IFF, UNFF • UN-NLBI, UN-FI, UN-SPF
	Type III: Transnational regulatory governance (Hybrid regimes)	Type IV: Transnational public-private partnerships (Collaborative Institutions)
State and non-state actors	FLEGT: Timber legality regime • EU FLEGT VPAs • EUTR; US Lacey Act; Aii-TPA REDD+: Climate and forest regime	The Bonn Challenge The Tropical Forest Alliance New York Declaration on Forests
	Type V: Transnational non-state market driven governance (Private regulation)	Type VI: Transnational private sector partnerships (Industry self-regulation)
Non-state actors	Forest supply chain sustainability certification • FSC (NGOs and industry), PEFC (industry) Food supply chain sustainability certification • RSPO (palm oil), RTRS (soy), GRSB (beef)	Sustainable supply chain initiatives (industry) • Consumer Goods Forum

EU Deforestation-free regulation, Jurisdictional Approach

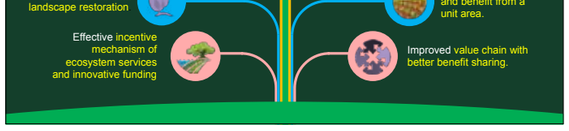
(Solrov et al., 2020)

EU-DR

- On 29 June 2023, the Regulation on deforestation-free products entered into force (Regulation (EU) No 2023/1115), and confirmed by the European Green Deal, the EU Biodiversity Strategy for 2030 and the Farm to Fork Strategy.
- The main driver of these processes is the expansion of agricultural land that is linked to the production of commodities like soy, beef, palm oil, wood, cocoa, coffee, rubber and some of their derived products, such as leather, chocolate, tyres, or furniture
- As a major economy and consumer of these commodities linked to deforestation and forest degradation, the EU is partly responsible for this problem and it wants to lead the way to solving it.
- Under the Regulation, any operator or trader who places these commodities on the EU market, or exports from it, must be able to prove that the products do not originate from recently deforested land or have contributed to forest degradation
- As of 29 June 2023, operators and traders will have 18 months to implement the new rules. Micro and small enterprises will enjoy a longer adaptation period, as well as other specific provisions.

GG expected outcomes	Macro indicators
Sustained economic growth	1. Growth of Gross Regional Domestic Product 2. Employment 3. Income
Inclusive and equitable growth	1. Ratio of income and firm profitability 2. Ratio of smallholders' managed land and concessions
Social, economic and environmental resilience	1. Rate of agroforestry expansion 2. Linkages between land-based and other sectors 3. Profitability of smallholder-managed land use system
Healthy and productive ecosystems providing services	1. Deforestation rate 2. Tree cover gain 3. Sedimentation 4. Surface runoff 5. Habitat fragmentation 6. Fire prone areas
Greenhouse gas emission reduction	1. Gross emission from mineral soil 2. Gross emission from peat areas 3. Sequestration rate

7 Strategies South Sumatra Green Growth Plan



Forest definition

- The FAO forest definition that the EU takes as it's basis has three components

1 ecological criteria based on (potential) tree-cover (with embedded issues on defining trees),

2 disqualifying agricultural tree cover,

3 allowing temporarily unstocked forest lands to remain forest for at last 5 years after clear-cutting or natural disasters, as long as they are expected to be regenerated. The third issue is also relevant for 'forest products', such as derive from plantation forestry: these can be certified as sustainably managed forest even if clear-felling/replant cycles are followed. The use of such lands for agricultural products (as may be evident in geolocations of traded products) cannot in itself be legal proof of 'deforestation' but can indicate transitional agroforestry practices.

- the institutional perspective ('it is forest as long as forest authorities say it is') dominates over vegetation-based perspective. As long as dues are paid to forest authorities, products traded as agricultural commodities can be harvested – as is practiced in 'community forestry' areas in Indonesia

Crucial issue is: technical and institutional reviews in defining forest and deforestation; inclusivity and capacity strengthening to support smallholder farmers

Jurisdictional Approach

Addressing problems of:

- **Project-based approach:** leakage, additionality (measurement, BAU vs others), permanence, social safeguard
- **Certification:** exclusion, externality, benefit sharing, leakage
- **Internal vs external,** common but differentiate responsibilities

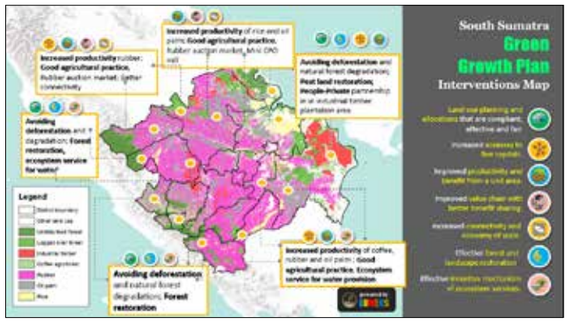
(Seymour et al., 2020)

Improving overall governance

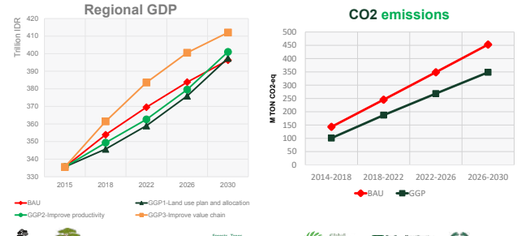
- **Inclusive:** relevant stakeholders within the vertical and horizontal processes should be actively involved so that the aspirations, concerns and constraints can be identified early enough;
- **Integrative:** coherence between the programs and activities across sectors and institutions as well as synchronization of expected outcomes is to be achieve;
- **Informed:** robustly data driven, information and valid models so the ex-ante impact that would occur if a GG scenario is implemented

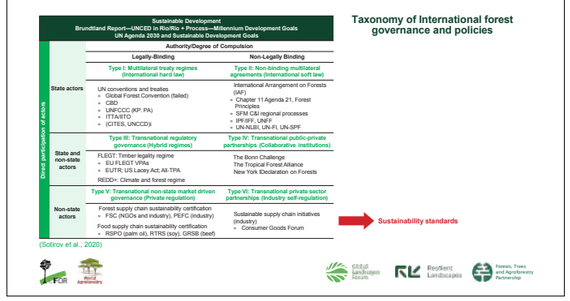
M&E is inherent to the process through agreed targets and goals

(Dewi et al., 2023)



BAU vs GGP





Session 1

"Enhancing Resilience of Tropical Forest Landscapes and Trees"

Chairperson:

NOGUCHI Shoji

Director of Forestry Division, JIRCAS

Sustainable Forest Management and Conservation

Wan Mohd Shukri Wan Ahmad

Director, Forestry and Environment Division, Forest Research Institute Malaysia (FRIM), Malaysia

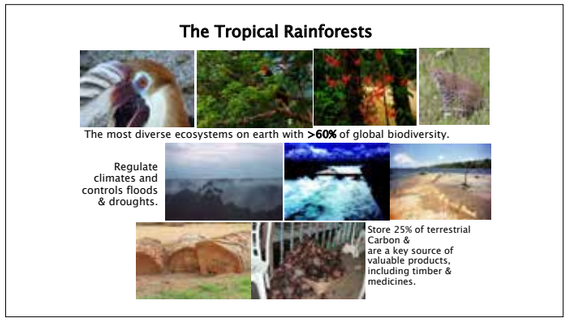
Dr. Wan Mohd Shukri Wan Ahmad is currently the Director of the Forestry and Environment Division at the Forest Research Institute Malaysia (FRIM). Prior to his current position, he led the Geo-information and Natural Forest Research Program. He obtained his B.Sc. and M.Sc. in Forest Management from Universiti Pertanian Malaysia (UPM) and Ph.D. in Environmental Science from Universiti Kebangsaan Malaysia (UKM). His field of interest is forest management and forest inventory. He has been involved in more than 50 research and consultation projects funded by national as well as international agencies. He has also published more than 80 research papers including journals and book chapters.

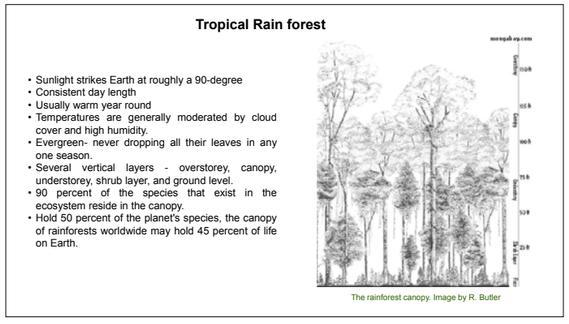
ABSTRACT

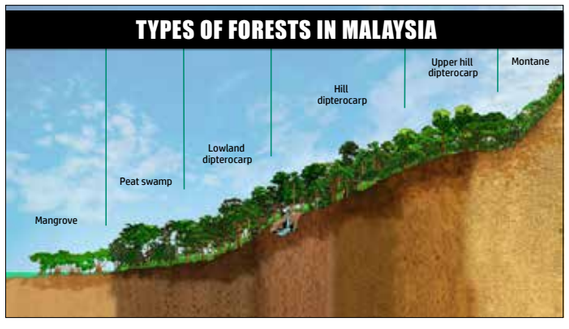
Malaysia's tropical rain forest forms a natural ecosystem that has evolved over the centuries, with a wide range of habitats that form the cradle of the country's biodiversity. The forest has been recognised internationally as one of the mega-diverse areas for both flora and fauna. The Convention on Biological Diversity reported that the flora of Malaysia is very rich, conservatively estimated to contain about 15,000 species of higher plants and with over 1,100 species of ferns and fern allies, many of which are endemic. This richness is reflected in a number of ecological plots established in the country, the most notable of which are 814 tree species inventoried in a 50-hectare plot in Pasoh, Peninsular Malaysia, and over 1,200 species in the 52-hectare plot in Lambir, Sarawak.

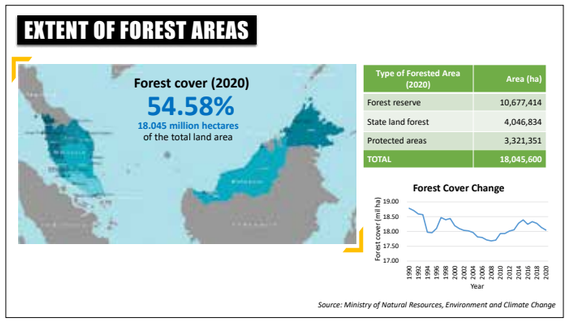
The forest is carefully managed in accordance with the principle of sustainable forest management to achieve clearly specified management objectives with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values in future productivity and without undue undesirable effects on the physical and social environment. The forest is also managed as a renewable resource on a sustainable yield basis and has contributed significantly toward socio-economic development. Apart from its socio-economic role, the forest also plays an important protective function, such as maintaining environmental stability, minimising damage to rivers and agricultural land from floods and erosion, and safeguarding water supplies.

Malaysia has been practising forest conservation since the 1930s and has established a network of protected areas for the conservation of biological diversity in the form of national parks, wildlife reserves and sanctuaries as well as nature parks. Peninsular Malaysia's largest national park, Taman Negara, which comprises mainly virgin forests of various types covering an area of 434,351 ha, was gazetted as early as 1939. Malaysia has also designated its forested land as a protected area, which includes watershed protected areas, wildlife sanctuaries, and fully protected forest areas. Managing the forest in order to maximise social, economic, and environmental benefits on a sustainable basis remains the greatest challenge facing the forestry sector.







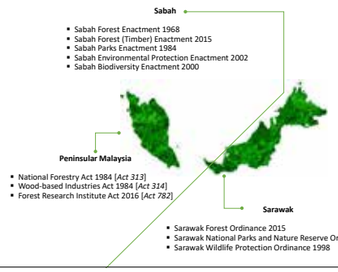


02 LAWS, REGULATIONS & NATIONAL STRATEGIES RELATED TO SFM

LAWS AND REGULATIONS RELATED TO SFM

Federal Constitution

Article 74(2)
Forestry is under the jurisdiction of the **state government**. Therefore, each state has the power and freedom to enact laws and manage forestry policies in their respective states.

