

Sunwoo

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The 9th International Conference of The East and Southeast Asia Federation of Soil Science Societies

>> **Soils as a Convergent Technology
in Tandem with Human and
Ecosystem Health**

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East and Southeast Asia Federation of Soil Science Societies
Rural Development Administration

Korean Society of Soil Science and Fertilizer
National Academy of Agricultural Science



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Distribution and Utilization of Indonesia Soils for Agriculture

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Indonesia in Glance

Indonesia is stretching from 94°45' to 141° 08' E longitude and 6° 08' N to 11° 15' S latitude, is bordered in the west and south by Indian Ocean, in the east by the Pacific ocean, and in the north by the South China Sea. This country is a huge archipelago extending for 4,500 km between the Asian and Australian continents. It consists of more than 17000 islands, of which only about 6,000 are inhabited. The five main islands are Sumatra, Kalimantan, Java, Sulawesi and West Papua (formerly called Irian Jaya). Indonesian total area is about 9.8 million km² where as the land area is about 1.9 million km² (1/5 of the total area) and the area, including the exclusive economic zone is about 7.9 million km² (4/5 of the total area).

In general, Indonesia has a tropical monsoon type climate, featuring slight changes in seasons and temperatures, low winds, a high degree of humidity and periodic heavy rainfall. There are two Monsoons: the East Monsoon or dry season running from May to September which is influenced by the Australian Continental air masses, and the West Monsoon or rainy season from December to March, which is influenced by the Asian Continental and Pacific Ocean air masses passing over the ocean. Temperatures are largely uniform throughout the year, i.e. between 22 until 27 °C, with a uniform relative humidity between 70 to 90 percent. The rainfall distributions vary between the regions, depending on topography, air mass movement, etc. Generally the country annual rainfall is relatively abundant and varies between 700 to 4,000 mm. On Sumatra, Kalimantan and West Java, the dry period is however not completely rainless, and there is ample soil moisture over almost the whole year. The climax vegetation on this part of Indonesia is therefore typical rainforest vegetation, and the area enjoys optimum climatic conditions for growing a wide range of crops. East Java, Nusa Tenggara and part of Sulawesi are much drier, and are covered by vast grasslands. However in those less favored areas, rain fed agriculture for at least 4 to 5 months each year, while tree growth is almost continuous (FAO-UNEP, 1994).

The characteristic features and the high number of general and endemic species. Within this region make the flora of Indonesia completely different from the flora of the neighboring continents, Asia and Australia, as well as from the tropical areas within these. The richness of the Melanesian region of which Indonesia represents the major portion, is reflected in the accommodation of close to 40,000 species of plants or about 10 to 12 percent of the estimated number of global plant species. Those tropical rain forests are the host of various fauna species. According to Tobey and Dutton (2002) 12 percent of mammals, 17 percent of birds, and 17 percent of reptiles and amphibians species of the world are found in Indonesia. Marine ecosystems are even more diverse, whereas Indonesia lies in the middle of a global bull eyes. Dealing with such richness of flora and fauna, Indonesia is known as the world's mega-biodiversity country.

Distribution and Utilization of Indonesian Soil

Indonesia has complexity of topography and also complexity of geology, climate and vegetation, and various types of soils. In the order level of Soil Taxonomy, Indonesia has 10 orders: They so-called Inceptisols, Ultisols, Oxisols, Entisols, Histosols, Mollisols, Andisols, Vertisols, Spodosols, and Alfisols. Table 1 shows the distribution of soil order in Indonesia.

Inceptisols, Ultisols, and Oxisols. The soils of Indonesia are dominated by Inceptisols, Ultisols, and Oxisols. The three orders scattered at mainly at Sumatra, Kalimantan, Sulawesi, and Papua Islands occupying 73%. The three orders of the soils generally have low pH, low CEC, and low nutrients. The soils are grown tropical-rain forest, plantations, and food crops. The main plantations planted at those soils are oil palm, rubber, coffee, cacao, clove, etc. The oil palm is planted in area where rain is fall all over the year. Sumatra, Kalimantan, and Papua are the main Islands where oil palm is planted. Beside rice, the other Indonesian main food crops are corn and cassava. The central corn plantation is Gorontalo Province of Sulawesi Island whereas the central for cassava is Lampung Province of Sumatra Island.

