生存圏アジアリサーチノード活動報告

Humanosphere Asia Research Node Activity Report

ARN 2022

生存圏アジアリサーチノード

Humanosphere Asia Research Node

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Preface

Director of RISH
Mamoru Yamamoto

The environment surrounding humans is rapidly changing with complicated interlinkages, threatening sustainable development and healthy living. There has been an increasing demand for reliable future projections based on an accurate understanding of current conditions of Humanosphere, and for the presentation of measures for solving the problems. To establish the Sustainable Humanosphere, international collaboration and expansion of Humanosphere Science on a global scale is important.

In 2016, Research Institute for Sustainable Humanosphere (RISH) launched a program called the Humanosphere Asia Research Node (ARN) to strengthen the hub functions of international collaborative research and fostering talented people who expand the field of Humanosphere Sciences internationally. ARN integrates our various facilities and human networks in ASEAN region and Japan for consolidating the international collaborative research on “Sustainable Humanosphere”. We have held a series of symposia on Humanosphere Science: the 1st ARN Symposium in Penang, Malaysia in collaboration with Universiti Sains, Malaysia (USM), the 2nd one in Uji, Japan, the 3rd one in Taichung, Taiwan in collaboration with National Chung Hsing University (NCHU), the 4th one in Nanjing, China in collaboration with Nanjing Forestry University (NFU), and the 5th one as ONLINE event due to the unfolding coronavirus (COVID-19) outbreak and travel restrictions. Last year, the 6th symposium was held online as a joint program of “LAPAN-Kyoto University International Symposium for Equatorial Atmosphere“, “The 6th Asia Research Node Symposium on Humanosphere Science”, and “INternational Conference on Radioscience, Equatorial Atmospheric Science and Environment (INCREASE)”.

In 2022 RISH, Kyoto University, has been reorganized and its internal organization and management structure have been drastically reformed. Last year, many Indonesian Scientific Organizations including Indonesian Institute of Sciences (LIPI) and Indonesian National Institute of Aeronautics and Space (LAPAN) were reorganized and integrated into the Indonesian Research and Innovation Agency (BRIN). In this regard, the 7th Asia Research Node Symposium on Humanosphere Science will be held on-line on December 21st (Wed), 2022 and bring together researchers and students with understanding the

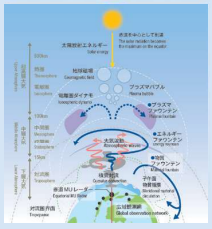
current status of both countries in scientific activities to achieve sustainable society. In addition, a session of this symposium will be held as the 10th Sustainable Development Seminar, a seminar that has been running for five years, providing young researchers and students with an overview of the current situation of science and society in Southeast Asia, mainly Indonesia. In this symposium, we aim to contribute to the establishment of new international joint researches, the expansion of the international research community, and the development of young international human resources, so that we can contribute to the establishment of sustainable society.

December 2022

Director of RISH, Kyoto University
Mamoru Yamamoto

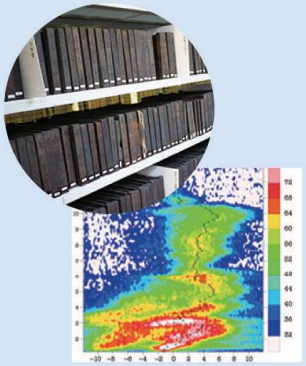
2. Humanosphere Asia Research Node

Cooperative Study of the "Equatorial Fountain"

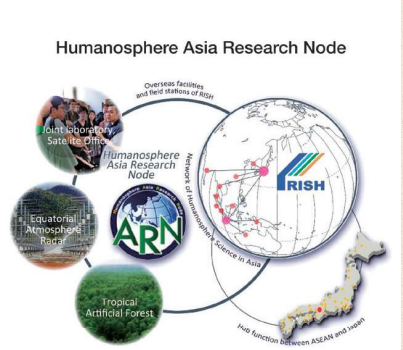


Cooperative Research on the Sustainable Production and Utilization of Tropical Biomass in Relation to Environmental Conservation