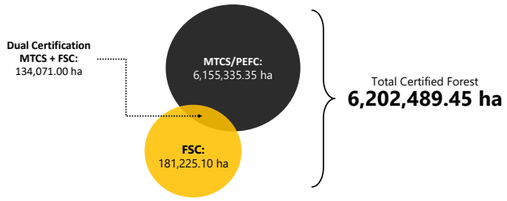


- Sabah Forest Enactment 1968
- Sabah Forest (Timber) Enactment 2015
- Sabah Parks Enactment 1984
- Sabah Environmental Protection Enactment 2002
- Sabah Biodiversity Enactment 2000

- National Forestry Act 1984 [*Act 313*]
- Wood-based Industries Act 1984 [*Act 314*]
- Forest Research Institute Act 2016 [*Act 782*]

- Sarawak Forest Ordinance 2015
- Sarawak National Parks and Nature Reserve Ordinance 1998
- Sarawak Wildlife Protection Ordinance 1998

CERTIFIED FORESTS AS OF 1 JUNE 2023

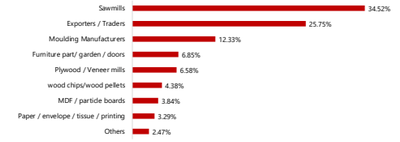


Source: Malaysian Timber Certification Council

CERTIFIED COMPANIES AS OF 1 JUNE 2023

361 companies issued with **PEFC** Chain of Custody Certificate

320 companies issued with **FSC** Chain of Custody Certificate



Source: Malaysian Timber Certification Council

AMENDMENTS OF REGIONAL FORESTRY LAWS

National Forestry Act 1984 (Amendment 2022)

- Tighten the process of degazetting permanent reserve forest (PRF)
- Increase fine and penalty on forest offences
- Strengthen enforcement against forest crime

Sabah Forest Enactment 1968 (Amendment 2018)

- Implementation of REDD+ initiative is regulated under the enactment
- Prevention of seized goods and equipment from being temporarily released

Sarawak Forest Ordinance 2015 (Amendment 2022)

- Creation of amenity forest from forest reserves, protected and communal forests or constituted from state land forests for educational, research and recreational purposes
- Introduce licensing of forest carbon activity in PRF and on state and alienated land

NATIONAL STRATEGIES FOR SFM

1. Ensure **sufficient forest areas** are managed through **good governance and practices** for the **conservation of biodiversity and ecosystem services**
2. **Manage, conserve and rehabilitate** the permanent reserved forests or forest reserves or permanent forests based on the principles of **sustainable forest management**
3. Ensure **continuous supply of raw materials** from natural forests and forest plantations to sustain the development of wood-based and non-timber forest industries
4. Encourage the **participation of indigenous, native and local communities** in the **protection, conservation and rehabilitation** of forests
5. Strengthen **capacity building**; **research, development and commercialization**; and **innovation** including providing adequate human financial resources to **improve forest management** and **utilization of forest resources**

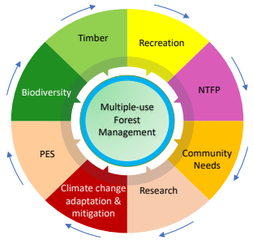
03 NATURE-BASED SOLUTIONS/ ECOSYSTEM-BASED APPROACHES IN THE COUNTRY

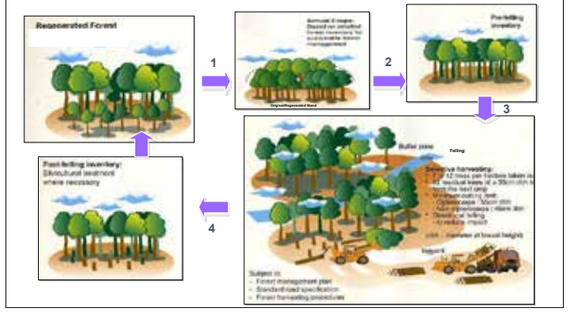
Greening Malaysia: 100 Million Tree Planting Campaign 1

- Launched on 5 January 2021
- **Campaign duration**: 2021-2025 (5 years)
- **Aim**: To increase awareness and involvement of all parties on the importance of trees and forest towards the wellbeing and the quality of life of the current and future generation
- **Participation**: All parties including state governments, ministries, government agencies, private companies, NGOs and CSOs, education institutions as well as individuals or general public

NATIONAL STRATEGIES FOR SFM

Forest management changed from focusing on timber production to "Multiple-use Forest Management"





2 Central Forest Spine

- The CFS Masterplan was developed in 2010 and reviewed in 2022 to **re-establish, maintain and restore forest connectivity** within the CFS area.
- Key achievements:
  - **28,565 hectares** of state lands have been gazetted to PRF and wildlife sanctuary
  - a **wildlife crossing (viaduct)** was developed in Gerik, Perak
  - **514 hectares** of forest area was rehabilitated with forest trees and fruit trees preferred by animals in identified habitats
  - A project entitled "Habitat Rehabilitation Programme through Tree Planting Activities under Central Forest Spine Management and Development Project" was chosen to be part of **ASEAN Green Initiative**

Wildlife crossing in Gerik, Perak

Heart of Borneo 3

- HoB is a **voluntary transboundary cooperation** between **Brunei, Indonesia and Malaysia** aimed at conserving and managing the contiguous tropical forest in the island of Borneo.
- The total area covered under the HoB Initiative is 20 million hectares of which **6.68 million hectares** are located in Malaysia (Sabah and Sarawak)
- Key achievements:
  - Sabah – **164%** increment of TPAs within the HoB area from 2007 to 2020
  - Sarawak – increment of HoB area from 2.1 million ha to **2.7 million ha** in 2018
- Support program for SFM under HoB:
  - Awareness programme on SFM, forest management certification (FMC) and multi-stakeholder consultation framework for local communities and camp workers
  - Establishment of community representative committee
  - Capacity building - training and workshop on SFM, FMC and Reduced Impact Logging

Crocker Range, Sabah

4 Nationwide Coastal Tree Planting Program

- Launched in 2005 and still on-going
- As of 2022, **nearly 7.2 million** seedlings of mangrove and other coastal species have been planted encompassing more than **3,000 hectares** of coastal area throughout Malaysia
- Involve participation from **all state governments**, various agencies, universities, **11 NGOs and local communities** related to mangrove
- Over **100 researches** regarding mangrove were carried out under the program

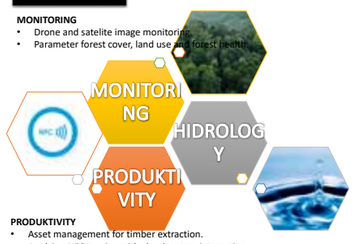
Tree planting by NGO in Perlis

Forest Rehabilitation and Restoration Program 5

Restoration of degraded areas along Kelantan riverbank

- Started in 2016 and still on-going
- As of 2022, more than **2,500 ha** of degraded forest throughout Malaysia has been rehabilitated with the planting of approximately **1.6 million forest trees**
- Involve participation from various NGOs
- This project will be continued until all the degraded forest within the Permanent Reserved Forests and other sensitive areas are planted

SMART FOREST



MONITORING
- Drone and satelite image monitoring
- Parameter forest cover, land use & forest health

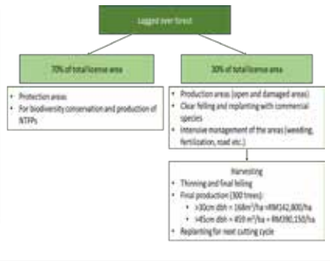
HIDROLOGY
- Realtime data and trigger indicator for monitoring.
- Rain distribution, turbidity and water level.
- Direct to user notification system
- Monitoring realtime data collection

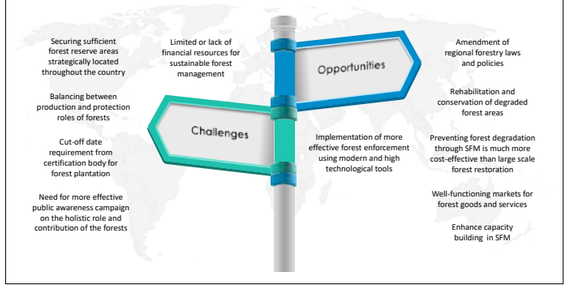
PRODUKTIVITY
- Asset management for timber extraction.
- Applying NFC tagging with cloud system integration.
- Accurate timber volume and log movement monitoring
- Quick timber extraction taxes report

05 KEY CHALLENGES AND OPPORTUNITIES IN SFM IMPLEMENTATION

04 R&D RELATED TO SFM

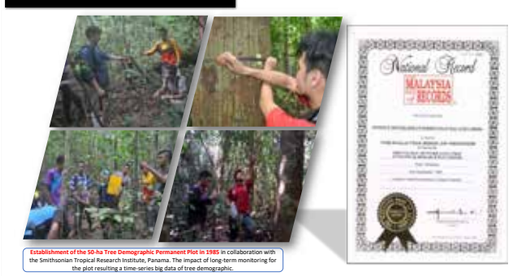
INTENSIVE FOREST MANAGEMENT





MANGROVE REHABILITATION IN SG HJ DORANI

PASOH 50-HA DEMOGRAPHIC PLOT (FRIM/FORESTGEO/AA-HARVARD)



Establishment of the 50-ha Tree Demographic Permanent Plot in 1985 in collaboration with the Smithsonian Tropical Research Institute, Panama. The impact of long-term monitoring for the plot resulting a time-series big data of tree demographic.

Thank you

Enhancing Tropical Forest Resilience and Production through Tree Breeding Technology

TANI Naoki

Senior Researcher, Forestry Division, JIRCAS, Japan

Dr. TANI Naoki is currently a Senior Researcher in the Forestry Division of the Japan International Research Center for Agricultural Sciences (JIRCAS). He also holds a professor position at the University of Tsukuba and serves as Pproject Leader of a SATREPS project on tropical forest resilience. His area of study includes forest genetics and molecular ecology in tropical forests, and he has extensive experience in international collaborations with research institutes in Malaysia, Indonesia, and Thailand. He received his Ph.D. in Agricultural Sciences from the University of Tsukuba in 1998. He joined JIRCAS in 2008 after 10 years' service at the Forestry and Forest Products Research Institute and 1 year as a visiting scientist at the Institut National de la Recherche Agronomique (INRA).

ABSTRACT

Tropical forests play a pivotal role in mitigating climate change, conserving biodiversity, and supporting local livelihoods. However, these invaluable ecosystems are increasingly vulnerable to the impacts of climate change, including extreme weather events and shifting environmental conditions. To address these challenges, our research focuses on improving the resilience of tropical forest tree species utilized for timber production.

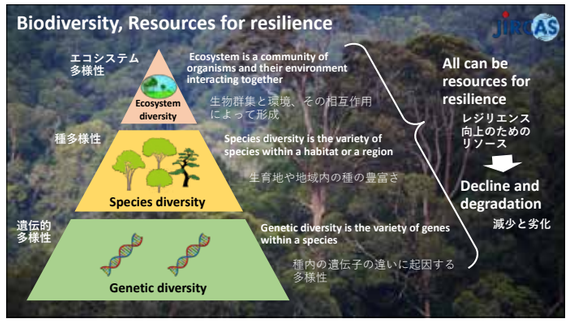
In this symposium, I would like to discuss our innovative approach that utilizes tropical forest genetic resources, physiological trait evaluation, and genomic selection technology to identify and propagate individuals with enhanced resilience to climate change and economic values. Traits encompass various factors, including drought tolerance, growth rate, timber quality, and adaptability to climate change.

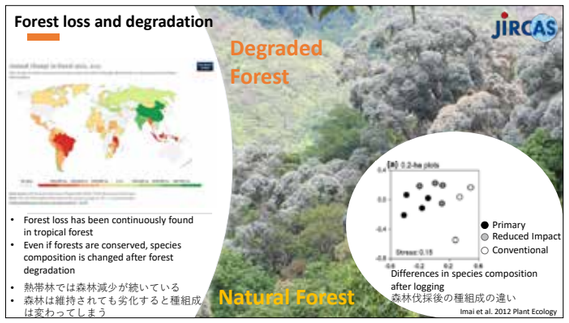
Genomic selection represents a revolutionary contribution to tree breeding. Conventional tree breeding methods necessitate lengthy evaluation periods, waiting for the growth of progenies to assess their phenotype for focal traits. In contrast, genomic selection allows us to evaluate the phenotype of seedlings in the early stages of the progeny, significantly accelerating the breeding cycle. This speedier approach not only increases the efficiency of breeding programs but also reduces resource requirements and expedites the development of resilient tree populations in tropical forests.