Table 1. The distribution of soil order in Indonesia (Soil Research Institute, 2006)

Soil Order	Area (million ha)	Percentage	Areal Distribution
Inceptisols	59.69	31.99	Sumatra, Kalimantan, Sulawesi, Papua, Java
Ultisols	54.20	29.05	Kalimantan, Sumatra, Sulawesi, Papua
Oxisols	23.08	12.37	Sumatra, Kalimantan, Papua
Entisols	14.54	7.79	Sumatra, Kalimantan, Java, Nusa Tenggara
Histosols	11.89	6.37	Sumatra, Kalimantan, Papua
Mollisols	9.75	5.23	Java, Kalimantan, Sulawesi, Papua
Andisols	7.77	4.16	Sumatra, Java
Vertisols	3.40	1.82	Central and East Java
Spodosols	2.07	1.11	Kalimantan
Alfisols	0.20	0.05	Java, Nusa Tenggara, Sulawesi
Total	186.59	100.00	

Entisols spread at Sumatra, Kalimantan, Java, Papua, and Nusa Tenggara Islands. The soils cover soils above bed rocks, alluvial soils, and volcanic-sandy soils. The soils above bed rocks are found at mountainous areas having rocks of limestone, granite, quartz, etc. The properties of these soils are shallow solum with different fertility depend on parent materials. The soils are mostly used for forest. Some Entisol at limestone areas with low rainfall found in Central and East Java and Nusa Tenggara Islands are planted teak wood. Entisol with the parent material of alluvial scattered at along the river sides and seashores. These soils are mostly used for food crops especially paddy, corn, soybean combined with lowland vegetables and fruits. North Java Island seashore is mainly for paddy. Other paddy areas are at the seashore of South and East Sumatra and South Sulawesi. Entisol with parent material from volcanic sand scattered at volcano areas at Sumatra and Java Islands. The soils are very fertile and mostly used for food crops such as paddy, corn, and soybean.

Histosols occupy 6.37% of the total Indonesian land. These soils distributed at east seashore of Sumatera Island, Kalimantan, and Papua. Histosols are mostly grown lowland tropical forest. Some Histosols near the rivers have been reclaimed by local peoples for paddy field. Since 1980's government opened some Histosols at Sumatra and Kalimantan Islands for transmigration of Java people for paddy field. In the first 5 years, the production was very high but in the next years the production decreased gradually and abandoned by farmers. In 1990'0 some private companies used Histosols for forest plantation especially acasia.

Mollisols in Indonesia is only occupying 5.23% of Indonesian area spreading at Java, Kalimantan, Sulawesi and Papua. Mollisol usually develop from limestone and basaltic rocks. Mollisols are used for food crops at Java Island but in the other Islands its still remain for forest. Wide areas of Mollisols are found in Papua but due to less infrastructure and peoples, the soils have not been used for agriculture.

Andisols are soils develop from volcanic ash materials. Because Indonesia is part of world "ring of fire" along Sumatra, Java, Bali, Nusa Tenggara, Sulawesi, and Maluku Islands, Andisols found around the volcanoes. The soils are low pH, high organic matter, and very high of P absorption. The soils are mostly still covered by forest. Some soils used for tea plantation and highland vegetables such as potato, carrot, cabbage, etc.

Vertisols are found in Central and East Java Island. These soils are developed from basaltic rocks rich in 2:1 type clay minerals of montmorillonite. The soils are relatively high pH, high CEC, and high macro and micro nutrients. Vertisols at Java Island are used as food crops especially rice during the wet season combined with corn or soybean in the end or before dry season. Tabaco is usually planted at Vertisols during dry season after rice plantation at East Java.