International Cooperative Studies Using the Database for Humanosphere Science



In 2016, RISH initiated a new program named “Humanosphere Asia Research Node (ARN)”, thereby strengthening the hub functions of international collaborative research and fostering innovation in Humanosphere Science with the ultimate goal of delivering solutions on a global scale. ARN’s achievements included the following: 1) an ARN joint laboratory at the Indonesian Institute of Sciences (LIPI) was founded jointly with the Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) project; 2) a number of RISH Open Seminars were delivered and broadcast live via web conferencing to selected foreign research organizations; 3) a server mirroring system for the “Humanosphere Science Database” was installed in Indonesia; 4) and a lecture and practical training course on atmospheric science was offered. ARN also served as a co-organizer for the International Workshop on Bioresources and Biodiversity in Uji, Kyoto (with the JASTIP), and the “Humanosphere Science School” in Indonesia. ARN held the 1st Asia Research Node Symposium on Humanosphere Science in Penang, Malaysia in February 2017, and the 2nd Symposium in Uji, Kyoto in July 2017, at which more than 30 speakers from Japan and all over the world were invited. With these ARN activities, RISH is in a perfect position to pursue the integration of different research disciplines and to promote the internationalization of Humanosphere Science.



Strengthening the hub functions of international collaborative research and fostering the work of people who sustain and expand humanosphere science to find global-scale solutions.

ARN & JASTIP Joint Laboratory

ARN serves as a network hub that connects research between ASEAN and Japan through joint laboratories in Indonesia and also provides an opportunity for various research institutes in Japan to access ARN’s overseas facilities. In addition, ARN highly encourages overseas researchers to conduct collaborative research using domestic facilities under the joint usage platform it promotes.

Capacity Building

ARN supports the career development of young researchers and engineers by offering opportunities for collaborative research and involvement in international schools in Indonesia and other Asian countries. With ARN’s support, these young scientists can grow into future leaders in various fields of Humanosphere Science.

Practical training on atmospheric science in Indonesia

The 1st ARN Symposium on Humanosphere Science (February 20-21, 2017/Penang, Malaysia)

The 2nd ARN Symposium on Humanosphere Science (July 19-21, 2017/Uji, Kyoto)

Humanosphere Science School 2017, The 7th International Symposium for Sustainable Humanosphere (November 1-2, 2017/Bogor, Indonesia)

URL **Humanosphere Asia Research Node** http://www.rish.kyoto-u.ac.jp/asiaresearchnodes_e/

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The 487th symposium on Sustainable Humanosphere

The 7th Asia Research Node Symposium on Humanosphere Science — *jointly with* — The 10th Sustainable Development Seminar

Virtual Symposium **December 21, 2022**

Welcome Speech

(JST/WIB: 10:00-10:30/08:00-8:30)

Prof. Mamoru Yamamoto (Director of RISH, Kyoto Univ., Japan)
Prof. Agus Haryono (Deputy of BRIN, Indonesia)
Prof. Yasuyuki Kono (Vice Chancellor of Kyoto Univ., Japan)

The 7th Asia Research Node Symposium on Humanosphere Science

(JST/WIB: 10:40-14:10/08:40-12:10)

Invited speakers:

Prof. Shuichiro Kuwajima (CFPH, RISH, Kyoto Univ., Japan)
Dr. Albertus Sulaiman (BRIN, Indonesia)
Dr. Ratih Asmana Ningrum (BRIN, Indonesia)
Dr. Akbar Hanif Dawam Abdullah (BRIN, Indonesia)

The 10th Sustainable Development Seminar

(JST/WIB: 14:10-16:30/12:10-14:30)

Invited speakers:

Ms. Ayumu Ohshima (JICA, Japan)
Dr. Noersomadi (BRIN, Indonesia)
Dr. Masaru Kobayashi (Grad. Sch. Agric., Kyoto Univ., Japan)
Dr. Andes Hamuraby Rozak (BRIN, Indonesia)
Prof. I Made Sudiana, M.Sc (BRIN, Indonesia)
Dr. Safendrri Komara Ragamustari (BRIN, Indonesia)

Closing Remarks

(JST/WIB: 16:30-16:40/14:30-14:40)

Prof. Toshiaki Umezawa (RISH, Kyoto Univ., Japan)

JST: Japan Standard Time; WIB: Indonesian Western Standard Time

Organized by

Academic Exchange Committee and Asia Research Node,
Research Institute for Sustainable Humanosphere (RISH), Kyoto Univ.