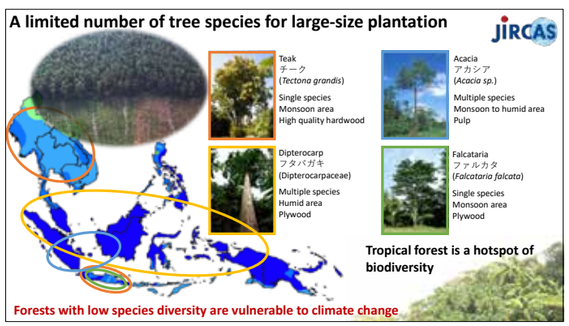
Ultimately, this research contributes to the broader discussion on tropical forest conservation, climate change mitigation, and sustainable resource management. By combining conventional tree breeding techniques with genomic technology, we strive to enhance the resilience of tropical forest species, contributing to global ecological stability and livelihood improvement.

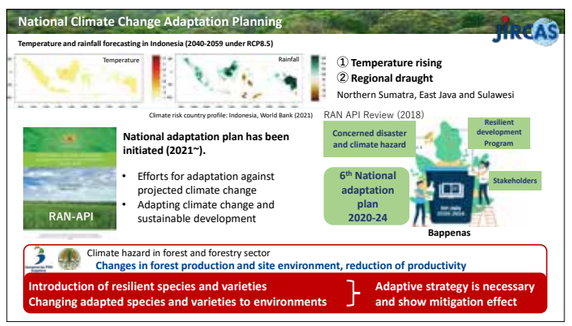
[1] Sawitri, Tani et al. (2020) Potential of genome-wide association studies and genomic selection to improve productivity and quality of commercial timber species in tropical rainforest, a case study of *Shorea platyclados*. Forests, **11 (2)**, 239.

[2] Akutsu, Tani et al (2023). Comparing modeling methods of genomic prediction for growth traits of a tropical timber species, *Shorea macrophylla*. Frontiers in Plant Science, *in press*





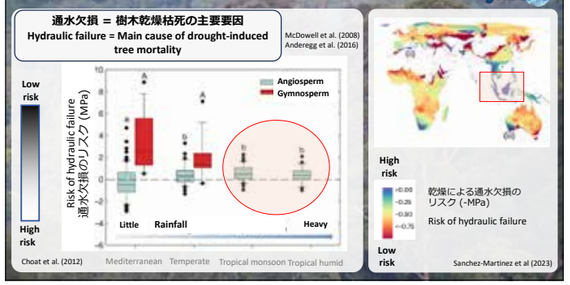




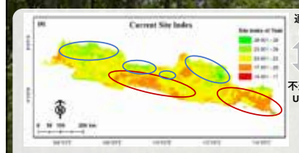
Tropical forest is vulnerable to drought

通水欠損 ＝ 樹木乾燥枯死の主要要因
Hydraulic failure = Main cause of drought-induced tree mortality

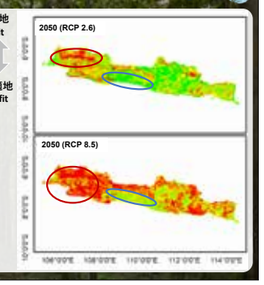
McDowell et al. (2008)
Anderegg et al. (2016)



Teak distribution under climate change



適地 Fit
不適地 Unfit



Current condition

- The high site index (SI) area is in low elevation.

Two RCP scenarios in 2050

- The currently suitable area will be changed.
- The currently unsuitable area will be better.

Eko et al (2022) JARQ

Project outcomes and Social Implementation

Social implementation

① Establishment of demonstration plantations
② Introduction to private companies and community
③ Human resources development

Project outcomes

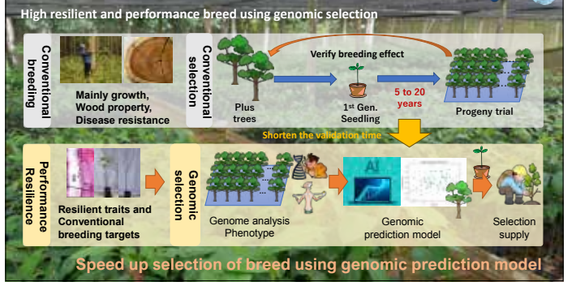
① High resilient individuals and propagation
② Guidelines for forest planting under climate change
③ Value-add through ecosystem services and economical analysis

Realizing climate change

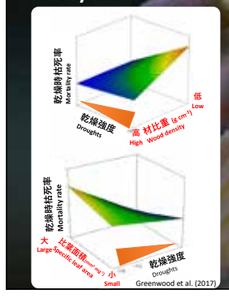
SATREPS JST JICA

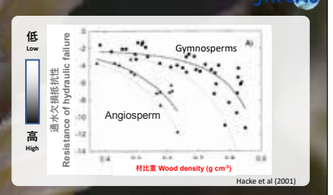
Tree breeding using genomic selection

High resilient and performance breed using genomic selection



Identify focal traits to increase resilience





Species with heavier wood and thicker leaves may be more robust to drought

材が重く、分厚い葉をもつ種ほど、乾燥に対して頑健である

The heavier woody species, the more resistant to hydraulic failure during drying period.

重い材の樹種ほど、乾燥時の通水欠損抵抗性が高い可能性

Deforestation Mechanisms and Sustainable Solutions

MIYAMOTO Motoe

Team Leader, Forest Environmental Policy, Department of Forest Policy and Economics, FFPRI, Japan

Dr. MIYAMOTO Motoe is the Team Leader for Forest Environmental Policy at FFPRI. Her area of study includes deforestation mechanisms and tropical forest conservation. She was a researcher at the Forestry Division, JIRCAS. She was supported by JIRCAS at the International Centre for Research in Agroforestry (ICRAF), Southeast Asia Region, Indonesia, from 1997 to 2000. She holds a Bachelor of Science degree in Mathematics from Kyusyu University; a Master's degree from the Graduate School of Environmental Science, Hokkaido University; and a PhD from the School of Life and Environmental Sciences, University of Tsukuba.

ABSTRACT

Tropical deforestation is a global environmental problem and a major source of greenhouse gas emissions. Efforts to halt deforestation have been promoted worldwide, but they have not met the initial expectations. Effective efforts require an understanding of the causes of deforestation and the adoption of appropriate strategies.

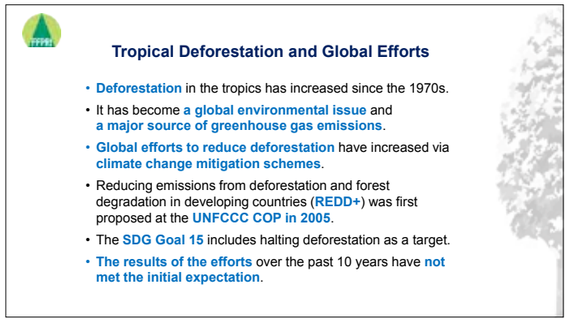
Deforestation mechanisms can be explained by three factors: poverty, agricultural rent (agricultural profitability), and forest scarcity. Poverty, the chief underlying cause, has the strongest impact on deforestation. The main proximate causes (e.g., road construction and expansion of export crops) are related to the increase in agricultural rent. In contrast, forest scarcity is an important factor that decreases deforestation. Deforestation rates would be high if all the three conditions coexisted at high rates, i.e., high poverty rate, high increase in agricultural rent, and high forest coverage.

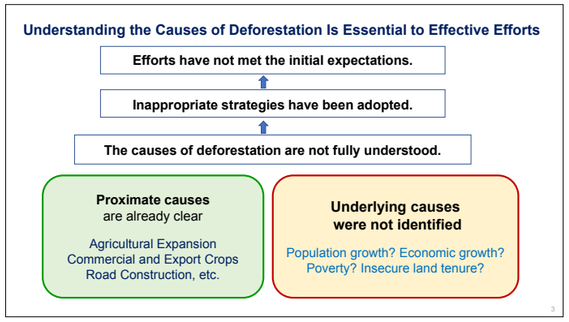
The current efforts to decrease deforestation mainly focus on lowering agricultural rent, which can be effective but may be unsustainable due to the high costs and social impacts. Studies have shown that poverty reduction strategies can sustainably reduce deforestation and, to this end, global efforts need to shift from agricultural rent reduction to poverty reduction.

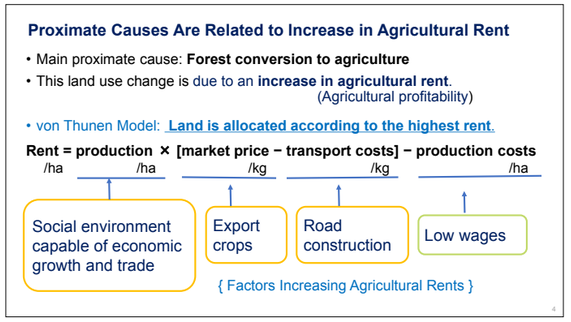
Sustainable solutions to tropical deforestation require multifaceted strategies to reduce poverty rates in developing countries. In particular, it is necessary to develop comprehensive social infrastructure (agriculture, health care, education, etc.) to support impoverished populations in overcoming poverty.

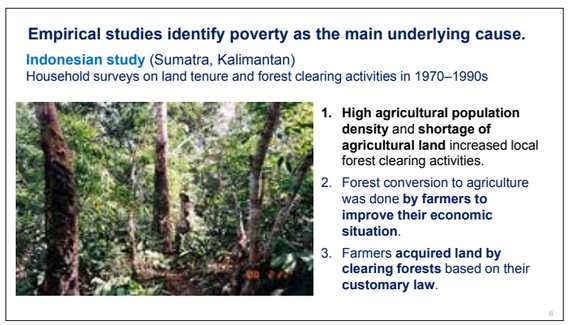
[1] Miyamoto M. Poverty reduction saves forests sustainably: Lessons for deforestation policies. World Development, **127**, 104746 (2020).

[2] Miyamoto M. Causes and Solutions to Tropical Deforestation: The Role of Poverty Reduction in Halting Deforestation Effectively. Journal of the Japanese Forest Society, **105**, 27—43 (2023) (In Japanese).







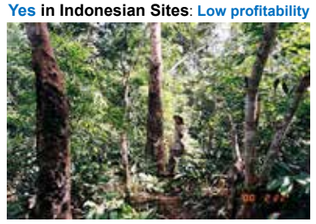


Does deforestation (forest conversion to agriculture) increase poverty?

Yes & No. It depends on the **Profitability of Agricultural Land**.

Forest conversion to rubber
↓
Low profitability of jungle rubber
↓
Sale of rubber land for living expenses
↓
Inequality in land holdings increase.
↓
Households having little or no land increase.

Yes in Indonesian Sites: Low profitability



7

Does deforestation (forest conversion to agriculture) increase poverty?

No in Peninsular Malaysia: High profitability

- **Oil palm development reduced poverty (strongest impact)**.
- Oil palm and rubber **smallholders** received **full government support**.
- Rubber Industry Smallholders Development Authority (**RISDA**) provides **technical support**, such as **highly productive seedlings, fertilizers, and subsidies for replanting**.

8

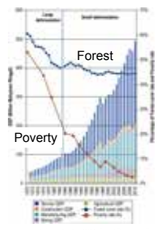
Does reduction of poverty reduce deforestation?

Yes Evidence from Peninsular Malaysia

Houses in 1967
[FELDA oil palm village]

Houses in 2011

Deforestation decreased when the poverty rate fell below 20%.



(Miyamoto et al, 2014, Forest Policy and Economics)

9

Mechanisms of Deforestation

Poverty Underlying cause	**Agricultural Rent** Proximate cause	**Forest Scarcity** Factor that decreases deforestation

Deforestation can be explained by **three factors**.