Spodosols are found at Kalimantan Island. The soils are characterized by low pH, low nutrients, and the texture of high sand content. The soils are mostly grown natural forest. Some Spodosols are converted to oil palm plantation. However, due to the limiting factors of the physical and chemical properties, the production of the plantation is still low.

Alfisols are very found at Java, Nusa Tenggara, and Sulawesi Islands developing from basaltic rocks. These soils have high pH and rich in macro and micro nutrients. However, because the soils only occupy 0.05% of the area and some soils found in the mountainous areas, Alfisols do not become important meaning for agriculture.

Various types of soils indicate that Indonesia support many type of ecosystem, because soil characteristics that determine the type of soil are the results of interaction of some land ecosystem parameters. Generally, Indonesia has both land and marine ecosystems, in which the land ecosystems include wetland and dry land ecosystems. Those ecosystems can still be differentiated into some sub-ecosystems. Various types of ecosystem in the tropical and humid climate of Indonesia are responsible for luxuriant vegetation of tropical rain forests containing timber and other forest

products. Within the forests grow a large variety of epiphytes, lianas and many kinds of flowers, including the great number of orchids, various kinds of bamboo, rattan, palm trees, etc.

Conclusions

Indonesia is the biggest archipelago country in the world having more than 17000 islands with the land area of 1.9 million km². It has complexity of topography and geology, climate and vegetation, and various types of soils. The soils of Indonesia are dominated by Inceptisols, Ultisols, and Oxisols. The three orders scattered mainly at Sumatra, Kalimantan, Sulawesi, and Papua Islands. The soils are mostly grown tropical-rain forest and the others are used for plantation of oil palm, rubber, coffee, cacao, clove, etc. Entisol with alluvial materials used largely for rice field at Java, Sumatra, and Sulawesi Islands. Histosols are mostly still grown lowland forest and used for forest plantation. Andisols mostly still covered by forest and some soils used for tea plantation and highland vegetables.

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AR04

Indonesian Society of Soil Science (ISSS)

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Introduction

Indonesia Society of Soil Science (ISSS) is professional organization of Indonesian soil scientists and other professional related to soil science. ISSS is founded in Jakarta 18 July 1972. The members of ISSS are about 2000 persons affiliated in universities, research centers, government institutions, private companies, etc. ISSS has headquarter office at Jakarta with 19 region branch-offices spreading all over the country. The vision of ISSS is become center of excellent for development and application of soil science and technology professionally for actualization of social aspiration of Indonesian such as stated in state foundation and constitution. The mission of ISSS are (1) to develop soil sciences in order land resources and other natural resources can support the sustainability of life; (2) to increase the application of soil science for development of land management in order Indonesian soil and water can be used continuously for prosperity and welfare of Indonesian people. ISSS has Center Board that lead by General Chairman and assisted by six Vice Chairmans. General Chairman is supported by General Secretary and General Finance Secretary for implementation of programs and activities. ISSS has 12 Divisions based on the variety of sciences developed by members of ISSS. Each division makes group discussion for solving specific problems. The divisions in ISSS are as follows (1) Organization Development, (2) Institutional Cooperation, (3) Mechanical Physics And Soil Conservasion, (4) Mineralogy Genesis, and Soil Classification, (5) Chemistry Biology and Soil Fertility, (6) Technology and Soil Engineering, (7) Agriculture, Forestry, and Environment, (8) Law, Social and Culture, (9) Housing, Mining, and Industry, (10) Survey, Mapping and Land Evaluation, (11) Spatial and Landuse Planning, and (12) Education and Research. ISSS is also has three Commisions for handling urgent problems those should be solved immediately. The three Commisions are Law and Act, Terminology, and Soil Classification.

Program

The programs of ISSS are arranged for achieving of its vision and mission. ISSS has three programs namely program for development and implementation of soil science, program for development of member role, and program for development of institution. The **first program** of development and implementation of soil science consist of (1) Research in basic soil science such soil characteristics, soil processes, land degradation, soil quality, etc; (2) Research in related to environment sustainability: landuse and land management, climate changes, sustainable land management, spatial and landuse planning, etc; (3) Research in related to human dimension: social, economic, culture, law, land conflict resolution, land economics, land sociology; (4) Formulate the soil technology for improvement of land efficiency with consideration of environmental sustainability; and (5) Active in formulation of development policy related to natural and land resources including compiling laws and rules.

