Indonesian Young Academy of Sciences (ALMI):

Science for Indonesian Biodiversity

Tatas Hardo Panintingjati Brotosudarmo

- *Vice President for Science & Policy, Indonesian Young Academy of Sciences (ALMI)*
- *Senior President, Indonesian Chemical Society*
- *Director, National CoE Ma Chung Research Center for Photosynthetic Pigments, Malang*

Capacity Building Workshop on Biodiversity and Its Research Management, September 23-24, 2019, National Library of the Republic of Indonesia Building, Jakarta

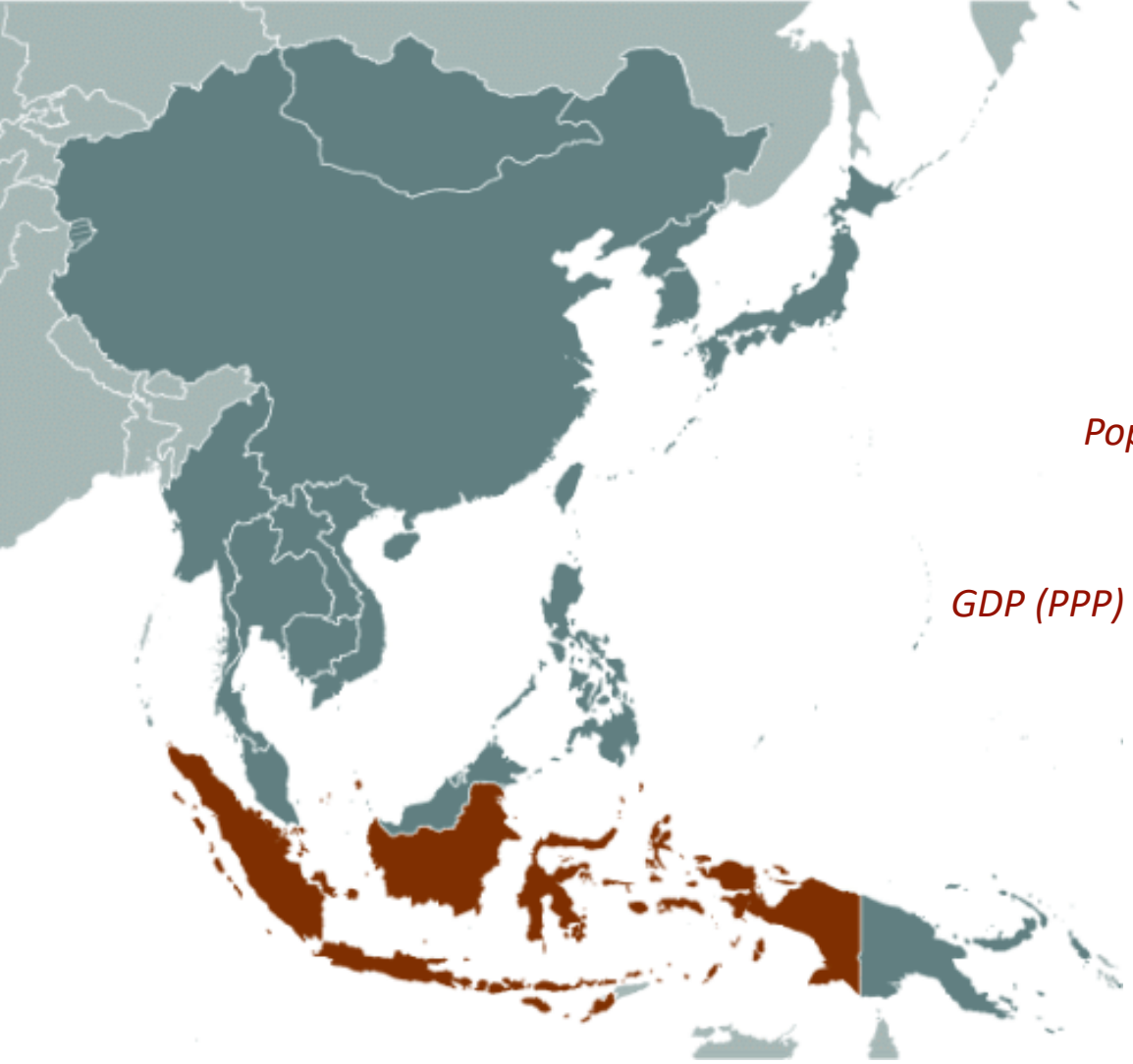
ALMI
Akademi Ilmuwan Muda Indonesia

AIPI
Akademi Ilmu Pengetahuan Indonesia

KEMENTERIAN SEKRETARIAT NEGARA RI

USAID
DARI RAKYAT AMERIKA

TEMPO INSTITUTE



Republic of Indonesia

Official Language (Lingua Franca)
Indonesian

Population 2017
World Bank
263,991,379

GDP (PPP) 2019 estimate
per capita
$14,020

Gini (2017)
39.5

Area
5,455,675.22 km^2
35.03% Land
64.97% Water

Number of Island
17,508

Ethnic Groups
> 300

Spoken Languages
> 700

State Recognized Religion
Islam, Christianity, Hinduism, Buddhism, and Confucianism

15 February 2018 TOTAL INDONESIAN HEI	15 February 2018 TOTAL PUBLIC HEI	15 February 2018 TOTAL PRIVATE HEI
4586	**400**	**4186**

https://www.drivingdirectionsandmaps.com/indonesia-google-map/

ALMI MISSIONS

- Encourage the creation of the advancement of frontier of science through cross-disciplinary collaboration among young scientists.
- Encourage the creation of scientific temper and the development of scientific culture of excellence in the younger generation.
- Encourage the use of science in the formulation of public policy.
- Become a part of the global young academy movement in responding to global challenges.

Established by the Presidential Decree RI No. 9/2016, Inauguration Ceremony at Prof. BJ Habibie' s House

ALMI WORKING GROUP



Indonesia as a united, sovereign, fair, prosperous, superior, competitive and respected nation in the world.