High Poverty Rate
High Rate of Increase in Agricultural Rent
High Forest Coverage
→ **Deforestation will happen**

If all the conditions coexist

Mechanisms of Deforestation Reduction

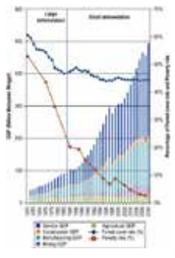
Low Poverty Rate

Low or Negative Rate of Increase in Agricultural Rent

Low Forest Coverage

If any of the conditions exist

Deforestation will be reduced



11

(Miyamoto et al, 2014, Forest Policy and Economics)

Current Efforts to Halt Deforestation:
Strategies to Reduce Agricultural Rent

Characteristics	**Strategies to Reduce Agricultural Rent in Tropical Rural Areas**
Examples	・Protected area expansion ・Moratorium on forest clearance ・Investment restrictions on companies linked to deforestation (forest conversion to agriculture)
Effectiveness	☐ **Effective, immediate impact**
Sustainability	☐ **Poor sustainability** due to high cost and socio-economic impact

12

Sustainable Solutions: Poverty Reduction Strategies

Characteristics	**Strategies to Reduce Poverty Rates in Developing Countries**
Content	**Developing a comprehensive social infrastructure to help impoverished populations overcome poverty** • Providing highly profitable agricultural land • Agricultural technical support • Education and medical support
Effectiveness	☐ **Meaningful impact of fundamental solutions**
Sustainability	☐ **High sustainability**

13

Sustainable Solutions to Deforestation

1. **Global efforts** to halt deforestation **require a shift in focus** from agricultural rent-reduction strategies **to poverty reduction strategies**.
2. **Multifaceted strategies to reduce poverty rates in developing countries** can be sustainable solutions to deforestation.
3. *Scope:* **Covering the impoverished population of the entire country or region**
4. *Objectives*: **To enable impoverished populations to overcome poverty**
5. *Content:* **Providing comprehensive social infrastructure, including agriculture, healthcare, and education**, to impoverished populations

14

Session 2

"Improving Industrial Sustainability of Tropical Timber/Non-Timber Products"

Chairperson:

IIYAMA Miyuki

Program Director/Information, JIRCAS

Contributions of Tree Improvement Program to Increase Forest Productivity and Achievement of Indonesian Nationally Determined Contributions (NDCs)

Mohammad Na'iem

Professors, Faculty of Forestry, Universitas Gadja Mada, Yogyakarta, Indonesia

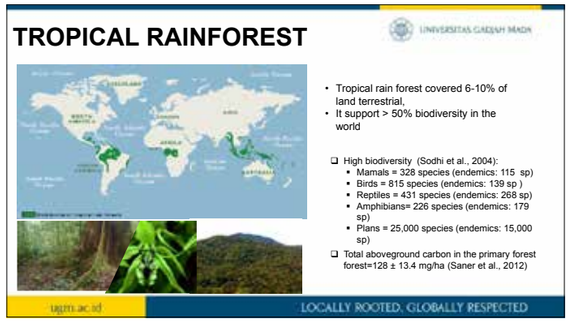
Dr. Mohammad Na'iem is currently the Professor in Faculty of Forestry, Universitas Gadjah Mada, Yogyakarta, Indonesia. He obtained Ph.D. in agricultural sciences from Graduate School of Agricultural Sciences, University of Tsukuba, Japan in 1992. His field of interest is tree improvement and has about more than 40 years of experience in tree improvement in some important species in Indonesia, i.e. Tectona grandis, Pinus merkusii and Dipterocarps species. He was Dean of Faculty of Forestry UGM during 2004-2012. He had many projects on forest productivity both in forest plantation and natural forest. He also published his research in papers including journals and chapters of books.

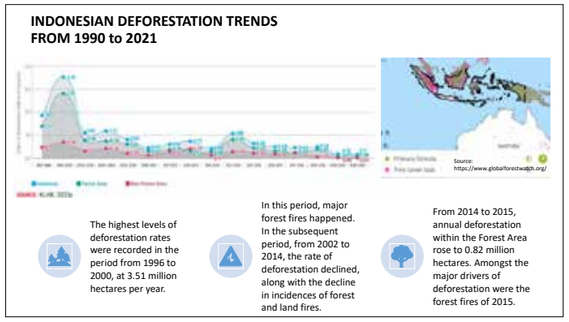
ABSTRACT

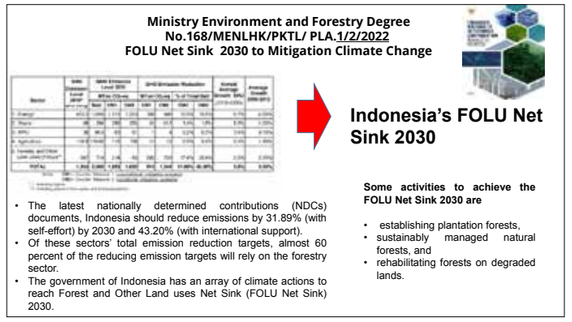
The forest area of Indonesia is the second-largest tropical forest in the world, with a total forest area of more than 120 million ha. Indonesia's tropical forest is one of the most biodiverse terrestrial ecosystems in terms of species richness and endemism, supporting 18.7% of the world's plant biodiversity. Thus, the existence of tropical forests is vital to reducing emissions and maintaining climate and resources. They provide timber, food materials, medicinal plants, and natural fibers, as well as recreation, aesthetic value, ecological benefits and more. However, Indonesia's tropical forests have been declining due to, among other things, forest fires, illegal logging, over-exploitation, and conversion of forests to other land uses. The highest rate of forest loss in Indonesia was in the period 1996-2000 (3.51 million ha), while the deforestation rate in the period 2019-2020 decreased by 75 percent to 115 thousand ha, the lowest rate since 1990. Preventing forest degradation could reduce around 15% of total greenhouse gas emissions, which would help combat climate change. Thus, Indonesia joined in signing the Paris Agreement for a better life and environment in the future.

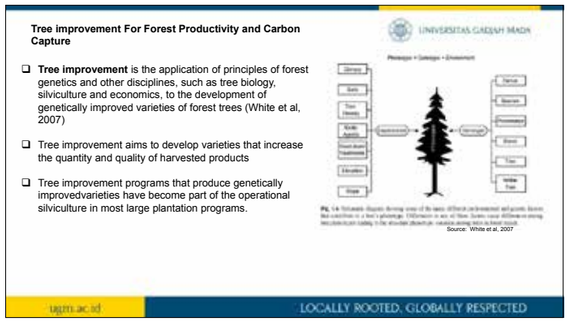
Based on the latest Nationally Determined Contribution (NDC) documents, Indonesia should reduce emissions by 31.89% (with self-effort) and up to 43.20% (with international support) by 2030. Of the total emission reduction targets from different sectors, almost 60 percent of the emission reduction targets will rely on the forestry sector. Thus, the government of Indonesia has an array of climate actions to achieve its Forest and Other Land Use Net Sink (FOLU Net Sink) 2030 targets. Some activities to achieve the FOLU Net Sink 2030 goals are the establishment of plantation forests, the sustainable management of natural forests, and the rehabilitation of forests on degraded lands.

Forest rehabilitation uses improved seeds to increase forest productivity through intensive silviculture (SILIN), which consists of tree improvement, environment manipulation, and pest and disease management programs. For example, implementing tree improvement in clonal teak plantations could increase forest productivity by >300% compared to using unimproved teak seed. In 20 years after planting, the trunk diameter, timber volume, and carbon sequestration in the clonal teak plantation were 42 cm, 300 m^3/ha, and 200 tons C/ha, respectively. Meanwhile, the rehabilitation of natural forests dominated by dipterocarp species could be established by enrichment planting with native species such as *Shorea leprosula*, *S. parvifolia*, *S. johorensis*, *S. macrophylla*, and *S. platyclados*. Enrichment planting with native species could increase forest productivity from 25-30 m^3/ha to 200-300 m^3/ha in 25 years after planting. Furthermore, enrichment planting with native species increased carbon storage in the secondary natural forest, reaching 139.52 tons C/ha. This study suggested that tree improvement programs using the SILIN technique should be implemented to improve land forest cover and forest productivity and achieve Indonesia's NDCs.









ROADMAP OF TEAK's TREE IMPROVEMENT PROGRAM FOR REFORESTATION MONSOON FOREST IN JAVA

Output	• Progeny test of teak • Silviculture trial of teak	Selected 150 clones teak based on growth and rooting ability	Selected 2 clones of teak for planting	Selected variety of paddy adapted on the teak plantation	• Increasing carbon absorption, forest productivity, ecosystem services and income of farmer • Selected clone of teak adapt with climate change
Activity Collecting 600 plus trees of teak (Pulau Madura, P. Kangean, P. Sepinggan, P. Paliat, P. Bawean, P. Sumbawa, P. Timor (Atambua dan Niki-Niki), Sul. Tenggara (Konawe Selatan), P. Muna, P. Buton, P. Saparua dan P. Buru)	Establishment research plantation	Selecting superior teak based on growth and rooting ability	Pilot project for clonal teak plantation	Pilot project of Integrated forest and Farming system /IFFS)	• GWAS Study of teak • Selecting clone of teak adapt with climate change • Establishment of clonal test of teak in 4 location
1997	**1997 - 2003**	**2004 - 2016**		**2017 - 2019**	**2021 - 2025**

ESTABLISHMENT of CLONAL TEAK PLANTATION

Progeny test

Clonal test

- **Selected Mother Trees of Teak**
- Establishment of Progeny Test and Clonal Test of Teak
- Selected the best clone of teak
- Improved teak diameter increment = 3 – 5 cm.
- Wood production per ha/ in 20 years = 300 m^3

MASS VEGETATIVE PROPAGATION OF TEAK FOR FOREST ROSABILITATION

- Establishment of Hedge orchard
- Large scale seedling production by shoot cutting in the nursery
- Preparing and maintenance seedling for clonal teak plantation

Large scale clonal teak plantation

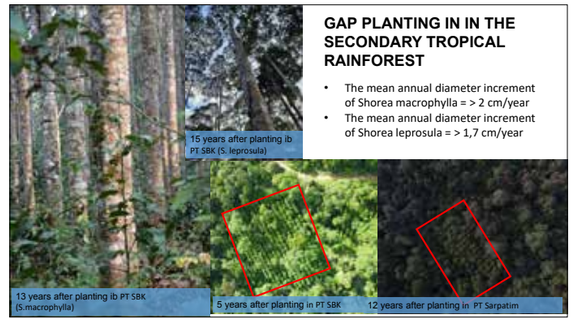
LARGE SCALE LINE PLANTING PLANTATION OF DIPTEROCARP IN THE SECONDARY TROPICAL RAINFOREST

Enrichment planting is artificial regeneration by adding species in the logged forest to increase the density commercial tree and to timber stock for next cutting cycle (Kettle 2010; Lamb 2014).

Use of native species for enrichment planting in the secondary tropical rain forest

GAP PLANTING IN IN THE SECONDARY TROPICAL RAINFOREST

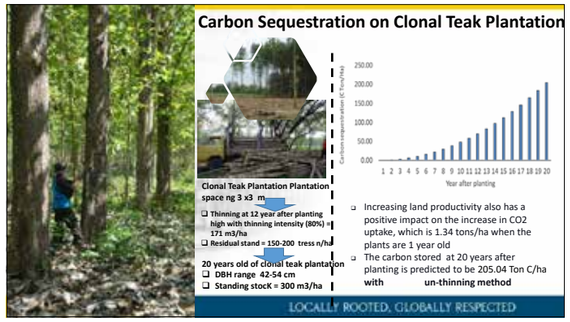
- The mean annual diameter increment of Shorea macrophylla = > 2 cm/year
- The mean annual diameter increment of Shorea leprosula = > 1,7 cm/year



Development Agriculture Plantation under Clonal Teak Plantation

Early stage of agroforestry system in the clonal teak plantation

Agroforestry under close canopy of clonal teak plantation



Carbon Sequestration on Clonal Teak Plantation

Clonal Teak Plantation Plantation space ng 3 x3 m

- Thinning at 12 year after planting high with thinning intensity (80%) = 171 m3/ha
- Residual stand = 150-200 tress n/ha

20 years old of clonal teak plantation

- DBH range 42-54 cm
- Standing stocK = 300 m3/ha

- Increasing land productivity also has a positive impact on the increase in CO2 uptake, which is 1.34 tons/ha when the plants are 1 year old
- The carbon stored at 20 years after planting is predicted to be 205.04 Ton C/ha **with un-thinning method**

LOCALLY ROOTED, GLOBALLY RESPECTED

ENRICHMENT PLANTING USING NATIVE SPECIES IN SECONDARY TROPICAL RAIN FOREST

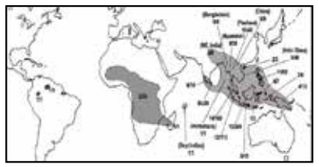
TOTAL CARBON SEQUESNTRATION IN SECONDARY TROPICAL RAIN FOREST WITH ENRICHMENT PLANTING

Carbon sequestration in the secondary tropical rain forest	**= 81.59 ton C/ha**
Carbon sequestration of enrichment planting in secondary tropical forest	= 139.52 **ton C/ha**
Total carbon in Secondary tropical forest after 20years after planting	**= 221.11 ton C/ha**