The **second program** for development of member role consist of (1) Development of education and training for increasing human resources capacity; (2) Organizing the symposium, seminar, workshop, colloquium for sharing information among members in development and application of technology; (3) Build up communication among members through information technology; and (4) Build up cooperation among ISSS members for doing professional activities.

The **third program** for development of institution covers (1) Development of the ISSS secretariat for coordination improvement of all ISSS members; (2) Development of network with many stakeholders to built up the mutual understanding; (3) Development of website and mailing list of ISSS; (4) Publication of the ISSS news twice a year (5) Publication of the Journal of Indonesian Soil; (6) Organize the Annual scientific meeting; 2008: In Palembang with the topic of wetland, 2009: In Yogyakarta with the topic of dry land; (7) Development of soil nomenclature, national soil classification, law and act related to soil; (8) Organize the 10th National Congress of ISSS in 2011 at Banjarmasin, South Kalimantan.

Activities of ISSS during the of Period 2007-2011

The ISSS conducts National Congress each four years where the members all over the country conducting National Soil Science Seminar for presenting papers as well as National Congress of Soil Science for electing the General Chairman of ISSS for the next four years period. In the 9th National Congress of Soil Science at Yogyakarta, in December 2007, Dr. Yuswanda A. Temenggung was elected as General Chairman for the period of 2007-2011. To achieve the vision and mission and for implementation of the programs, the general chairman has arranged the ISSS Center Board for 2007-2011. Based on the programs, the activities of ISSS during the period of 2007-1011 are as follows.

1. In March 8, 2008, the ISSS organized the first Round Table Meeting at Bogor, West Java Province. The Head of Advisory Board of ISSS, Joyo Winoto, Ph.D gave Keynote Speech with the theme of "Revitalization of ISSS to answer the national problems. Some 200 ISSS members especially Advisory Board and Center Board Members attended that meeting. At that time, the General Chairman gave the honor to Prof. Go Ban Hong for his dedication for ISSS for very long time.
2. In May 22, 2008, the ISSS Collaborated with Mine Reclamation Research Center, Bogor Agricultural University and other institutions conducted National Seminar of Mining Reclamation. Some ISSS members contributed papers in that seminar attending by 150 members. ISSS gave highlight the importance of land reclamation after mining for sustainable of land, water, flora and fauna environment.
3. In November 17-18, 2008, ISSS conducted National Seminar on Lowland for Sustainable Agriculture at Palembang, South Sumatra. The program covered Seminar with the topic of lowland, land judging contest for peatland followed by students of department of Soils Science from 13 national universities, and field trip to the peatland reclamation area.
4. In March 4, 2009, ISSS collaboration with Indonesian Survey Association organized Talkshow and National Seminar with the theme: The Role of Land Geo-spatial Information for Supporting Food and Energy Sovereignty. The objectives of the talkshow and seminar are (1) to look for the solution alternatives for handling food and energy through optimalization of land geo-spatial information and (2) to strengthen the collaboration between Indonesian Society of Soil Science and Indonesian Surveyor Accociation for facing national problems related to sustaibnable geo-resources management.

In November 20-21, 2009 ISSS will conduct the National Seminar at Yogyakarta for discussing special issues of dryland. Some International soil scientists will be invited as keynote speakers. Indonesian government supports the financial of this seminar especially for encouraging ISSS members to propose national and international publication. Such as have been stated in the program, ISSS will organize the 10th National Congress of Soil Science at Banjarmasin, South Kalimantan.

Besides the above listed activities, ISSS publish news twice a year and Journal of Indonesian Soil twice a year. For making more intensive communication among members, ISSS uses mailing list group discussion. Hot issues related to soils such as landslides, flood, earthquake, etc are continuously discussed through mailing list group discussion. Through this communication system, ISSS members can contribute their ideas for solving every problem for finding the best solution.