Sustainable Society

Advancement of **science** and scientific **culture of excellence** in Indonesia, with the aim to increase the nation's **competitiveness**

Frontier of Science | Science & Society | Science & Policy | Science & Education

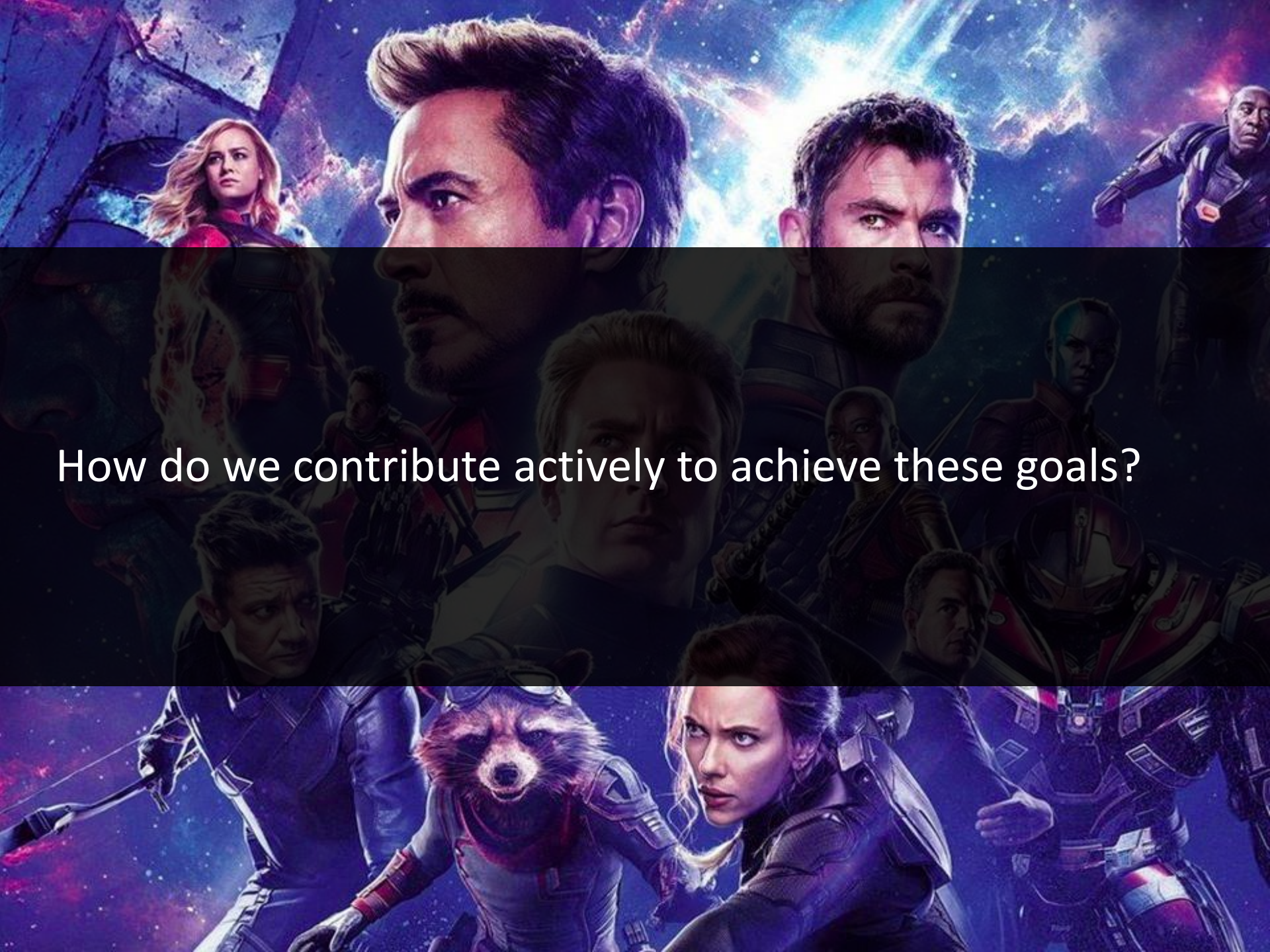
ALMI WORKING GROUPS

ALMI
Akademi Ilmuwan Muda Indonesia


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Courtesy of Dr. Yanuar Nugroho, ALMI Fellow, Deputy Chief of Staff, Executive Office of the President, Republic of Indonesia

Courtesy of Dr. Yanuar Nugroho, ALMI Fellow, Deputy Chief of Staff, Executive Office of the President, Republic of Indonesia



How do we contribute actively to achieve these goals?