CLONAL PLANTATIONS PLAY A KEY ROLE TO INCREASE FOREST PRODUCTIVITY and CARBON SEQUESTRATION

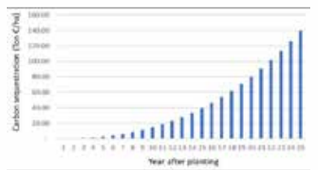
DIPPTEROCARPS FOREST

- The family of Dipterocarpaceae consists of 16 genera making up about 515 species
- Dipterocarps was dominated found in Borneo 269 species (58% endemik), Peninsula Malaysia (160 species) and Sumatra (113 species) (Aston 1982)



CONTRIBUTION ENRICHMENT PLANTING TO INCREASE CARBON SEQUESTRATION IN THE SECONDARY TROPICAL RAINFOREST

UNIVERSITAS GADJAH MADA

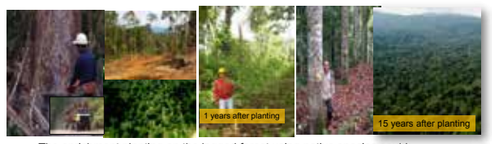


Enrichment planting using line planting technique could improve carbon sequestration in secondary tropical rain forest = 139.52 ton C/ha

ugm.ac.id

LOCALLY ROOTED, GLOBALLY RESPECTED

IMPLICATIONS FOR THE SUSTAINABLE MANAGEMENT OF TROPICAL RAINFORESTS

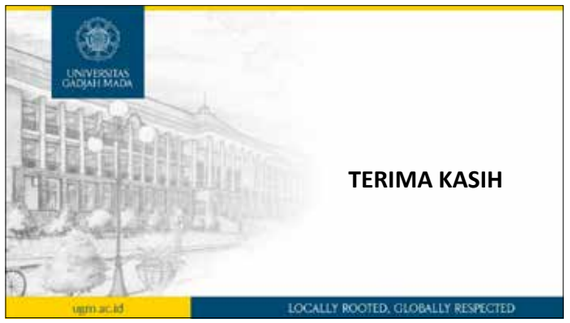


The enrichment planting on the logged forest using native species could:

- increase the standing stock of logged forest
- preserve the native species from extinction

Enrichment planting of dipterocarps could:

- restore the genetic diversity of logged forests and
- maintain forest productivity for the future, making forestry more sustainable, with high ecosystem services



Oil Palm Trunk - High Value Technology for Tropical Forest Conservation

KOSUGI Akihiko

Project Leader, Biological Resources and Post-harvest Division, JIRCAS, Japan

Dr. KOSUGI Akihiko currently works at JIRCAS as Project Leader of the "Asia Biomass" research. His area of study includes microbiology and biomass utilization. He received his Ph.D. in Applied Biology and Chemistry from Tokyo University of Agriculture in 2000. He worked as a postdoctoral fellow (Molecular & Cellular Biology) at the University of California, Davis, USA (2000-2003). He also worked as a researcher at Kaneka Corporation (2003-2005). He joined the Japan International Research Center for Agricultural Sciences (JIRCAS) in 2005. He has about 20 years of experience in collaborative research in Malaysia and Thailand. He is also a professor at the Graduate School of Life and Environmental Sciences at the University of Tsukuba.

ABSTRACT

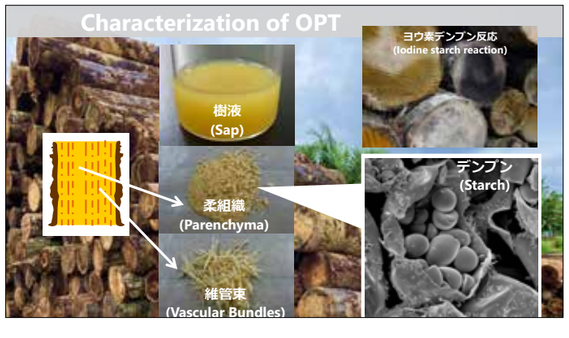
Palm oil extracted from palm fruits is the most consumed vegetable oil in the world and is used as a raw material for producing cooking oil, margarine, and shortening. It accounts for about 30% of total vegetable oil production of 200 million tons. In Indonesia and Malaysia, where 80% of the world's palm oil is produced, approximately 3.6 million ha of tropical rainforest have been converted to oil palm plantations over the past 20 years, and there are substantial concerns about their impacts on the natural environment and ecosystems.

Oil palms are replanted when they reach an economic age (25-30 years after planting). In Indonesia and Malaysia, approximately 63 million oil palm trunks (OPTs) are felled annually, and reforestation is carried out in approximately 440,000 ha per year. The plantation is like a waste dump for biomass, leading to the failure of replantation due to the spread of pests. It also has a significant impact on the environment, causing greenhouse gas (GHG) emissions due to the decomposition of OPTs. New plantations need to be established to compensate for the failure of replantation, even as tropical forests are being cut down and disappearing at an alarming rate.

JIRCAS has developed a technological system that enables efficient production of renewable energy and chemical materials from OPTs through field surveys and research on OPT at a palm plantation in Malaysia. In 2019, we started the SATREPS project titled "Sustainable Replantation of Oil Palm by Adding Value to Oil Palm Trunk through Scientific and Technological Innovation."[1] In this project, we are developing activities for dissemination and social implementation through the development of a technology for manufacturing high value-added products from OPT. Panasonic Housing Solutions Co., Ltd., a member of the project, has developed a technology to produce recycled OPT board for use in furniture and building materials with intermediate materials, and is moving toward manufacturing and marketing the product[2]. In addition to reducing GHG emissions, this technology is expected to have several other positive effects, such as halting the destruction of forests, a source of CO_2 absorption, as a "new material that can replace wood," and creating new jobs in oil palm-producing countries.

The project members and JIRCAS will contribute to the protection of tropical forests through the sustainable management of palm plantations by adding value to OPT[3].

[1] https://satreps-opt.com/
[2] https://panasonic.co.jp/phs/technology/palmloop/
[3] https://sj.jst.go.jp/stories/2022/s0830-01j.html



SATREPS-OPT project

Project title : Project on sustainable replantation of oil palm by adding value to oil palm trunk through scientific and technological innovation

National research project : April 2019 ～ Mar 2025（6 years）

Project Leader
Akihiko KOSUGI

JIRCAS

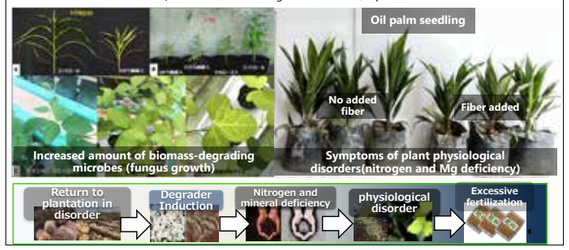
Project Leader
Prof. Sudesh K Kumar

Universiti Sains Malaysia

Effects of OPT fiber residues on crops

OPT fiber residues are tested in crop cultivation tests to see how they affect plants.

（Uke *et-al. Journal of Environmental Management* Vol 295, Open Access）



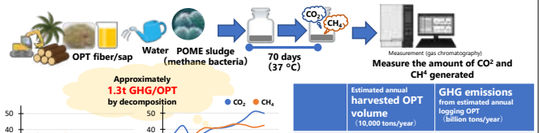
Factors in Deforestation

The massive consumption of wood panels in Asia is another cause of deforestation.

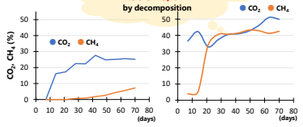
IDC OTSUKA Ariake Showroom

Estimates of greenhouse gas (GHG) emissions from OPT logging

When harvested oil palm fibers are left in the soil, how much GHG is emitted?
Predict how plantation management requires GHG emissions in different situations.



Approximately **1.3t GHG/OPT** by decomposition



	Estimated annual harvested OPT volume（10,000 tons/year）	GHG emissions from estimated annual logging OPT（billion tons/year）
Malaysia	7,500	0.98
Indonesia	15,000	1.96
Malaysia + Indonesia	22,500	2.94
Japan's GHG reduction target (from "Japan's National Intended Nationally Determined Contribution (government draft)" at COP21)		3.66

OPT commercialization demonstration pilot plant (Kluang process)

Developing global solutions to palm oil industry issues

If you want to know more about our activities, ...

JIRCAS channel

JIRCAS Dream Biomass Solutions Co.
（JDBS）
https://opt-jdbs.com/

Development of Kluang process for palm biomass

Panasonic Housing Solutions Co.

From the **PALM LOOP** special page, a technology for converting waste oil palm wood into recycled wood board

Thanks very much for your attention

www.jircas.go.jp

SATREPS-OPT project

Development of Timber and Oil Palm Industries in Southeast Asia and International Policy for Tropical Forest Conservation

SAMEJIMA Hiromitsu

Research Manager, Biodiversity & Forests Area, IGES, Japan

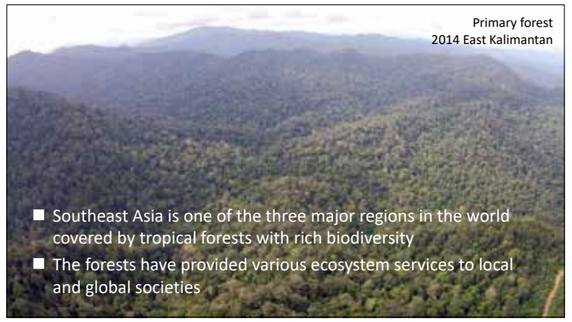
Dr. SAMEJIMA Hiromitsu mainly conducted research on the sustainable management of tropical forests at Kyoto University after obtaining his Ph.D. in 2005. Since moving to IGES in 2015, he has been researching REDD+, illegal logging, and the deforestation risk caused by agricultural crops.

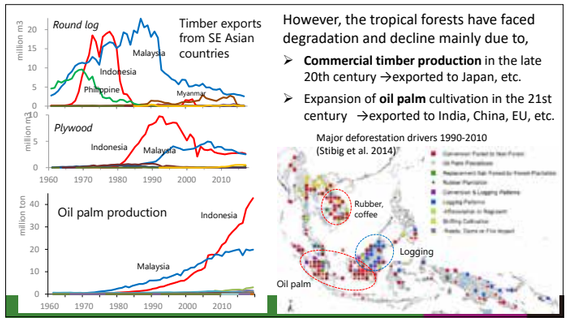
ABSTRACT

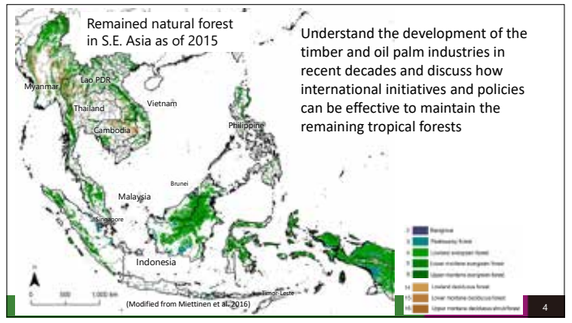
Southeast Asia is home to one of the three major tropical forests in the world, and the region boasts valuable biodiversity. However, these tropical ecosystems have faced degradation and decline mainly due to commercial timber production in the late 20th century and the expansion of oil palm cultivation in the 21st century.

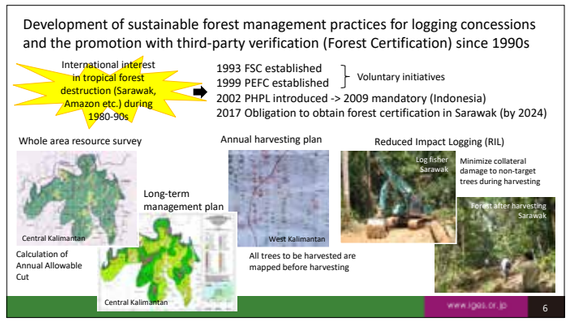
The rapid increase in commercial timber production after World War II, particularly in the Philippines, Indonesia, and Malaysia, was primarily fueled by imports from Japan. Although selective logging methods were adopted, they often caused irreparable damage to forest ecosystems and local communities. This problem was further exacerbated by the rapid increase in illegal logging during the political and economic crisis era in Indonesia around 2000. In response, timber-importing countries, including Europe, the United States, and Japan, introduced policies restricting imports of illegally logged timber. At the same time, timber-producing countries also introduced measures such as timber legality assurance systems and mandatory forest certification. Meanwhile, in regions such as Vietnam and Java, smallholders have cultivated fast-growing trees, which have become an integral part of the timber supply chain.