URL: https://www.rish.kyoto-u.ac.jp/arn7/
Contact person: Toshiaki Umezawa (tumezawa@rish.kyoto-u.ac.jp)

Program

December 21, 2022

Time JST/WIB — JST: Japan Standard Time; WIB: Indonesian Western Standard Time

09:30-10:00/07:30-08:00	Registration and internet connection		
10:00-14:10/08:00-12:10	**The 7th Asia Research Node Symposium on Humanosphere Science**		<Chair> Prof. Hubert Luce (RISH, Kyoto Unversity)
Time		**Title**	**Speaker**
10:00-10:10/08:00-08:10		Welcome speech	Prof. Mamoru Yamamoto (Director of RISH, Kyoto University)
10:10-10:20/08:10-08:20		Welcome speech	Prof. Agus Haryono (Deputy for Research and innovation facilitation, National Research and Innovation Agency (BRIN), Indonesia)
10:20-10:30/08:20-08:30		Welcome speech	Prof. Yasuyuki Kono (Vice Chancellor of Kyoto University)
10:30-10:40/08:30-08:40	Photo Sesssion		
10:40-11:10/08:40-09:10	Invited	Transdisciplinary New Approach for Humanosphere Science at the Center for Future Pioneering Research on the Humanosphere (CFPH)	Prof. Dr. Shuichiro Kuwajima (Center for Future Pioneering Research on the Humanosphere (CFPH), Research Institute for Sustainable Humanosphere (RISH), Kyoto University)
11:10-11:20/09:10-09:20	Break		
11:20-11:50/09:20-09:50	Invited	New Era of BRIN, Climate and Atmospheric Sciences	Dr. Albertus Sulaiman (Research Center for Climate and Atmosphere Badan Riset dan Inovasi Nasional (BRIN))
11:50-12:20/09:50-10:20	Invited	The role of National Reseach and Innovation Agency in building an ecosystem of genetic engineering research and innovation in Indonesia	Dr. Ratih Asmana Ningrum (Research Center for Genetic Engineering Research Organization for Life Sciences and Environment National Research And Innovation Agency (BRIN))
12:30-13:20/10:30-11:20	Break and RISH Open Seminar (Prof. Yoshiharu Omura)		
13:40-14:10/11:40-12:10	Invited	Research Collaboration of Biomass and Bioproducts in Indonesia	Dr. Akbar Hanif Dawam Abdullah (Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN))
14:10-16:30/12:10-14:30	**The 10th Sustainable Development Seminar**		<Chair> Prof. Wakao Ohmura (RISH, Kyoto University)
Time		**Title**	**Speaker**
14:10-14:40/12:10-12:40	Invited	Introduction of JICA Global Agenda and Technical Cooperation Projects in Southeast Asia	Ms. Ayumu Ohshima (Japan International Cooperation Agency (JICA))
14:40-15:00/12:40-13:00	Invited	On the tropical upper troposphere and lower stratosphere dynamics observed with GNSS Radio Occultation	Dr. Noersomadi (Research Center for Climate and Atmosphere National Research and Innovation Agency (BRIN))
15:00-15:20/13:00-13:20	Invited	Alang-alang SATREPS project and beyond	Dr. Masaru Kobayashi (Graduate School of Agriculture, Kyoto University)
15:20-15:40/13:20-13:40	Invited	Challenges and perspectives for plant conservation in Indonesia	Dr. Andes Hamuraby Rozak (Research Center for Plant Conservation, Botanic Gardens, and Forestry National Research and Innovation Agency (BRIN))
15:40-15:50/13:40-13:50	Break		
15:50-16:10/13:50-14:10	Invited	Challenges and Opportunity to Use Sorghum as Food and Renewable Energy Sources in Indonesia	Prof. Dr. I Made Sudiana, M.Sc (Research Center for Applied Microbiology, National Agency for Research and Innovation of Indonesia)
16:10-16:30/14:10-14:30	Invited	A Multidisciplinary Project on the Utilization of Sorghum for the Production of Clean Energy and Biomass-based Products	Dr. Safendrri Komara Ragamustari (Research Center for Applied Microbiology Indonesian National Research and Innovation Agency Cibinong Science Center)
16:30-16:40/14:30-14:40	**Closing Remark**		Prof. Toshiaki Umezawa (RISH, Kyoto University)

The 7th Asia Research Node Symposium on Humanosphere Science

Transdisciplinary New Approach for Humanosphere Science at the Center for Future Pioneering Research on the Humanosphere (CFPH)

Shuichiro Kuwajima
Center for Future Pioneering Research on the Humanosphere (CFPH),
Research Institute for Sustainable Humanosphere (RISH),
Kyoto University, Japan