Strategy in the Science & Policy Working Group

ALMI
Akademi Ilmuwan Muda Indonesia

Enabling Community

Research Funding System

Community of Researchers

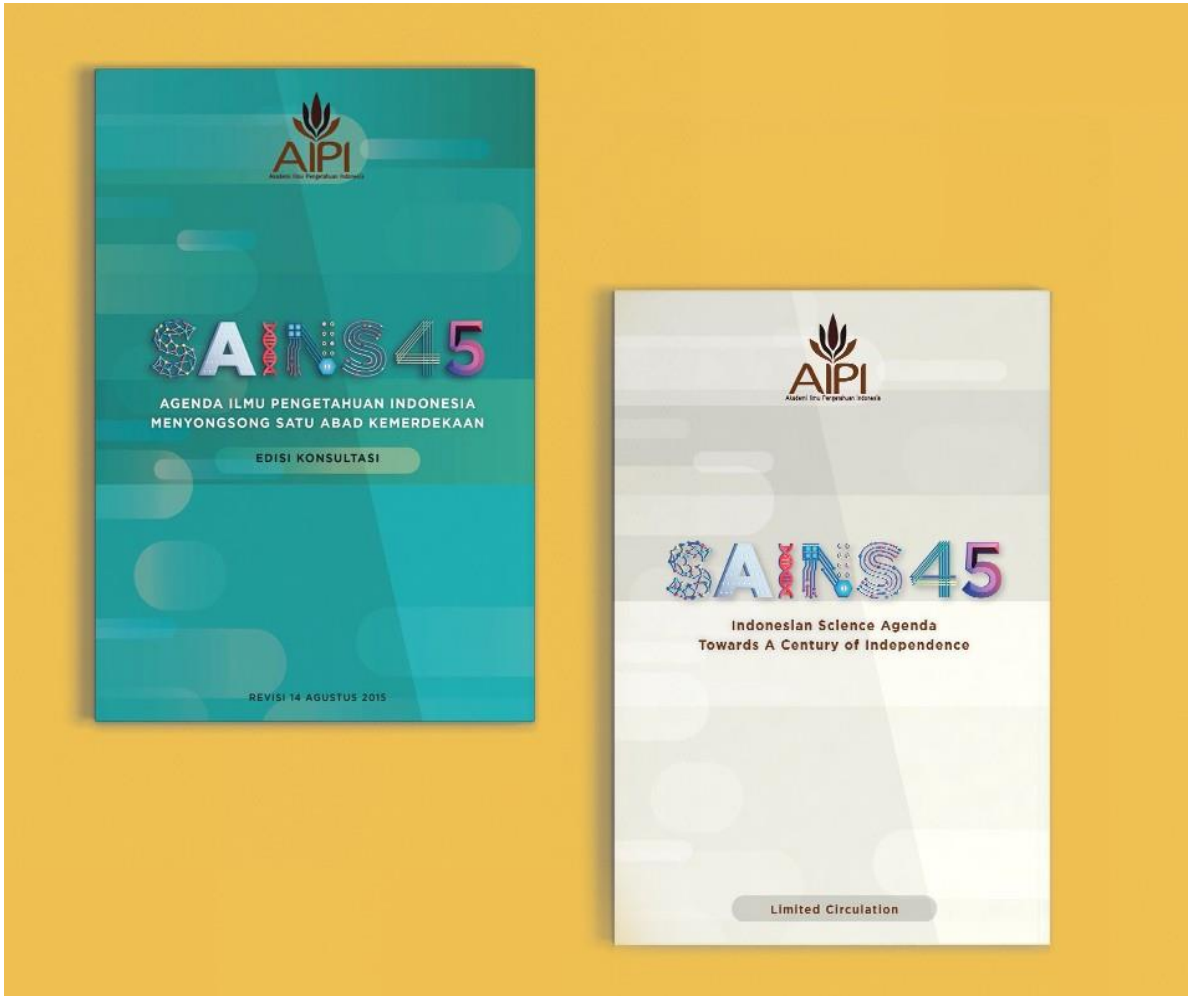
Indonesia Science Agenda

Policy Advices

National Science & Technology System Bill

Science for Indonesian Biodiversity

Enabling Community: Directing Science Agenda



ALMI
Akademi Ilmuwan Muda Indonesia

AIPI
Akademi Ilmu Pengetahuan Indonesia

From the preparation of SAINS45, born:

ALMI
Akademi Ilmuwan Muda Indonesia

Supported by

KEMENTERIAN SEKRETARIAT NEGARA RI

Kementerian PPN/ Bappenas

KNOWLEDGE SECTOR INITIATIVE

USAID
FROM THE AMERICAN PEOPLE

Australian Aid

TEMPO INSTITUTE
Center for Excellent Journalism

KOMPAS

Enabling Community: Directing Science Agenda

ALMI
Akademi Ilmuwan Muda Indonesia

SAINS45:

Dreams and Ideals of Indonesian Young Scientists in 2045

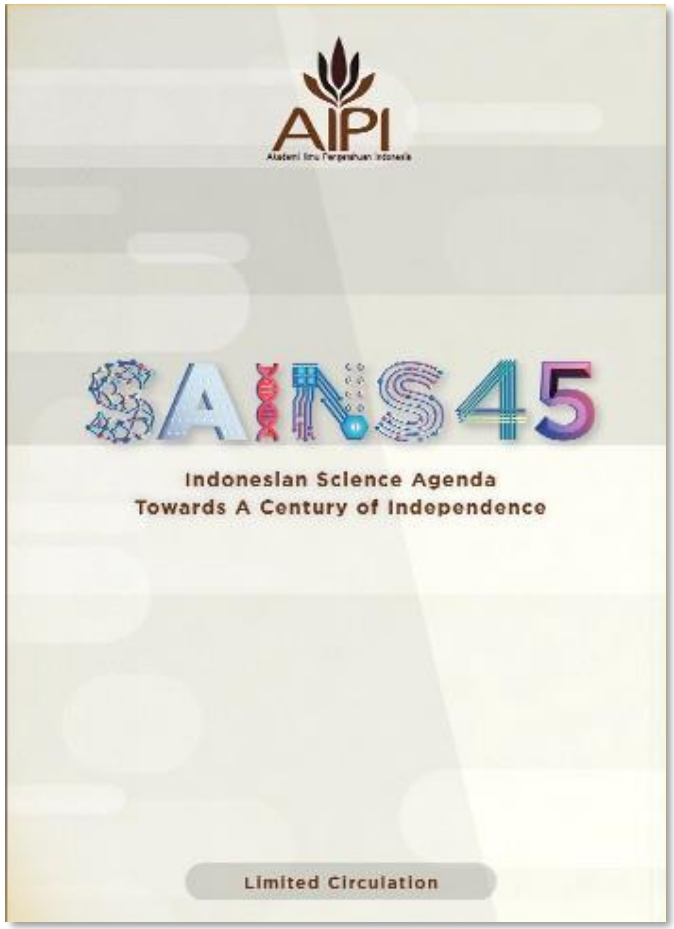
Young Scientists Forum 2016

Discussing Consultative Edition of SAINS45

Enabling Community: Directing Science Agenda

SAINS45:

45 Fundamental scientific questions for the future of Indonesia



- Fundamental scientific questions that have strategic value to tackle the main problems faced by the Indonesian people.
- The solutions offered have a great impact in answering these problems while advancing science in Indonesia.
- Time frame - leading to the celebration of One Century of Indonesian Independence.
- Utilizing young Indonesian scientists connected through the AIPI Frontiers of Science annual meeting since 2010.

Enabling Community: Directing Science Agenda

ALMI
Akademi Ilmuwan Muda Indonesia

8 Clusters of Questions

Enabling Community: Developing Research Funding System

The establishment of research funding system…

DIPI
Indonesian Science Fund

AIPI
Akademi Ilmu Pengetahuan Indonesia

ALMI
Akademi Ilmuwan Muda Indonesia

The Indonesian Science Fund (*Dana Ilmu Pengetahuan Indonesia*, DIPI) provides independent scientific research funding for investigators who show evidence of strong and exemplary scientific merit and potential.

We aim to elevate the overall quality of Indonesian research to produce cutting edge science to build Indonesia's global competitiveness through sustainable financial infrastructure. DIPI grants are autonomous from the state budgeting cycle and state financial administration system. Applications for research funding are reviewed by panels of independent experts.

SAINS45 has been adopted by DIPI as reference for research focus areas

SAINS 45

INDONESIAN SCIENCE AGENDA
TOWARDS A CENTURY OF INDEPENDENCE

Available online at
www.aipi.or.id

I. IDENTITY, DIVERSITY, AND CULTURE

1. What makes Indonesia "Indonesia"?
2. *Torang Samua Basudara*: one nation in the midst of diversity
3. Nationalism in the era of transnationalism
4. How technology reshape humanity?
5. Footprints of human evolution in Indonesian archipelago
6. Changing architecture of science: how to respond?