In Malaysia and Indonesia, the expansion of oil palm cultivation has been a significant factor in deforestation in these decades, often resulting in land conflicts with local communities. It should be noted, however, that not all oil palm plantations were established by destroying natural forests, and many suffer from low productivity. In addition, an increasing number of small-scale farmers are turning to oil palm cultivation as their main source of livelihood. Along with cattle and soybean cultivation, oil palm is a significant contributor to deforestation and a primary target of the EU Deforestation Regulation (EUDR) introduced this year. Some Japanese companies have also voluntarily engaged in sustainable sourcing. Nevertheless, the due diligence requirements imposed by the EUDR and similar initiatives have been criticized for having a negative impact on small farmers with complex supply chains. Given this situation, stakeholders advocating sustainable sourcing in consuming countries should aim to create supply chains that not only promote due diligence but also contribute to the sustainable development of local communities in the producing countries.







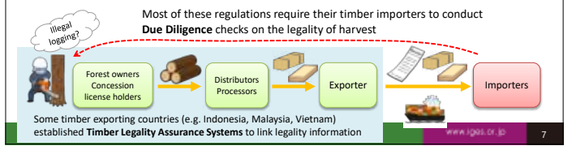


Timber importing countries have introduced regulations to control illegally harvested timber since 2000s

Illegal logging after the Asian Financial Crisis 1997 (Indonesia), etc

EU	Timber Regulation (2010)
	Deforestation Regulation (2023)
USA	Revision of Lacey Act (2008)
Australia	Illegal Logging Prohibition Act (2012)
Japan	Revision of Act on Promoting Green Procurement (2006)
	Clean Wood Act (2016, revised in 2023)
S. Korea	Act on the Sustainable Use of Timbers (2017)
China	Revision of Forest Act (2019)

Most of these regulations require their timber importers to conduct **Due Diligence** checks on the legality of harvest



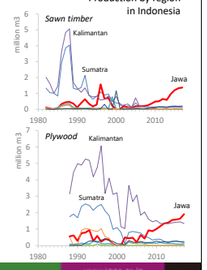
Some timber exporting countries (e.g. Indonesia, Malaysia, Vietnam) established **Timber Legality Assurance Systems** to link legality information

Growth of small-holders tree farming

Expanding cultivation of fast-growing trees for building materials (e.g. falcata) in Java has changed major production areas of timber products in Indonesia

Sawmill and veneer factories in villages

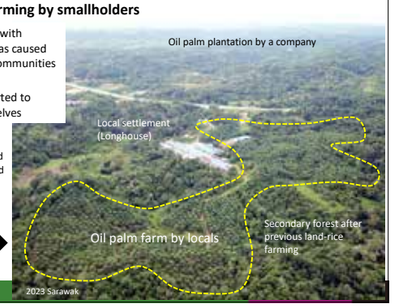
Production by region in Indonesia

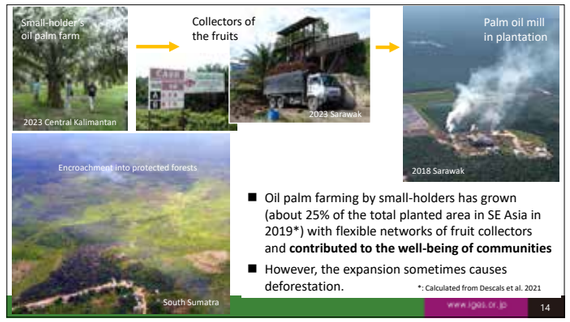


Expansion of oil palm farming by smallholders

- Oil palm cultivation started with industrial plantations and has caused negative impacts on local communities in various places in SE Asia
- However, small-holders started to cultivate oil palm by themselves

Drastic transition of major livelihood from land-rice farming (+ rubber and pepper) to oil palm farming in rural areas of Borneo



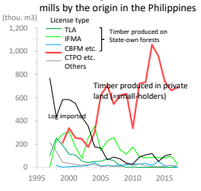


- Oil palm farming by small-holders has grown (about 25% of the total planted area in SE Asia in 2019*) with flexible networks of fruit collectors and **contributed to the well-being of communities**
- However, the expansion sometimes causes deforestation.

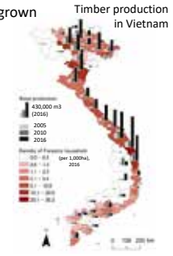
*: Calculated from Descals et al. 2021

Small-holder tree farming has grown in several regions of SE Asia

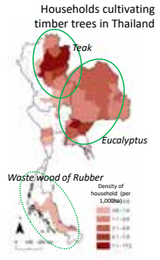
Volume of round logs delivered to timber mills by the origin in the Philippines



Timber production in Vietnam



Households cultivating timber trees in Thailand



Small-holder tree farming is suitable for protecting the remaining natural forests and for social welfare. However, supporting it by forest certification and Due Diligence of timber legality is not easy.

Oil palm

- Palm oil is the most consumed vegetable oil in the world (35% in 2022).
- The high productivity and low cost contribute to global food security
- However, the development of oil palm plantations has caused severe deforestation and land grabbing from local communities in Indonesia and Malaysia

Deforestation by agriculture commodities in tropical regions

- Voluntary initiative by private companies in importing countries (e.g. using RSPO)
- Governments pledged to end deforestation by 2030
  - 2014 New York Declaration on Forests
  - 2021 Glasgow Leaders' Declaration on Forests and Land Use

2023 EU Deforestation Regulation (EUDR)

- Prohibit to place six forest-risk commodities (cattle, cocoa, coffee, oil palm, soya, and wood) derived from **illegal production** and/or **deforestation from 2021** onward from being placed on the EU market.
- Obligate all the importers to submit a Due Diligence Statement, including **geolocation coordination** of the production sites

Nevertheless, the DD requirements have been criticized that they could negatively impact the small-holders with complex supply chains

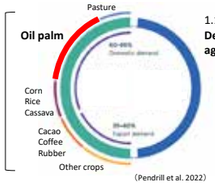
Conclusion

- Timber and oil palm have been major deforestation drivers in SE Asia in these decades
- Timber
  - Sustainable forest management has been promoted to reduce the negative impacts of logging
  - Timber production by small-holders is partially replacing timber production from large companies concessions
- Oil palm
  - Land use efficiency is important to enable palm oil production without deforestation.
  - Small-holder farming of oil palm can contribute to the well-being of the local communities
- Initiatives in consuming countries for forest conservation in the producing countries can only be effective by considering the sustainable development of the local communities.

- **Oil palm is the largest deforestation driver** in South & SE Asia.
- However, **there are also vast areas of land deforested for agricultural development but not yet in production**.

Deforestation area in South & SE Asia during 2011-2015

>1.1 M ha/year Deforestation Resulted in agriculture production

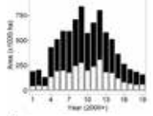


1.1-1.2 M ha/year
Deforestation without expansion of agricultural production

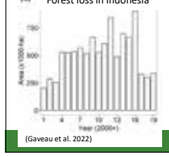
- Unrecorded agriculture area and production
- Crop booms and bursts
- Land speculation
- Low suitability land or inadequate management
- Unclear or contested land tenure
- Fire spreading from forest clearing and land management

(Pendrill et al. 2022)

Annual oil palm expansion in Indonesia



Forest loss in Indonesia



(Gaveau et al. 2022)

- The expansion of oil palm has been Indonesia's **most significant deforestation driver** in the past 20+ years.
- However, the **plantations were not always developed with deforestation**.
  - One-third of the deforested area was converted into oil palm plantations (industrial plantations + small-holders)
  - The expansion and deforestation peaked in the late 2000s and early 2010s (more than 500,000 ha per year)
  - However, **the area of new plantations developed from non-forests was larger than the area from forests through the time**

➔ Improving land use efficiency is important to increase oil palm production without deforestation

Panel Discussion

Panel Chair:

HAYASHI Keiichi

Program Director/Environment, JIRCAS

Speakers:

KITAJIMA Kaoru

Kyoto University, Japan

Sonya Dewi

Director of Asia Programme, CIFOR-ICRAF, Indonesia

Wan Mohd Shukri Wan Ahmad

Director, Forestry and Environment Division,
Forest Research Institute Malaysia (FRIM), Malaysia

TANI Naoki

Senior Researcher, Forestry Division,
Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

MIYAMOTO Motoe

Team Leader, Forest Environmental Policy, Department of Forest Policy and Economics,
Forestry and Forest Products Research Institute (FFPRI), Japan

Mohammad Na'iem

Professors, Faculty of Forestry, Universitas Gadja Mada, Yogyakarta, Indonesia

KOSUGI Akihiko

Project Leader, Biological Resources and Post-harvest Division,
Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

SAMEJIMA Hiromitsu

Biodiversity and Forest Area, Institute for Global Environmental Strategies, Japan

HAYASHI Keiichi:
Good afternoon. Once again, my name is Hayashi Keiichi, Program Director of Environment in JIRCAS. And it is my pleasure to moderate this session for the next half an hour.

We had two keynote speeches and three presentations in each session to understand the current issue on how to realize coexistence of robust tropical forests and sustainable industry. To begin this panel session, I'd like to ask some questions to the panelists.

So firstly, to Prof. Kitajima, on the conservation and sustainable use of forests, whose multiple functions remain an important issue in the forest industry. In the academic context, some articles pointed out that afforestation, which focuses on GHG sequestration in forests, is biased towards species with high commercial and carbon credit value. Against this backdrop of this global debate, could you once again, share your views on the approach that should be taken to halt the decline in forest area and maintain the ecological functions of the forest?

KITAJIMA Kaoru:
I think the key is to understand resilience in proper terms. And the way to manage, I mean, forests recover. I mean, we all agree, those of us here, that ultimately, trees can be grown again. At the same time, we need to realize there is no one solution. I think this is something Sonya said that there is no one solution that fits, you really need to think about the landscape context and think about the best. I think, I totally agree with what other panelists said. We need to have, forest itself needs to keep its value, whether it's biodiversity or timber production, providing resources to local people. So how do we actually maximize these multiple functions of forests for people in general? And so we really need to think about how we can actually have proper governance.

So, and the answer can be different. I was very pleased to see for example, enrichment planting in Indonesia has been producing, some, you know, successful regeneration of high value timber. So, I think we really need to be thinking of solutions together. And so, there's no one right answer, but resilience means not necessarily resisting changes. From changes, impacts and disturbance, what do we want to recreate and what is the best answer? It may change as the environment changes, climate changes, and our societies change.

HAYASHI Keiichi:
Thanks so much for your view on the conservation and sustainable use of forests framed against the backdrop of the global debate on coexistence.

And taking off from Prof. Kitajima. I have some questions to Dr. Shukri, and then Dr. Miyamoto.

Firstly to Dr. Shukri. In Malaysia, each state has established its own timber legality assurance system for forest management. Could you please explain the impact of these state laws and the role of research institution or institutes such as FRIM?

Wan Mohd Shukri Wan Ahmad:
As I said just now there are a little bit differences between each state in order to manage the forest, but we are bound with the same basis of the system of sustainable forest management. Of course, the system is based on analysis and based on some projections. The enactment and procedures between states are not much different but slightly different. I don't see any impact because all the state leaders in Malaysia sit in one council; they call it the National Land Council. So, everything is

agreed and the National Land Council must be followed by the state government.

In terms of FRIM research, we did a lot of research actually in terms of sustainable forest management, for example, research on the optimum cutting cycle. As I said just now, the optimal cutting cycle for peninsula Malaysia is 30 years, but we see a little bit of problem to achieving that 30-year cycle. Research says that maybe 45 or 60 years is the optimum, not 30, because 30 is so short.

Other than that, research on the silviculture and management, even I myself lead one of the expert groups to modify SMS (selective management system). Currently, we apply a selective management system since 1978 (almost more than 40 years). So now we have to relook the system. So, we have so many experts in this group and suggest to the policymakers what is the best system now, for example, we have to do retooling. For the longest time we used and still use a bulldozer which for the earth is very damaging. So, we have to change the system. Probably we use we call it a log fisher. So, this is one of the methods we proposed for the new system.
And FRIM is also involved in the expert committee in joining all the three policies between Peninsular Malaysia, Sabah and Sarawak. And now we have a Malaysian policy on forestry. No more three different policies for three regions but only one policy for three regions. So that I think is a new theme for Malaysia to support sustainable forest management.

HAYASHI Keiichi:
Thanks so much for sharing the knowledge and the importance of the role of FRIM to implement and sustain state laws.