The world today is simultaneously encountering three aspects of globalization, digitalization, and sustainabilization. The challenge of sustainability science has become important to solve serious problems such as global environmental changes, lack of national governance and social equity imbalances that have surfaced as side effects of these changes. However, there are several problems with the current sustainability science, such as: insufficient scientific research that directly impacts the transition to sustainable and resilient structures; the lack of a scientific framework that can be applied in a real-world context; the lack of compelling concepts for cross-disciplinary research, have been pointed out. In other words, it can be understood that the sources of knowledge have diversified and that conventional science is no longer necessarily the only important provider of knowledge.

In Japan, a new concept of "Convergence of Knowledge" was proposed in the Sixth Science, Technology and Innovation Basic Plan. The value created by interdisciplinarity and/or transdisciplinarity has been increasingly expected by expanding the scope beyond the previous policy to include the humanities and social sciences. It is important to bridge the gap between newly generated knowledge and its practical application.

For the past 20 years, the Research Institute for Sustainable Humanosphere (RISH) in Kyoto University has been leading the humanosphere science by presenting effective scientific approaches that contribute to the sustainable survival of human beings. In response to the rapid social transformation, we have established the Center for Future Pioneering Research on the Humanosphere (CFPH) in 2022, strengthening a function for cross-disciplinary and exploratory research. Currently, we are attempting to expand the possibilities of humanosphere science with more stakeholders by establishing the following four research units in advance.

- Unit for Interdisciplinary Research on Wood Science
- Unit for Atmosphere-Plant-Soil Interaction Research
- Unit for Advanced Measurement and Technology Development
- Biomass Product Tree Industry-Academia Collaborative Research Unit

In the symposium, we would like to introduce our challenges of the center to rethink the relationship between social issues and science through the humanosphere science, and to offer the possibility of finding a new role for science in a confusing society.

New Era of BRIN, Climate and Atmospheric Sciences

Albertus Sulaiman
Research Center for Climate and Atmos
Badan Riset dan Inovasi Nasional

Based on Presidential Regulation no 78 2021, a National Research and Innovation Agency (BRIN) was formed, which is an integration of the Agency for the Assessment and Application of Technology (BPPT), the National Nuclear Energy Agency (BATAN), the National Institute of Aeronautics and Space (LAPAN) and the Indonesian Institute of Sciences (LIPI), and a research and development institute in the Ministry. The business concept that applies at BRIN differs from the processes carried out by previous institutions and will be described in this paper. In line with the regulation, research on climate and atmosphere is combined into a research center for climate and atmosphere. This paper will be ended with an explanation of current and ongoing research topics at the climate and atmosphere research center.

The role of National Research and Innovation Agency in building an ecosystem of genetic engineering research and innovation in Indonesia

Ratih Asmana Ningrum
Research Center for Genetic Engineering, National Research and Innovation Agency, Indonesia

Research Center for Genetic Engineering (RCGE) of National Research and Innovation Agency (BRIN) focuses in biodiversity utilization. Currently, there are green and red biotechnology research cluster in RCGE. The main purpose of research activities is to contribute to climate change issue by increasing food security and health. In green biotechnology, molecular biology is used to study the diversity of plant characteristics and bioengineering is used to assembly abiotic tolerance, biotic resistant or quality improvement of crops. In red biotechnology, biopharmaceutical and molecular diagnostics are two main topics developed. RCGE has active role in molecular biology and genetic engineering in Indonesia. Through various research funding schemes and talent management programs provided by BRIN, RCGE has many international and national collaborations in research and capacity building. How to establish talented young researchers is one of our priorities, so RCGE provides research supervision for students and becomes visiting researcher to post-doctoral host as well. As a government research institute, we will continue to strive to build a research and innovation ecosystem in Indonesia, especially in genetic engineering which is a key technology in dealing with various future problems.

Research Collaboration of Biomass and Bioproducts in Indonesia

Akbar Hanif Dawam Abdullah
Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Indonesia

Research Center for Biomass and Bioproducts was designed to answer the challenges of various national and global issues, including: less optimal utilization of abundant natural resources, dependence on imported products, and the high level of biomass waste from the agriculture and forestry sectors. Our mission is mastery of biomass conversion technology into bioproducts, both in the form of conventional products such as paper, pulp and furniture; or in new (advanced) products such as bioplastics, bio-adhesives, biofuels, cellulose based, starch based, and high quality functional bioproducts.