II. ARCHIPELAGO, MARINE, AND BIORESOURCE

7. Mega-biodiversity: how will this Noah's Ark survive?
8. Caring for marine biodiversity is caring for the future
9. In the sea, will we triumph?
10. How can we feed the world from our seas?
11. Poverty in coastal communities: irony in abundance
12. Potentials of the extreme deep seas

III. LIFE, HEALTH, AND NUTRITION

13. Are we what we eat?
14. The journey of germs: between animal, human, and environment
15. How to outsmart pathogens?
16. Exploring the archipelago for medicine
17. How to remain healthy in old age?
18. How to prepare for an aging population?
19. Beyond stem cells, what is next?

IV. WATER, FOOD, AND ENERGY

20. Water for all: how to secure it?
21. Smart agriculture for the best yield
22. Agriculture beyond food: vaccines and medicines
23. Geothermal energy, the hidden treasure

V. EARTH, CLIMATE, AND THE UNIVERSE

24. Understanding the dynamic nature of the mother earth
25. Tropical forests: to conserve or to convert?
26. How does waste become a blessing?
27. Deciphering the might of Indonesian maritime continent
28. Carbon and climate change: the cycle that shapes human destiny
29. Exploring the universe from the equator

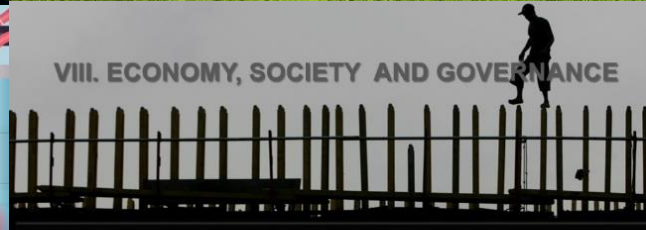
VI. DISASTERS AND COMMUNITY RESILIENCE

30. Living on this restless earth
31. Measuring latent coastal and oceanic disasters
32. Living with disaster

VII. MATERIAL AND COMPUTATIONAL SCIENCE

33. Scanning the earth, counting nature's gifts
34. In search of green mining
35. Harvesting solar energy: inventing novel materials
36. Material designs for strategic industries
37. Computational science and complex systems for Indonesia

VIII. ECONOMY, SOCIETY AND GOVERNANCE



38. One country, one nation, one economy
39. Wanted! Institutions that guarantee and drive prosperity
40. Will the youth continue to write Indonesia's history?
41. What new forms will inequality and poverty take in the future?
42. How to filter the flood of information?
43. How to formulate public policy that is both effective and democratic?
44. Education for human development
45. How can we make humane people-oriented laws?

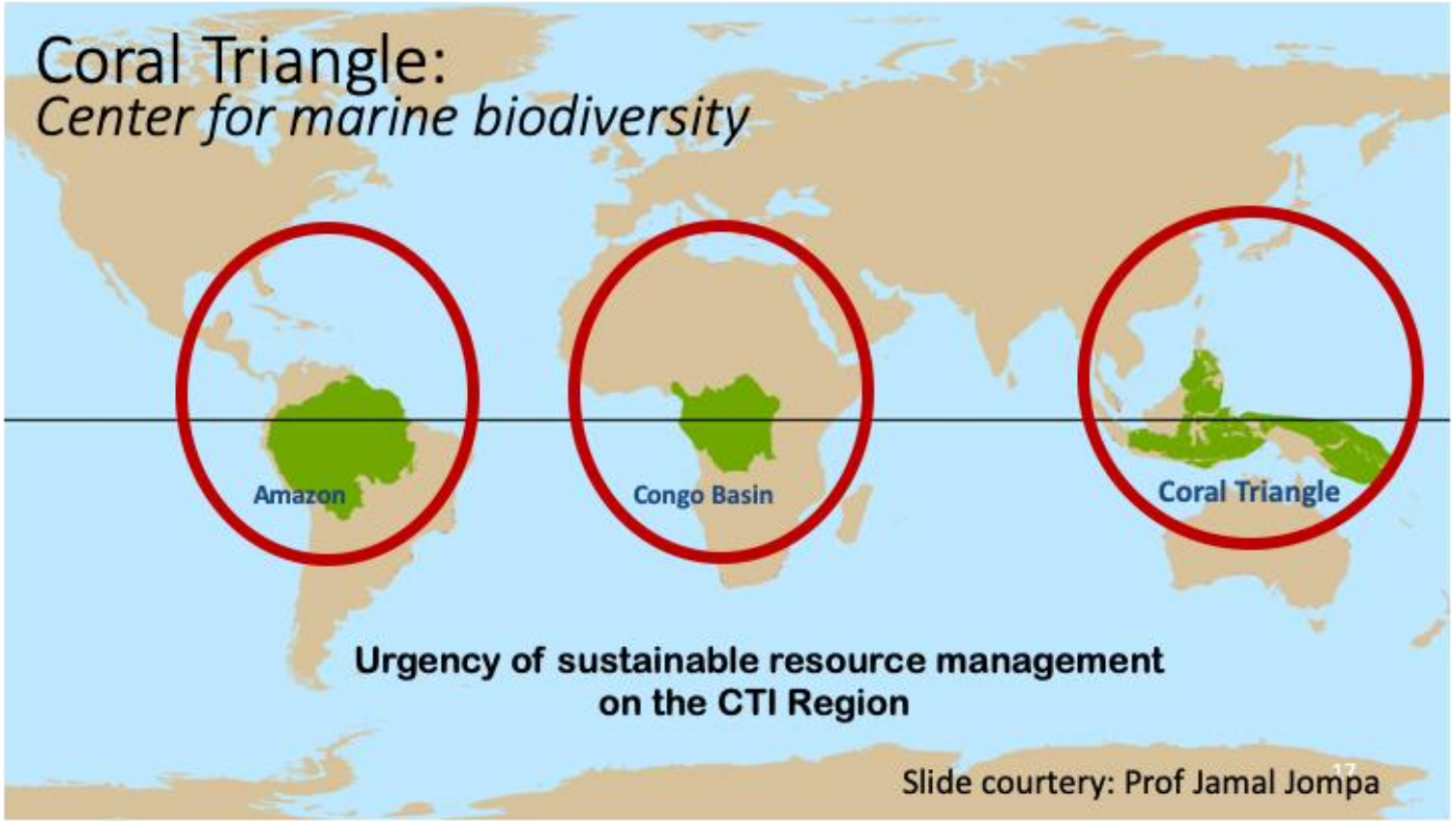
What next?