So now, the question goes to Dr. Miyamoto. In your presentation, you talked about the relationship between poverty and deforestation. You mentioned that poverty reduction measures are highly effective in reducing deforestation and that these measures are highly sustainable. In many developing countries with tropical forests, long term policy implementation is needed to effectively put poverty reduction measures into practice.

Could you please share your insights on the role that Japan and international research institutions should play in this context?

MIYAMOTO Motoe:
I would like to respond in Japanese. Now from my point I have talked about the solution for reducing deforestation. And in that sense, I proposed the reduction of poverty and showed the direction going forward. Now, in implementing this measure in developing nations, we have to be more specific in outlining the measures which will be useful in each country in terms of poverty reduction, we have to have clarity on this.

With scientific evidence, effective measures should be clarified. By so doing, the government as well as the related organizations will be able to implement the measures with confidence. Therefore, the national organizations and international research institutions should lead such research. For example, the successful cases in the world where they have been able to reduce poverty should be taken up.

And also, the countries that have been successful in reducing poverty reduction and unsuccessful countries should be subject to comparative analysis. What is important in this analysis is to obtain reliable data over long term. Now, this is first and foremost in research of the impact on poverty. It should not be viewed in the short term; we have to look into long term implications.

And also in the relevant countries, in order to collect such reliable data, we need cooperation from the counterparty in the countries. Their research methods and inclusive data will become very important to ensuring scientific evidence.

Therefore, the national research institutes and international research institutions are important, and they have good environment for research. And they have also very good environment for researching, and the preceding research can be subject to literature search as well. They have a good environment to do this. Therefore, scientific evidence-based quality should be provided in assessing poverty reduction measures. So, we hope to see leadership from developed nations.

HAYASHI Keiichi:
Thank you, Dr. Miyamoto, for your thoughts about the role of Japan and international research institutes.

So, I would also like to look at current forest-related issues from the forest industry's point of view. And then I would like to hear from Dr. Dewi. According to FAO statistics, global demand for timber has increased significantly, and it is expected to continue to increase in the future. While various efforts are being made around the world to halt the decline in forest areas and preserve the ecological functions of forests, the supply of timber to the market is also increasing, making the sustainable development of forests increasingly important.

In timber-producing and -consuming countries, the introduction of forest certification and due diligence is helping to curb illegal logging. In addition, ESG investment in forests have recently attracted attention. While these global trends promote the sustainable development of forests, it is also risking the development of monocultures in the forest industry. Could you please explain what international organizations such as CIFOR-ICRAF are doing to address these issues?

Sonya Dewi:
It's very difficult to answer. So basically, CIFOR-ICRAF looks at the timber sustainability issue through a systemic lens, looking at the green value chain at the multiple levels. So, we do many different things, but at least I would like to highlight three things. One is on policy analysis. The second one is on the governance and the third one is about small holder capacities strengthening as Dr. Samejima mentioned, and its growing importance regarding smallholders.

So, the first one, the kind of things that we did is like looking at the analysis comparing the FSC which is a widely used certification for timber with EUDR for example, because there are differences in terms of cutoff date. FSC cutoff date is 1994, while EUDR's is 2020, meaning that timber that cannot be certified by FSC can still be accepted under EUDR. So, we are now looking at a remedy framework, like for example, restoration, so that this gap can be filled.

Secondly, regarding governance, actually there are a lot of areas that have been given as a concession to production forests. In Indonesia, I think in total is 11 million hectares, but only 3 million hectares have been planted and managed sustainably. So, in terms of meeting the demand that is increasing, this sort of things can be addressed. And why actually there's this big gap, why there are 8 million hectares that cannot be planted or managed sustainably, it's because of the conflict with IPLC that is in the surrounding area.

So, governance is very important in terms of really also giving some access to the local community

to manage as well to reduce the conflicts. And also, partnership of course is very important, the partnership between smallholders and the companies as well. And then, this social forestry has been a big vehicle. And within that, agroforestry is being seen as the, you know, measure with the most potential. This is also addressing the issue about monoculture in the big forest plantation thing.

And on top of that, I think another thing that we have done or we are doing is that the timber supply is not only coming from forests. When we talk about timber, it is only forest, forest, forest that we think. So now, especially in the dry part of the tropical world, we are now working on trees outside forests. So, in India, for example, we target huge ambitious areas and tree planting, including for timber. So not only for timber, but including timber. So, all these options, I think, we can explore and depending on which context and what option will be suitable.

So, I think in answering your question, I think we can actually be optimistically addressing those issues in the future, if governance is improved, and if policy is, you know, developed in a way that is really suiting the context, and the third one is if the smallholder producers are raised in terms of their capacity.

HAYASHI Keiichi:
Thank you so much for your thoughts in terms of the role of CIFOR and ICRAF for government and policies on smallholders' function in line with the forest industry.

So now, taking off from the thoughts and the views from Dr. Dewi, I have some questions for Prof. Na'iem and Dr. Samejima.

Mohammad Na'iem:
Okay.

HAYASHI Keiichi:
So, I have some questions to you. Indonesia is one of the world's leading timber producers and exporters, and the work through forest certification programs ensures that timber is produced with minimal environmental impact.

The country continues to face challenges related to sustainable industry, such as illegal logging, and negative environmental impacts.

What do you think are the root causes of these problems and what initiatives are needed to address them?

Mohammad Na'iem:
Right now, Indonesia has taken a strategic step to combat illegal logging, reduce deforestation and also the degradation of tropical forests through at least two approaches. One is by law enforcement and the other is by signing the Paris Agreement, as well as the development of Indonesia FOLU NET SINK 2030. This FOLU NET SINK is a strategic plan to reduce emissions in Indonesia.

On the other hand, the fundamental issue of unsustainable tropical forest management is actually due to the low productivity of natural tropical forests in the second generation. As I mentioned in the video, the growth rate is at the average of 0.2 to 0.6, but by intensive silviculture approach, we are also doing species trial of 30 species of dipterocarps. We have a good result at least, we found five

first green Meranti: Shorea leprosula, Shorea hepeifolia, Shorea johorensis, Shorea platyclados and Shorea macrophylla that have very good growth rates, and they can then be used for enrichment planting.

So, right now, we have many concession holders, many forest companies that work with us especially, for example, Sari Bumi Kusuma Company in Central Kalimantan. Now, this company already has implemented the line planting or gap planting method on 50,000 hectares of land. So, I think based on that result, intensive silviculture actually can enhance the productivity of natural forests, preserve native species from extinction and efficiently support sequestration of significant amount of carbon from rainforest.

HAYASHI Keiichi:
Okay, thanks so much, Prof. Na'iem for your information of what Indonesia is doing to tackle the causes of the problem.

So, now I would like to ask questions to Dr. Samejima. First, certification plays an important role in the sustainability of timber production. And there seems to be an opportunity to introduce due diligence on deforestation, in addition to the legality of harvest. Do you think this will promote the prevention of forest functionality?

SAMEJIMA Hiromitsu:
Yes, in general, since legality is required, it means compliance of the law in producer countries. In case the law on producing companies allows land conversion of forests for example for oil palm plantation, the requirement of a timber legality itself is not enough to conserve forests. So, requirements for forest certification can guarantee the maintaining of forests.

However, as I already mentioned in my presentation, and also by Ibu Sonya, sometimes supply chain, promotion of certified products which creates traceability can have a risk to exclude small holders or undermine local government control or trial of jurisdictional approach, so, we need to consider what efforts have been made in the sourcing region.

HAYASHI Keiichi:
Thank you, Dr. Samejima for your comments. And once again to all panelists, thank you so much for your thoughts and valuable comments which will stimulate us for more discussion.

I think I better open questions from the floor. Please let us know who you are, and to which panelist your question goes if you have a question.

Questioner (FFPRI):
My name is Toma, I have a question to Dr. Kosugi. The use of a trunk of oil palm, I think many efforts were made so far. And I have seen many trials, but it's not yet being commercialized, that's my impression. And you have mentioned that a marketplace test plan is now under operation. If what you're doing becomes a success case, in other places like Malaysia, or Indonesia, Sarawak, do you expect that this technology can be expanded into these countries?

KOSUGI Akihiko:
Yes, I think you can expect that. This research has been going on for maybe 15-16 or even 18 years. And depending on the situation, I think you know that the background is quite different. The

present background and restoration five years ago or 10 years ago, are entirely different. I think that is the point. So, I think what is important is to be able to continue. Continuation is important.

HAYASHI Keiichi:
Thank you for the question and the answer. Is there any other question from the floor? Yes, please.

Questioner (JIRCAS):
I am Tsujimoto from JIRCAS. As an agronomist, I feel like I'm kind of out of the league from the topic of this symposium, but I was happy to hear in Dr. Miyamoto's presentation, that the provision of profitable agricultural land and technologies can be one key to reduce poverty, and then stop deforestation. And then personally, I'd like to believe in that story, and many of the presentations supported that story. But if I'm allowed to play a kind of devil's advocate, that kind of profitable agriculture technology can be a factor in increasing the agricultural rent, if I borrow your word, and the von Thunen model that motivates farmers to explore more lands, use those agricultural technologies, and explore more profits. And the paper that I recently read was a case in the Congo. The paper indicates that the provision of improved seeds of corn maize actually accelerated primary forest loss because farmers explored seeds for fertile soils under the primary forest.

So, I believe that improvement of agricultural technology is important. But sometimes human beings are very greedy and unstoppable. So, my questions are: what is the key to not letting agricultural technologies go into that kind of negative end in forest management and how can we harmonize improved agriculture management practices and forest management, so maybe my questions are directed to Dr. Miyamoto, but I would also like to hear the view of the keynote speakers. In this kind of harmonization how to manage both agricultural improvement and forest management.

HAYASHI Keiichi:
Thanks so much for your question. And so firstly, answer from Dr. Miyamoto and then followed by answer or comments from our keynote speakers.

MIYAMOTO Motoe:
I think that is a very important question. To improve profitability of agriculture, land could be used only for that purpose and it may lead to reduction of forests.
Yes, I hear such voices. Is it better to improve product profitability or not? There were a lot of such discussions, but according to many empirical studies, by improving profitability, the area of farmland conversion, at first, more forests will be converted into farmland, so at that time forests will decline and be converted into farmland, but if profitability is high, then that trend stops faster. In the case of Peninsular Malaysia, in the 1980s, poverty ratio went down by 20%. And then forest reduction stopped.

In the case of Indonesia, profitability is low, so farmers, there are no means for farmers to overcome poverty other than shifting forests into farmland, because there were no subsidies from the government as well.

So, if profitability is low, people will keep converting forests into farmland. So, we do see such empirical studies. And currently, the majority of views is that if agriculture is highly profitable, that will lead you to reduction of poverty and stop deforestation. That trend has been demonstrated.

HAYASHI Keiichi:
So next to our keynote speaker, Prof. Kitajima, yes.

KITAJIMA Kaoru:
We all have to eat so we have to have cropland. I think it's not just the profitability of land. Two things must be considered.

One is a sustainability of existing food-producing land. If they become degraded, people look for additional land. So yes, it's important to have a good, efficient and productive system, but it has to be sustainable. You know, when we talk about nature-positive production landscape and nature-positive production, we really need to be thinking about not to let soil degrade. So, I think the new technology must be sustainable. That's the key.

Two, governance is important. Forested lands are ultimate common that are controlled by government, whether it's national level, or local, or regional government. So, if we allow people to have no rules, then there is no stopping of forests being converted. So, governance is a key.

And so, when I talked about the example of how Japan actually recovered forests, I think we recovered forests during the Edo era, it was governance. And I think currently, oil palm moratorium is ongoing, but it's not effective to regulate small holder farmers in Indonesia from cutting trees to start producing oil palm. So how do we actually deal with governance? I think it's actually perhaps the most important thing, yes, we need to have poverty reduction, we need to make use of agricultural technology. And we have to increase the crop yield per unit area of existing agricultural land, but how do we actually govern the ultimate common, forests and grasslands that are not currently under, you know, managed land.

HAYASHI Keiichi:
Thanks so much. And now Dr Dewi.

Sonya Dewi:
Yeah, this is a very valid question. We have seen also a lot of examples that it happens in Indonesia, like, you know, when one particular land use or agricultural practice is very profitable, then not only the local people, but other people coming from far away grab the land and encroach the forest.