Our research scopes of biomass resources including wood, non-wood, natural fiber, sugar starch, corps, herbaceous, agriculture residue, aquatic plant, and oily-plant residue; follows up the trends and challenges in innovation of material, chemical, energy from oil-refinery to bio-refinery industry.

Based on BRIN Regulation No. 9/2022 which was stipulated on February 25, 2022 RC Biomass and Bioproducts performs the following tasks: a. implementation of technical tasks of research, development, assessment, and application, as well as inventions and innovations in the field of biomass and bioproducts; b. preparation of scientific recommendations or scientific responses for goverment in the field of biomass and bioproducts; c. providing technical guidance and supervision in the field of biomass and bioproducts; d. implementation of cooperation in the field of biomass and bioproducts; and e. monitoring, evaluation, and reporting in the field of biomass and bioproducts.

Currently there are 18 research groups in RC. Biomass and Bioproduct, which are: Advanced Bio-composites, Bio-based and Synthetic Adhesives, Biocarbon, Bioproduct of pyrolysis, Eco Harvesting, Forensic of Lignocellulose, Wood Engineering, Lignocellulosic Functionalization, Advanced Primary Processing of Biomass, Polyphenol Bioproducts, Nutraceutical Bioproducts, Herbaceous Bioproducts, Bioproduct of Essential Oils, Polysaccharide Engineering, Biocompatible materials, Functional Cellulose, Nanocellulose, and Biopolymer. All these groups represent research topics in the center.

We have collaborated with furniture company from Jepara to use their waste, and use it for Chip Block Pellet. We also collaborate with company to use natural products such as starch, chitosan, cellulose, agar, carrageenan, and alginate to become bioplastic for packaging, disposable dishware, straws, and plastic pellets. We are also working on converting biomass (lignin, hemi-cellulose, cellulose) to become value-added products such as biomedical pulp, and an source for bioadhesives, low-calories sweetener, and food. In addition, we are also actively doing research on wood and forest products, to maintain sustainable wood-based industry

The 10th Sustainable Development Seminar

Introduction of JICA Global Agenda and Technical Cooperation Projects in Southeast Asia

Economic Development Department, Japan International Cooperation Agency (JICA)

Japan International Cooperation Agency (JICA) is a governmental agency of Japan that provides bilateral official development assistance in the various form, such as technical cooperation, concessional loans and grant aid.

In 2021, JICA launched "JICA Global Agenda", which are the thematic/sectoral strategies in 20 prioritized themes. They are JICA's cooperation strategies for global issues, stating priorities, targets, and approaches towards the achievement of SDGs, and they aim at maximizing development impacts on the global issues through further strengthening partnership among diverse actors to tackle complex challenges the world faces.

Also JICA has implemented a lot of projects in Indonesia for more than 60 years in several sectors including agricultural sector in collaboration with the Indonesian counterparts to accomplish socioeconomic development.

In this session, speaker explains the summary of JICA Global Agenda focusing on agriculture and rural development, JICA's Country Assistance Policies and some agricultural projects in Indonesia.

On the tropical upper troposphere and lower stratosphere dynamics observed with GNSS Radio Occultation

Noersomadi[1]
[1]Research Center for Climate and Atmosphere,
National Research and Innovation Agency (BRIN), Indonesia

The tropopause is a boundary layer between the upper troposphere and lower stratosphere (UTLS), typically at altitudes of 10–30 km. Various coupling processes occur across this region which influence mixing between the troposphere and stratosphere, primarily through the activity of atmospheric waves. In particular, understanding the behavior of the tropical tropopause layer at 12–19 km altitude is important for comprehending the mixing and transport of tropospheric minor constituents. A sharp increase in stability at the tropopause acts to enhance the amplitudes of atmospheric gravity waves. On the other hand, the level of wave activity considerably modifies temperature profiles near the tropopause.

Using both ground-based measurements and satellite data from direct and remote-sensing techniques, several studies have been conducted to investigate the dynamics and radiative processes occurring in the UTLS. Global Navigation Satellites System Radio Occultation (GNSS-RO) is a measurement technique to retrieve the atmospheric profiles using GNSS signals received on board low Earth orbit satellite. The Constellation Observing System for Meteorology, Ionosphere and Climate mission #1 (COSMIC-1) has successfully uncovered dynamics in the upper troposphere and lower stratosphere from global temperature profiles. The new COSMIC mission #2 (COSMIC-2) GNSS-RO has been launched on June 25, 2019. About 4,000 high vertical resolution of atmospheric temperature and humidity profiles were retrieved per day.