- Translating SAINS45 Agenda into an actionable science policy:
- Pilot Study: **Science for Indonesian Biodiversity**

WHY BIODIVERSITY?

Home to 11% of the Earth's species (terrestrial biodiversity)

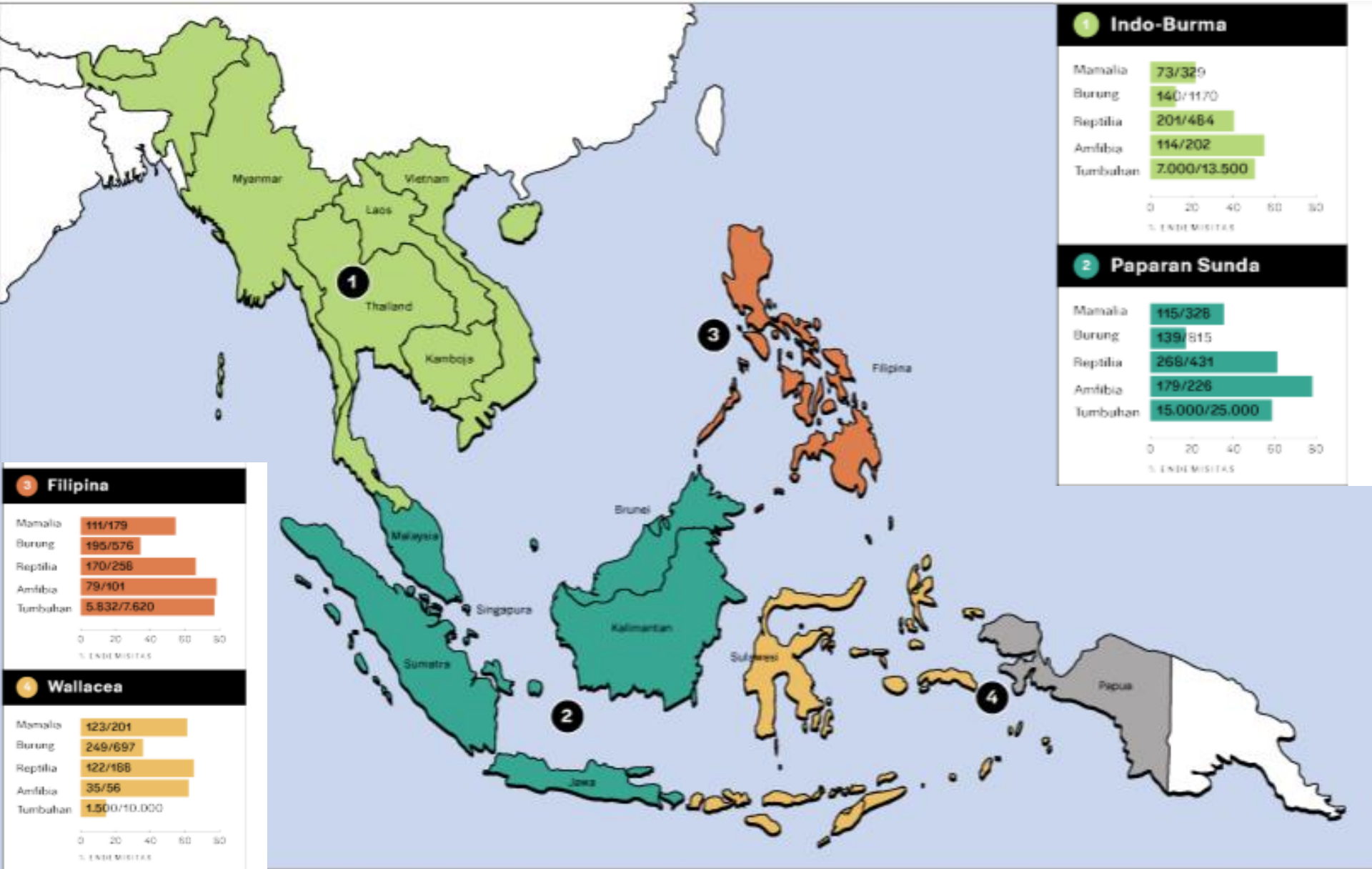
The world's richest marine biodiversity



Policy Advices: Science for Indonesian Biodiversity

ALMI
Akademi Ilmuwan Muda Indonesia

Numbers of endemicity and species richness in Southeast Asia (Modified from Sodhi dkk, 2004)



1 Indo-Burma

Mamalia	73/329
Burung	140/1170
Reptilia	201/484
Amfibia	114/202
Tumbuhan	7.000/13.500

2 Paparan Sunda

Mamalia	115/328
Burung	139/815
Reptilia	268/431
Amfibia	179/226
Tumbuhan	15.000/25.000