So, I agree with Prof. Kitajima that yeah, governance policy is very important. Policy and management are very effective policies that can really be implemented. Yeah, sometimes policy is there, but the government doesn't really understand or anticipate what it entails. Yeah. So, policy can be good, can also be bad, like, for example, just to give you an example, when there was forest fire in 2015, huge forest and land fire because of El Nino, and huge area of peat was burned, was on fire, and then the government really stopped and banned the use of fire for land clearing, while actually fire is the most efficient, the cheapest way to prepare land. And when the government blocked that, yeah, and with the severe punishment, the farmers couldn't do that, and they did not, they don't do that. I see myself in the field, what happened is, they start going back to the national park close by and do the illegal logging. So, unless sustainable options for agriculture are there, you know, policy cannot be really implemented. Policy can be there and it's well intentioned, but cannot be implemented. But I think, you know, economic only is not enough, profit only is not enough. We need to understand the political economy and also, you know, generating good governance in terms of implementing effective policy.

Mohammad Na'iem:
Related to the green plantation between crops and trees, I have an experience in Indonesia. Actually, if we make plantations, we have to use a wider distance among forest trees. For example, in Indonesia, I have what we call selected trees, I planted 6 by 8 or 10 by 5, that means in one hectare, the number of trees is around 150 to 200 trees. And in between trees, we can plant crops, any kind of crops including cajuput for example. So, after harvesting about 15 or 20 years, we will harvest the wood. Teak wood, you know, has a nice performance because it is a selected tree, comes from cutting material, but annually we can also harvest many kinds of crops, and additionally, the kind of crop can also be selected. We only use the best one. For example, if it's paddy rice, we use the variety of situ patenggang that grows very well and also the taste is like Japanese rice.

I think I agree with Ibu Sonya and Ibu Kitajima that the policy of government is very important. Like what has been mentioned by Ibu Sonya that we have 12 million hectares of timber estate areas but only 3 million that is already managed. I think it is quite bad, and I hope the government can also see what happened in the field.

HAYASHI Keiichi:
Thank you, Prof. Na'iem for your comments based on your experience in Indonesia. So, one question from the floor, I think.

Questioner (FAO):
My name is Mitsugi from FAO. I think because many audiences in person are Japanese, I will be speaking in Japanese.
First, I thank you very much for organizing this very nice symposium. And I have a comment and also one question.

My comment is, as the other person who asked a question mentioned, perhaps approach in communities other than forestry communities, is very important going forward. For example, in relation to agriculture that was mentioned, my expectation is that we would like to have crosscutting sessions, including people from outside of the forestry community. That will be very useful.

And about land use change and shift, I'm very interested in that topic. And this is an area where it is difficult to implement solutions only with the forestry sector and community. So please consider such a cross disciplinary gathering. And this is not a question specifically addressed to anyone; please select the appropriate person to answer. To halt deforestation, we are struggling and SDG targets' achievement may be difficult, and oftentimes people use the word transformation, but to halt deforestation, what will be the transformation?

It doesn't have to be a logical question, but I would like to invite your ideas on what kind of transformation we can have.

HAYASHI Keiichi:
Thank you for your question and comment. So, let's invite our panelists for the response to this question.

Prof. Kitajima first, some comments or response to this question. Is that okay?

KITAJIMA Kaoru:
It's very difficult. There is no one single transformation that can affect but I am glad you started Mitsugi-san, you started your question from saying that, in order to solve sustainable forest management, we need to see the whole package; I think Miyamoto-san talked about poverty reduction. Sonya talked about legal systems.

And I think actually, I like what you suggested that we need to be talking, crossing the sectors within the so-called AFOLU – agriculture, forestry and other land uses, because I think we have different emphases in education and we don't necessarily understand like, what trees to plant where, what is the best species. I think even within those of us working in forestry, our knowledge is often limited. We really need to be sharing more information. And I think basic science and problem-solving skills are so important. We need to see not just what we learn from a textbook, but see the situation and think adaptively. Sometimes local people have the answer. Some of the traditional ecological knowledge has a very good scientific, you know, reasoning, that others don't. But how do we actually see and find solution?
Transformations perhaps don't come in just one magic bullet. So how do we actually have a good solid scientific foundation so that we actually see what is the best local solution? And that is very important to keep in mind. I think the best solution comes from scientists and next generation of managers, government employees who actually understand that there is no one magic bullet.

HAYASHI Keiichi:
Thank you for the comment. Dr. Dewi, sure yes, but please make it short.

Sonya Dewi:
I thought I was expected to. Okay. Yeah, it is a very big question. But to me, you know, in terms of transforming that system, the whole system, I think one single thing that I think could push us through is, you know, going into our mindset, the common but differentiated responsibilities. So, this is really, between the global north and global south, you know. The global south keeps on pushing, producing, because the consumers or the market is demanding more and more, and vice versa.

So, I think, among the SDGs, this sustainable production to consumption is very important, and it can start from ourselves. And the young generation actually is very good in taking up. There are many more, now, changing their lifestyle, they become vegetarian, I think the percentage of young people becoming vegetarian is much bigger than in the older generation. And sustainable clothing, things like that. They are very savvy about that.

So, I think, you know, from our own, in fact, we cannot transform the whole world, at least we can transform, we can start it from ourselves first. And I think by changing lifestyle, you know, being wiser in terms of this production to consumption thing, I think, and be mindful about having a common responsibility to the planet and to the people. But it should be differentiated, yeah, between the global south and global north and wherever we are in the society.

Questioner:
Thank you for the opportunity to ask my question. My name is Mahmuda. I'm an agricultural economist from Bangladesh, and I'm doing my PhD at Rissho University. Today, I am here and I have known a lot of information about sustainable development and forestry. And I'm particularly interested in Dr. Kosugi Akihiko for the oil palm trunk high value technology for tropical forest conservation. I think we have seen the production of oil palm trunk into pellets through a process

that can produce byproducts like artificial wood. And that is, I think, in Malaysia, and it is going on in a project.

My question is, what is the economic value of this process? Because this seems a little bit complicated as agricultural process does have a byproduct, various byproducts of wood, because there are also sap and other products from the oil palm trunks. But it seems that it cannot be inclusive for small or medium entrepreneurs to invest in this kind of businesses.

So, my question is, how can we include the small and medium entrepreneurs into this kind of sustainable value product businesses, for the afforestation or reforestation in the ethnic groups?

HAYASHI Keiichi:
Dr. Kosugi.

KOSUGI Akihiko:
I think it depends on the demand. So, actually, our produced pellets, as you know, are not cheap. I mean, so yeah it has a high value. That's why it depends on the price to sell from our producer, but now the situation, as I already told someone, the situation does change. Yeah, environmental protection has a set of barriers. That is why, I think 10 years ago or 15 years ago, the situation has quite changed. So, actually, at the time, economic motivation is of high priority. But now, not only that is the motivation, but also environmental motivation and society's motivation, you know, are necessary to realize this. That's why, I actually don't know what this business is going to do in the future, but I think, you know, situations change, and also, it depends on the demand. That's my answer to you.

HAYASHI Keiichi:
Thanks so much for the answer to the question from Dr. Kosugi.
So, now, since this session has come to an end, let me summarize this session.
So, among the multiple functions of forests, the GHG absorption function is crucial to mitigate the climate crisis. And it has become clear that the introduction of certification systems and due diligence measures is essential to strengthen this function.
On the other hand, we also found that prioritizing tree species with high commercial and carbon credit value puts other vital forest functions at risk and prevents the realization of sustainable use.
We also found that poverty alleviation efforts are also important in preventing forest area reduction.
Thus, we gain a deeper appreciation for the importance of collaborative efforts between companies and governments, to conserve, and for sustainable use of forests, as well as the importance of providing scientific evidence for production sites, and certification systems.
In order to strengthen tropical forests, it is necessary to understand the physiological characteristics and the environmental adaptability of individual tree species, improve breeding and silvicultural techniques and develop such as resource management strategies within the landscape to support a sustainable industry. The combination of these research results will generate innovation and enable governments and companies to respond flexibly and appropriately to the dynamic environmental and social context surrounding tropical forests.
So, to all panelists, and everyone in this venue, thank you once again, for your cooperation and active participation to make this session fruitful and meaningful.
Let us give a round of warm applause to all of you.

Closing Remarks

YAMAMOTO Yukiyo
Vice-President, JIRCAS

On behalf of the organizers, it is a great pleasure for me to make a few closing remarks at the end of this symposium.

The JIRCAS International Symposium is held annually to provide a forum for discussion and exchange of experiences on agriculture, forestry, and fisheries in developing regions. In the past symposia, we have addressed themes such as the United Nations-designated international years, national and international issues, international research cooperation, and so on. This year, we focused on tropical forests and the forest industry. In the keynote speeches, Prof. KITAJIMA Kaoru of Kyoto University and Dr. Sonya Dewi of CIFOR-ICRAF provided us with profound insights into the resilience and sustainability of tropical forests and related industries. In addition, prominent researchers shared their latest research findings in these areas.

As we collectively acknowledge that the world population is projected to approach 10 billion by 2050, the imperative to develop technologies for a sustainable food system becomes more urgent. Looking at the global system as a whole, however, there is no doubt that the survival of human society will be threatened without systems and technologies to properly and sustainably manage the tropical forest resources that cover most of the Earth’s land area. In order to achieve this, we must be aware of the issues related to the compatibility of tropical forests and forest industry, and use the systems and technologies appropriately. It is my sincere hope that our symposium has not only facilitated dialogue but also provided a valuable opportunity for sharing essential information and knowledge in this regard.

Finally, I would like to extend special thanks to the Ministry of Agriculture, Forestry and Fisheries, and the Forestry and Forest Products Research Institute for their unwavering support in organizing this event. I would also like to express my appreciation to all symposium participants, both on-site and online, as well as everyone involved in the planning and execution of this event. We are truly grateful for your valuable contributions and participation.

Program

13:00–13:30	Registration

Opening

13:30–13:50	Opening Remarks:	
	KOYAMA Osamu	President, JIRCAS
	Welcome Remarks:	
	KOSAKA Zentaro	Deputy Director-General, Forestry Agency, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan
	Welcome Remarks:	
	NAKASHIZUKA Tohru (ASANO Toru)	Director General, Forestry and Forest Products Research Institute (FFPRI), Japan

Keynote Speeches

13:50–14:10	Climate Change, Fire and Forest Resilience	
	KITAJIMA Kaoru	Professor, Graduate School of Agriculture, Division of Forest and Biomaterials Science, Kyoto University, Japan
14:10–14:30	Global Policy Developments and Initiatives on Tropical Forests and Sustainable Industries	
	Sonya Dewi	Director of Asia Programme, Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF), Indonesia

Session 1 "Enhancing Resilience of Tropical Forest Landscapes and Trees"

Chairperson: **NOGUCHI Shoji,** Director of Forestry Division, JIRCAS

14:30–15:15	Sustainable Forest Management and Conservation	
	Wan Mohd Shukri Wan Ahmad	Director, Forestry and Environment Division, Forest Research Institute Malaysia (FRIM), Malaysia
	Enhancing Tropical Forest Resilience and Production through Tree Breeding Technology	
	TANI Naoki	Senior Researcher, Forestry Division, JIRCAS, Japan
	Deforestation Mechanisms and Sustainable Solutions	
	MIYAMOTO Motoe	Team Leader, Forest Environmental Policy, Department of Forest Policy and Economics, FFPRI, Japan
15:15–15:30	Q&A	

15:30–15:50	Coffee Break

Session 2 "Improving Industrial Sustainability of Tropical Timber/Non-Timber Products"

Chairperson: **IIYAMA Miyuki,** Program Director/Information, JIRCAS

15:50–16:35	Contributions of Tree Improvement Program to Increase Forest Productivity and Achievement of Indonesian Nationally Determined Contributions (NDCs)	
	Mohammad Na'iem	Professor, Faculty of Forestry, Gadjah Mada University, Indonesia
	Oil Palm Trunk - High Value Technology for Tropical Forest Conservation	
	KOSUGI Akihiko	Project Leader, Biological Resources and Post-harvest Division, JIRCAS, Japan
	Development of Timber and Oil Palm Industries in Southeast Asia and International Policy for Tropical Forest Conservation	
	SAMEJIMA Hiromitsu	Research Manager, Biodiversity & Forests Area, IGES, Japan
16:35–16:50	Q&A	

Panel Discussion

16:50–17:25	Panel Chair:	
	HAYASHI Keiichi	Program Director/Environment, JIRCAS

Closing

17:25–17:30	Closing Remarks:	
	YAMAMOTO Yukiyo	Vice-President, JIRCAS