This study demonstrated high vertical resolution of GNSS-RO data is useful for studies on mesoscale temperature perturbations in the UTLS.

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2. Firas Rasyad, Tri Wahyu Hadi, **Noersomadi** : Short vertical-wavelength gravity wave activities in the upper troposphere lower stratosphere observed with global navigation satellite system radio occultation under different QBO phases. IOP Conf. Ser.: Earth Environ. Sci. 893 012007, 2021.

Alang-alang SATREPS project and beyond

Masaru Kobayashi
Graduate School of Agriculture, Kyoto University, Sakyo, Kyoto 606-8502 JAPAN

The movement to shift from fossil to renewable energy source is accelerating globally. At present, biomass is the largest source of renewable energy, accounting for around 10% of total primary energy supply. Biomass resources are also important as the source of organic compounds including industrial feedstock. Therefore, it is essential to develop technologies that enable sustainable production and supply of biomass resources. Kyoto University, in collaboration with BRIN (former Indonesian Institute of Sciences) and other institutes, has conducted a research project, aiming at developing technologies to utilize unused grasslands widely distributed in Southeast Asia, including Indonesia, for the production of biomass resources. The project has been implemented as a JICA- and JST-supported Science and Technology Research Partnership for Sustainable Development (SATREPS) from 2015 to 2022. It envisaged the cultivation of sorghum (*Sorghum bicolor*) on degraded alang-alang (*Imperata cylindrica*) grasslands, which often have been formed in deforested areas. For this trial to be effective as a means of producing renewable energy and resources, obtaining sufficient yield of sorghum is mandatory. Fertilizer application would be practically essential to achieve the goal, as the soil in alang-alang grasslands does not contain enough amount of nutrients necessary to support vigorous growth of the biomass crops. Meanwhile, excessive use of fertilizers can lead to various problems, including salinity, soil acidification, and the loss of soil microbial diversity. Therefore, as a part of the project, we investigated the feasibility of utilizing alang-alang grasslands for sorghum cultivation, examining if reasonable yields of biomass can be obtained without an application of excess amount of fertilizers. Alang-alang grasslands were land-cleared and planted with sorghum under different regimes of fertilizer application. Results from multi-year cultivation tests showed that the cultivation with modest amounts of fertilizer could give the yields of 20–30 ton ha^{-1} per round of cultivation, which meets the level required to produce a net benefit in reducing carbon dioxide emissions via utilization of the biomass as biopellet. As for the possible environmental impacts of the practice, we analyzed the diversity of soil bacteria before and after the land use change, and found no obvious negative effects. These results suggest that biomass production utilizing the currently unused alang-alang grasslands is feasible without placing a significant burden on the environment, although we also recognize the necessity of longer-term evaluation of the impacts, such as the change in soil organic matter contents. Further improvement of efficiency is also essential as a means of obtaining renewable energy and resources. From a sustainable perspective, the goal should be achieved through a reduction of inputs, rather than higher yields depending on larger inputs. Utilization of beneficial microorganisms or the use of pellet ash as the source of nutrients are the examples of issues that should be considered.

Challenges and perspectives for plant conservation in Indonesia

Andes Hamuraby Rozak[1], Yayan Wahyu Candra Kusuma[2]

[1]Research Centre for Plant Conservation, Botanic Gardens, and Forestry - Indonesia,
[2]Research Centre for Ecology and Ethnobiology - Indonesia

Indonesia is a home for about 40,000 flowering plant species (Widjaja et al., 2015) but facing a decline due to various threats such as habitat loss, overexploitation, pest and diseases, and climate change (BGCI, 2021; Budiharta et al., 2011). As of 2022, there were more than 950 plant species categorized as threatened plants based on IUCN Red List (IUCN, 2021) and only 175 species have been already conserved in the Indonesian Botanic Gardens. This value is far away from the target of the Global Strategy for Plant Conservation (GSPC) that stated at least 75% of threatened plant species in ex situ collections and at least 20% available for recovery and restoration programs (CBD, 2012). However, even though the GSPC targets has been ended in 2020, the new ambitious targets regarding plant conservation should be available soon through the mechanism of COP 15 of the Convention of Biological Diversity (CBD). Indonesia as a member of COP 15 actively participates to achieve the GSPC targets through many programs including conducting tree species assessment, searching and conserving threatened plant species in the ex situ conservation facilities, establishing more ex situ conservation facilities through new botanic gardens and restoration programs (Widyatmoko & Risna, 2017). However, there are also many challenges that we face such as limited well-trained human resources, limited available data and facilities as well as the COVID-19 pandemic that halt many planned programs. Nonetheless, plant conservation actions are still undergoing in Indonesia through multiple collaborations not only with stakeholders inside the country but also from overseas to reach all the goals and targets for conserving the threatened plant species in Indonesia.