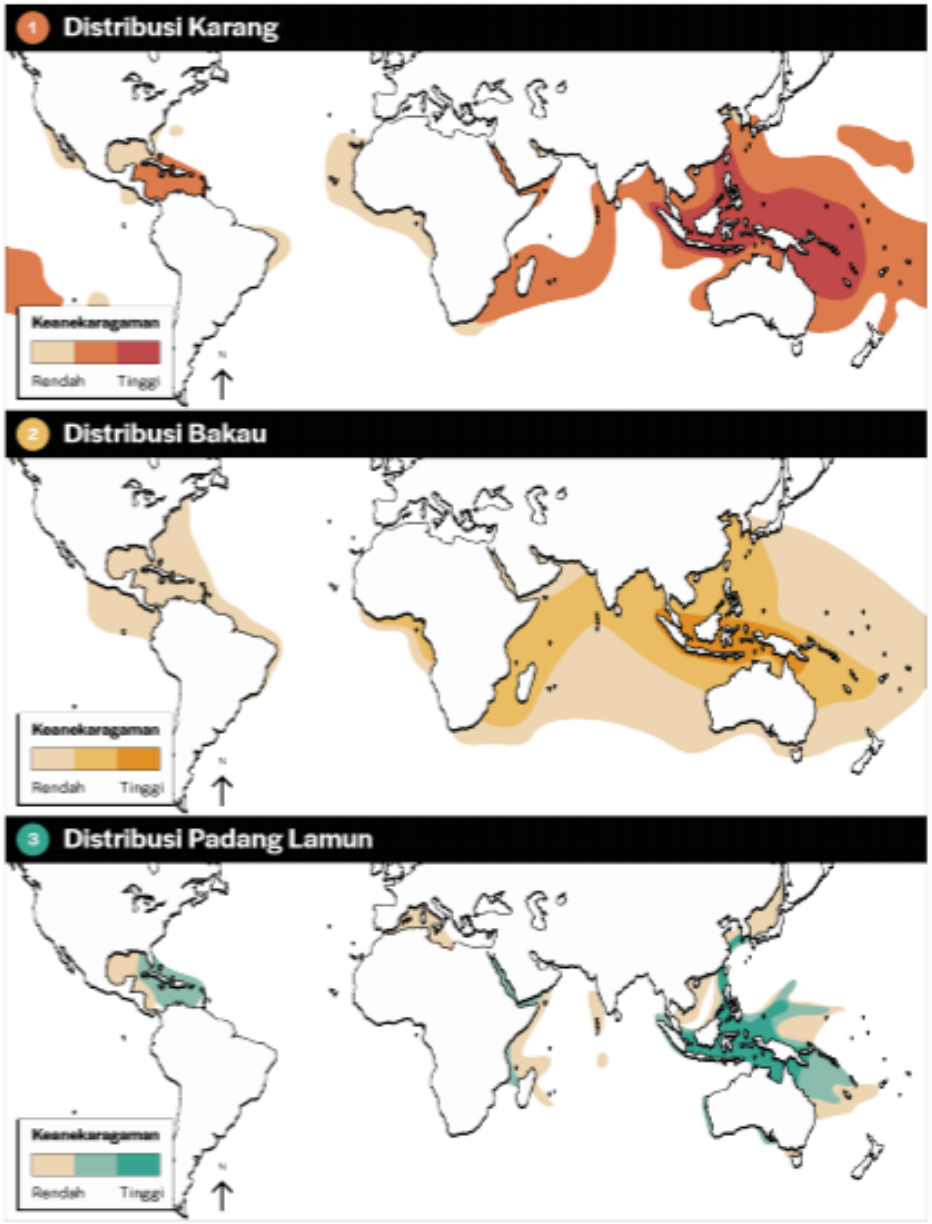
3 Filipina

Mamalia	111/179
Burung	195/576
Reptilia	170/258
Amfibia	79/101
Tumbuhan	5.832/7.620

4 Wallacea

Mamalia	123/201
Burung	249/697
Reptilia	122/168
Amfibia	35/56
Tumbuhan	1.500/10.000

Policy Advices: Science for Indonesian Biodiversity

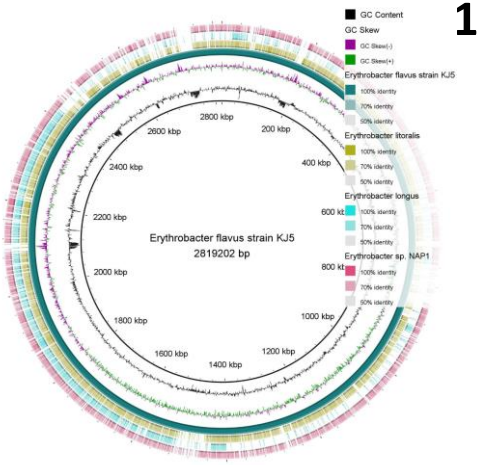


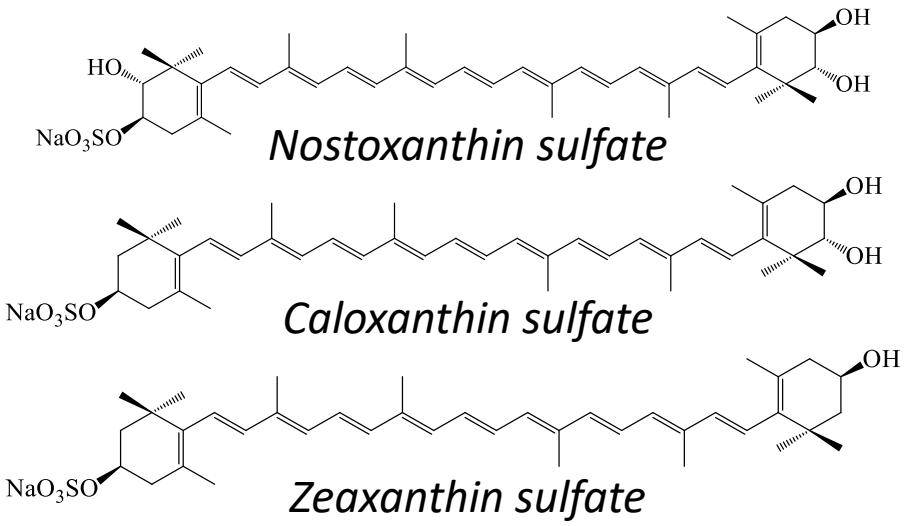
Global distribution and biodiversity levels of three key ecosystems in coastal and marine areas, namely coral reef ecosystems, mangrove forests, and seagrass beds.

Indonesian waters have the highest biodiversity in the world for these three ecosystems.

Policy Advices: Science for Indonesian Biodiversity

Recent Work at the Brotosudarmo Laboratory (2019)





Function of Coral Symbiont:

1. **Detoxification:** Hydrogen sulfide is toxic to a wide range of eukaryotic organisms, such as coral and sponges. Previous studies have suggested that the co-existence of sulfur-oxidizing bacteria might convert hydrogen sulfide to sulfate, thereby contributing to coral health.

2. **UV-Blue Light Protection:** Ability of carotenoid to absorb UV-Blue light radiation contributes to the protection of coral from bleaching.

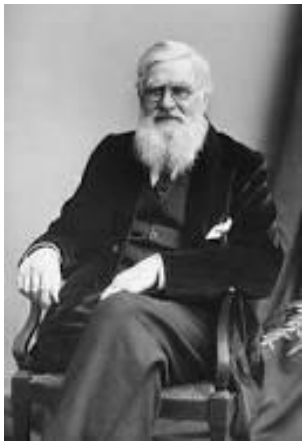
Setiyono, E.; Heriyanto; Pringgenies, D.; Shioi, Y.; Kanesaki, Y.; Awai, K.; **Brotosudarmo, T.H.P.** (2019) Sulfur-Containing Carotenoids from A Marine Coral Symbiont Erythrobacter flavus Strain KJ5. Marine Drugs, 17, 349 (*Impact Factor = 3.772)*

Policy Advices: Science for Indonesian Biodiversity

The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps

Georg Eberhard Rumphius
1627-1702
Pioneer of tropical taxonomy and botany

Franz W. Junghuhn
1809-1864
Plant acclimatization efforts



Alfred Russel Wallace
1823-1913
Theory of evolution & modern biogeography (with Charles Darwin)

Christiaan Eijkman
1858-1930
Nobel Prize 1929 in medicine for the discovery of vitamins

Eugene Dubois
1858-1940
Inventor of fossils Homo erectus in Sangiran

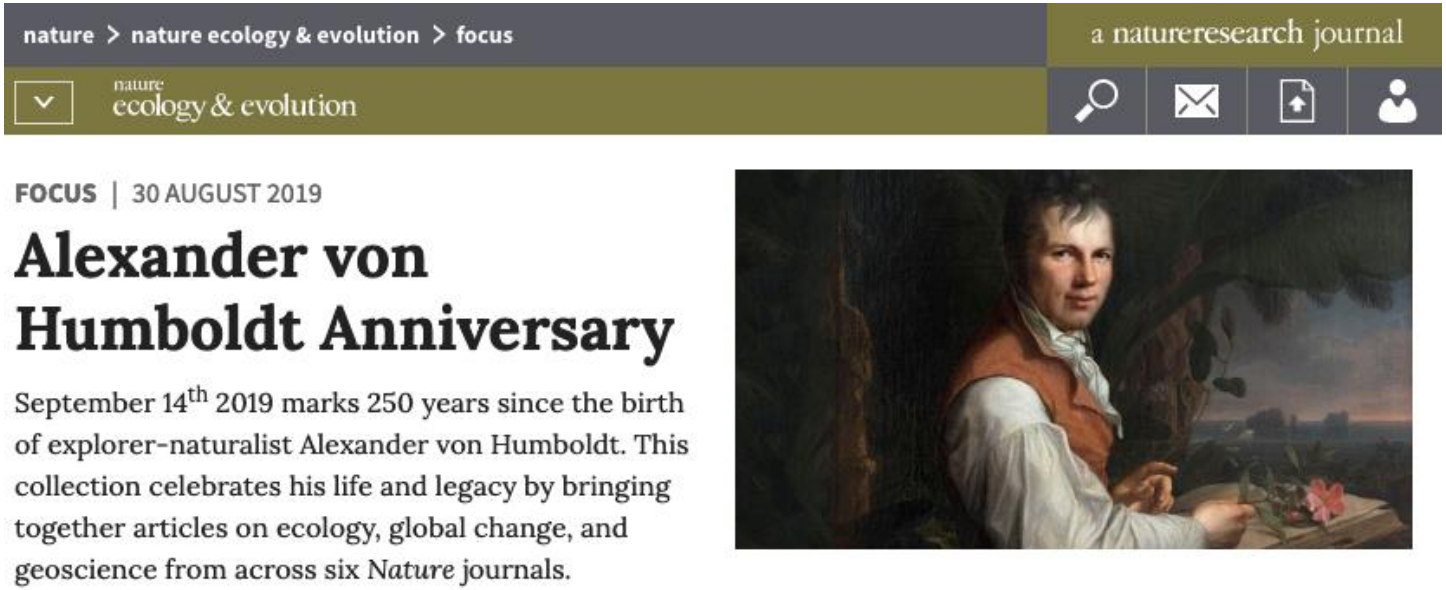
Policy Advices: Science for Indonesian Biodiversity

ALMI
Akademi Ilmuwan Muda Indonesia

The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps

Policy Advices: Science for Indonesian Biodiversity

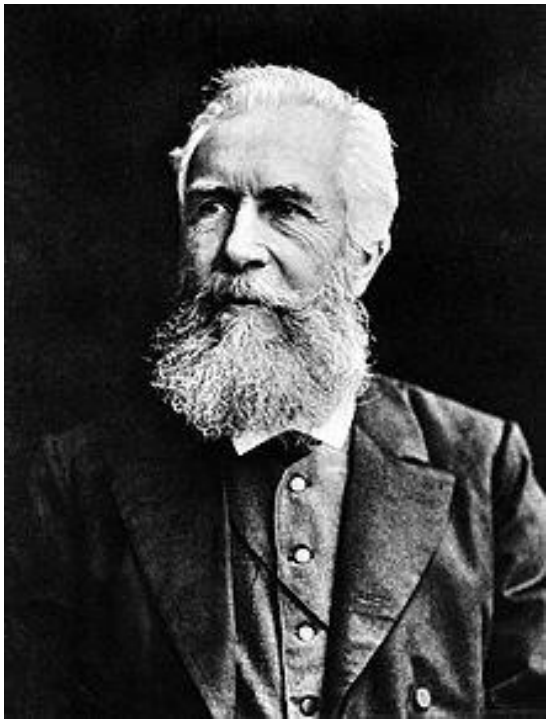
The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps



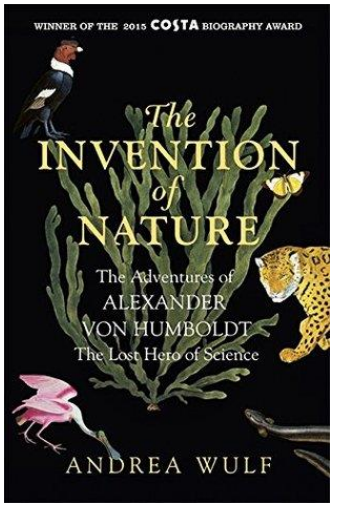
"He who, with a keen appreciation of the beauties of nature manifested in mountains, rivers, and forest glades, has himself traveled over the torrid zone, and seen the luxuriance and diversity of vegetation, not only on the cultivated sea-coasts, but on the declivities of the snow-crowned Andes, the Himalaya, or the Nilgherry Mountains of Mysore, or in the primitive forests, amid the net-work of rivers lying between the Orinoco and the Amazon, can alone feel what an inexhaustible treasure remains still unopened by the landscape painter between the tropics in both continents, or in the island-world of Sumatra, Borneo, and the Philippines" [Humboldt, 1877 (1845), vol 2, p93]

Policy Advices: Science for Indonesian Biodiversity

The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps



"Over the next decade Haeckel travelled a great deal – mainly within Europe but also to Egypt, India, Sri Langka, Java and Sumatera. He still taught students at Jena, but his was happiest when travelling. His passion for adventure never disappeared. ***In 1900, aged sixty-six, he went on expedition to Java, the mere prospect of which, his friends commented, 'rejuvenated' him.*** *During these explorations, he collected specimens but also sketched. Like, Humboldt, Haeckel thought that the tropics were the best place to understand the fundamental of ecology." –page 309*



Ernst Heinrich Philipp August Haeckel (1834 –1919) was a German zoologist, naturalist, philosopher, physician, professor, marine biologist, and artist who discovered, described and named thousands of new species, mapped a genealogical tree relating all life forms, and coined many terms in biology, including *ecology*, *phylum*, *phylogeny*, and *Protista*.