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Challenges and Opportunity to Use Sorghum as Food and Renewable Energy Sources in Indonesia

I Made Sudiana[1], Satya Nugroho[1], Reni Lestari[1], Subyakto[1], Edi IswantoWiloso[1], Toga Pangihotan Napitupulu[1], Idris[1], I Nyoman Sumerta[1], Ruby Setiawan[1], Leonard Wijaya[1], Yuli Siti Fatma[1], Yustian Rovi Alfyansyah[1], Masaru Kobayashi[2], Kenji Umemura[2], Toshiaki Umezawa[2]

[1]National Agency for Research and Innovation of Indonesia

[2]Kyoto University, Japan

The Indonesian government is committed to reducing carbon emissions by 2030 by around 30%, and energy mix (renewable energy mix 2025). The opportunity to achieve this target is to replace fossil fuels with renewable energy. In line with that commitment the Ministry of Mineral Resources and Energy plan to introduce policy on cofiring development program of national electrical power plant, i.e. substituting 5 % coal with biomass energy with a total capacity of 18,154 MW, with estimated biomass requirement of 4.2 million tons per year. One of the opportunities is to use biomass from agricultural activities, such as palm oil waste, coffee waste and so on. However, the use of these wastes cannot meet the required energy needs. One promising resources is sorghum biomass which can be produced on marginal land. From the results of calculations by the SATREPS Project for the production of biomass energy and material through revegetation of alang-alang (*Imperata cylindrica*) field. From the scenario of substituting 5% coal on co-firing system, it requires around 100,000-200,000 ha of marginal land. To materialize this government plant on biomass utilization for renewable energy sources there are many things that still need to be studied including 1) selection suitable type of biomass, 2) guarantee sustainability of biomass supply, 3) availability of land for plant cultivation energy, 4) supply chain institutions biomass, 5) biomass transport distance and pellets, 6) loss/shrinkage due to transport or storage, 7) economy biomass compared to coal (price and externalities), and 8) calculation methods. The sorghum planting project on a large scale is being launched by the Indonesian government, which not only aims to fulfill energy needs from biomass, but is also in line with the crisis of food needs due to geopolitical changes and the global crisis.

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A Multidisciplinary Project on the Utilization of Sorghum for the Production of Clean Energy and Biomass-based Products

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The availability and utilization of materials and energy are important aspects in supporting sustainable development. Thus, efforts to develop new models for their sustainable production and utilization need to be promoted and supported. The models need to be environmentally-friendly and can be sustained in the long-run. In addition, all relevant stakeholders need to be included and involved in the process to ensure its success. The "business as usual" approach, characterized by a sectoral, fragmented, and pragmatic mindset, particularly in regards to the involvement of stakeholders and inclusion of technical knowledge, need to be reconsidered. A multidisciplinary and multi-stakeholder approach can be an option, because of the complexities of the issue. Here we share lessons learned from a multidisciplinary project on the utilization of sorghum for the production of clean energy and biomass-based products, supported by the Japan International Cooperation Agency (JICA) and Japan Science and Technology Agency (JST), and conducted by the Indonesian National Research and Innovation Agency (BRIN), formerly the Indonesian Institute of Sciences (LIPI), and Kyoto University, from 2016 - 2022. The project accommodated the involvement of many different stakeholders, including stakeholders from academia, government, industry, and civil society organizations. Furthermore, the project also included many fields of science, ranging from basic natural sciences, applied life sciences, engineering, environmental economics, etc. The dynamics between the different stakeholders and sciences involved in the project can be used as knowledge for future projects involving different stakeholders and fields of sciences.

Keywords: Sorghum, energy, bio-based materials, multidiscipline, multistakeholder

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