Policy Advices: Science for Indonesian Biodiversity

Biodiversity drives economic development

Figure 5. Indonesia Green Beans Export Markets 2017 vs 2018 (ton)

Rahmanulloh, A. and McDonald, G., Coffee Annual – Indonesia Coffee Annual Report, USDA Foreign Agricultural Service, date 5/15/2019, Gain Report Number: ID1911

THE CHALLENGES FACED BY BIODIVERSITY

United Nations' 3rd Global Diversity Outlook raises 5 main reasons for the loss of biodiversity:

1. Loss and degradation of habitat:
2. Climate change;
3. Pollutions
4. High exploitation and unsustainable use resources
5. Massive invasion of alien species;

Human ecological footprints increasingly exceed earth's biocapacity.

Slide courtesy: Prof Emil Salim

Policy Advices: Science for Indonesian Biodiversity

Topics

1. the need for adequate knowledge regarding the wealth of Indonesia's biodiversity
2. damage to important ecosystems and the threat of extinction of various species
3. the potential for optimal biodiversity benefits
4. strengthening of science and technology related to potential utilization and biodiversity conservation
5. roles in formulating various related policies

Policy Advices: Science for Indonesian Biodiversity

Recommendations:

A. National Investment Priorities in Biodiversity Utilization and Management

1. Development of Science-Based Ecotourism
2. Bioprospection for Drug Discovery and Energy
3. Deep Sea Exploration

B. Developing Science and Technology for Indonesian Biodiversity

Developing Science and Technology for Understanding the Basic Characteristics of Indonesian Megabiodiversity

1. Making More Comprehensive Research Through Proper Development of Observation and Modeling.
2. Increasing Understanding of Ecosystem Balance for the Continuity of Protection of Endemic and / or Endangered Species.
3. Understanding the Pattern of Biodiversity Adaptation to Global Development and Climate Change.
4. Strengthening Indonesian Biodiversity Specimen Banks

Policy Advices: Science for Indonesian Biodiversity

Recommendations:

B. Developing Science and Technology for Indonesian Biodiversity

Increasing Community Participation in Efforts to Manage Productive and Sustainable Biodiversity

1. Increasing Public Awareness of the Importance of Biodiversity
2. Developing Local Wisdom
3. Develop Citizen Science and Computational Data

Improving the Utilization and Economic Value of Excellence in Indonesian Biodiversity

Utilization and Exploitation of Ecosystem Services

Technology Inspiration from Nature: Developing Biomimicry Science

Sustainable Use of Deep Sea Resources

Policy Advices: Science for Indonesian Biodiversity

Recommendations:

B. Developing Science and Technology for Indonesian Biodiversity

Develop and Improve the Effectiveness of Conservation and Governance of Biodiversity

1. Restoration and conservation of key ecosystems: forests, mangroves, seagrass beds, and coral reefs
2. Interaction and impact of alien species on local species

C. Human Resource Development

D. Institution and Funding

1. Competitive Funding System, Autonomy, and Sustainability
2. Reviving Indonesian Biodiversity Clearing Houses
3. International Collaboration
4. Research University

Prioritizing Biodiversity in Public Policy

- New paradigms and new ways based on science and technology are needed in managing Indonesia's natural resources and **people** as the main capital of development.

Natural resources-based economy → **Knowledge-based economy**

- To make biodiversity a foothold in bringing Indonesia into a developed country, it takes a **big commitment** and **strong political support** to make science and technology the main key to innovative economic development.

Prioritizing Biodiversity in Public Policy

- Development **an integrated biodiversity database** is required as a breakthrough in biodiversity management, including in making **evidence based-policies** for economic use of biodiversity

- To make Indonesian economy aware of biodiversity science, a major breakthrough and political support for investment in **financial infrastructure** are needed in the form of an autonomous, sustainable and flexible research funding system from the annual stage budget cycle to drive strategic frontier science (Development of Sovereign Wealth Fund system for research in biodiversity)

Policy Advices: Science for Indonesian Biodiversity

Jakarta (12 November 2018) - Introducing "Science for Indonesia Biodiversity"

Policy Advices: Science for Indonesian Biodiversity

Jakarta (29 August 2019) - Indonesian Young Academy of Sciences (ALMI) in cooperation with AIPI launches "Science for Indonesian Biodiversity"

Policy Advices: Science for Indonesian Biodiversity

STUDY COMMITTEE / WRITER:

Prof. Jamaluddin Jompa, Chair
Dr. Alan Frendy Koropitan
Dr. Berry Juliadi
Dr. Lisman Suryanegara
Dr. Roby Muhamad
Dr. Sonny Mumbunan
Dr. Sudirman Nasir
Dr. Tika Sukarna
Dr. Vanny Narita
Prof. Sangkot Marzuki (AIPI, Advisor)
Dr. Budhi M. Suyitno (AIPI, Advisor)
Prof. Jatna Supriatna (AIPI, Advisor)

STUDY DIRECTOR

Dr. Hasnawati Saleh

EDITOR

Uswah Chabibah
Anggrita D. Cahyaningtias (until Sep 2018)

Acknowledgement

Forum Discussion Series

Emil Salim
Endang Sukara
Djoko Iskandar
Daniel Murdiyarso
Mubariq Ahmad
Eniya L. Dewi
Endah Murniningtyas
Diah S. Saminarsih
Hawis Madduppa
Brigitta Isworo Laksmi
Ilyas Asaad
Herry Subagiadi

Editing Team (Tempo Institute)

Yosep Suprayogi
Purwanto Setiadi
Idrus Fahmi Shahab
Mardiyah Chamim
Mahardhika

267 Young Scientists Network

Alumni Pertemuan Frontiers of Sciences AIPI

Policy Advices: Science for Indonesian Biodiversity

Acknowledgement

50 Fellows of the Indonesian Young Academy of Sciences

ACKNOWLEDGEMENT

AIPI
Akademi Ilmu Pengetahuan Indonesia

KEMENTERIAN
SEKRETARIAT NEGARA RI

USAID
DARI RAKYAT AMERIKA

TEMPO
INSTITUTE