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SMART RAIN FOREST MANAGEMENT AND CONSERVATION PROGRAM IN MALAYSIA THROUGH MYTREEEVOLUTION

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Abstract

Sustainable forests management (SFM) maintains and enhances the long-term health of forests ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for current and future generations. MyTreeVolution is the unique knowledge transfer and community services transformation project created by excellent experts from CEO Faculty Programme Cycle together with Forestry Department of Peninsular Malaysia (FDPM). MyTreeVolution has a mission to transform the method of planting activity and conservation of natural forest by having a commitment from Higher Education Institution to engage actively with stakeholders regarding planting inventory, public awareness and participation, big data management and finally consistent serving Malaysia Forest Restoration Plan. MyTreeVolution has collaborated with Forestry Department of Peninsular Malaysia (FDPM) as the main partner in supporting the idea of Industrial Revolution 4.0, towards the future coordination and administration in forest management support through communication, education, and public awareness (CEPA). Furthermore, quite numbers of engagement of stakeholders from DoE, LAs (local authorities), NGOs as well as participation from Industry, named integrated corporate social responsibility (i-CSR) committed to about RM 1 million from various aspects, including the plant seedlings. The project introduces Geo-trees concept in which Volunteer use a smartphone to collect tree inventory data using Geotrees mobile app and recorded in the database and later these data can be visualized in the Geotrees web mapping to estimate tree growth, carbon sequestration, and tree benefits. Overall volunteers supporting this program amounted to 10,000 peoples from various backgrounds at local and international participation, as an example planting trees at Sg Bonus (Taman Sri Rampai, KL) involved with US Navy Marine and school kids from Klang Valley. Overall, this program facilitates agencies, institutions, industry and other impacted stakeholders to improve the monitoring and action-plan of plants restoration via IoTs applications.

Keywords: Geotrees, Forest management, IOTs, Sustainability.

Introduction

Malaysian forests are a major part of the nation's landscape and crucial to its economic progress. Sustainable Forests Management (SFM) maintains and enhances the long-term health of forests ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for current and future generations. In year 1992, the International Tropical Timber Organization (ITTO) adopt a definition of SFM as the process of managing permanent forest land to achieved one or more clearly specified objectives of management with regard to the production of continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment".

We live in an era of unprecedented environmental change, motivating equally unprecedented global actions to protect and restore forest ecosystem. These efforts could fail to achieve their ambitious goals if they are not informed by clear and appropriate concepts and definitions of forest. Forest definitions provide the conceptual, institutional, legal and operational basis for the policies and monitoring systems that drive or enable deforestation, forest degradation, reforestation and forest restoration. The area of land covered by forest and trees is there an important indicator of global environmental condition. Food and Agriculture Organization of the United State of America produces the results from its Global Forest Resources Assessment every five years period. All countries involves in major survey of assessment using a common reporting framework, agreed definitions and reporting standards to provide statistics on forest area and related data on forest condition and use.

There are several reasons why forests are so important; it is divided by two groups which is important to human and important to environmental. Human live and all living things such as animal and insect are depending on forest because forests help us to breath. Forest produced oxygen that we need to live and absorb carbon dioxide that produced by living things. One single mature tree can produce a day's supply of oxygen for anywhere from two to four people. Forest not just trees they're more than that. Almost half of all known species live in forests, including 80 biodiversity on land, from very rare species to endangered apes all depending on forest. In this century, deforestation activity seems quite critical but still in control. Environmental non-governmental organizations (NGOs) and indigenous peoples' organizations actively involved in stakeholder consultation before logging activities and forest development projects takes place. NGOs activist claims that many of forests are destroy because a development. Deforestation and tree-cutting activities have really effect the environmental. For example deforestation can make the soil erosion destruction, waster cycle destruction, and climatic change. This study aims to elaborate the forest resources in Malaysia, impacts of sustainable forest management, Communication, Education and Public Awareness (CEPA) program benefits towards rain forest tree protection, and Mytreevolution program. The study introduces Geotrees concept in which Volunteer use a smartphone to collect tree inventory data using Geotrees mobile app and recorded in the database and later these data can be visualized in the Geotrees web mapping to estimate tree growth, carbon sequestration, and tree benefits.

Forest resources in Malaysia

Malaysia is composed of West Malaysia, also known as Peninsular Malaysia, and East Malaysia consisting of the states Sabah and Sarawak. Responsibilities for forestry are divided between the federal and state governments. The forestry departments of each state are responsible for regulating forest exploitation and management. The departments of the 12 states of Peninsular Malaysia come under the umbrella of the Forestry Department of Peninsular Malaysia, while the departments of Sabah and Sarawak are autonomous. According to the FAO (2015), Malaysia has around 22.2 million hectares of forested land, which constitutes to 67.6% of the total land area. Around 20.2 million hectares of the forested land is primary or otherwise naturally regenerated forest, and around 2.0 million hectares is planted forest. Natural forests are under state ownership, except for some alienated (privatized) land where forest clearance is permitted for private use. For the forests under state ownership a basic

distinction can be made for forests inside the Permanent Reserved Forests (PRF) and on state land outside the PRF. The state has the management rights of these forests, but these are transferred to private parties via private concessions in the PRF, or harvesting permits in state lands [8]. An overview of the forest resources of Malaysia is shown in figure 1.

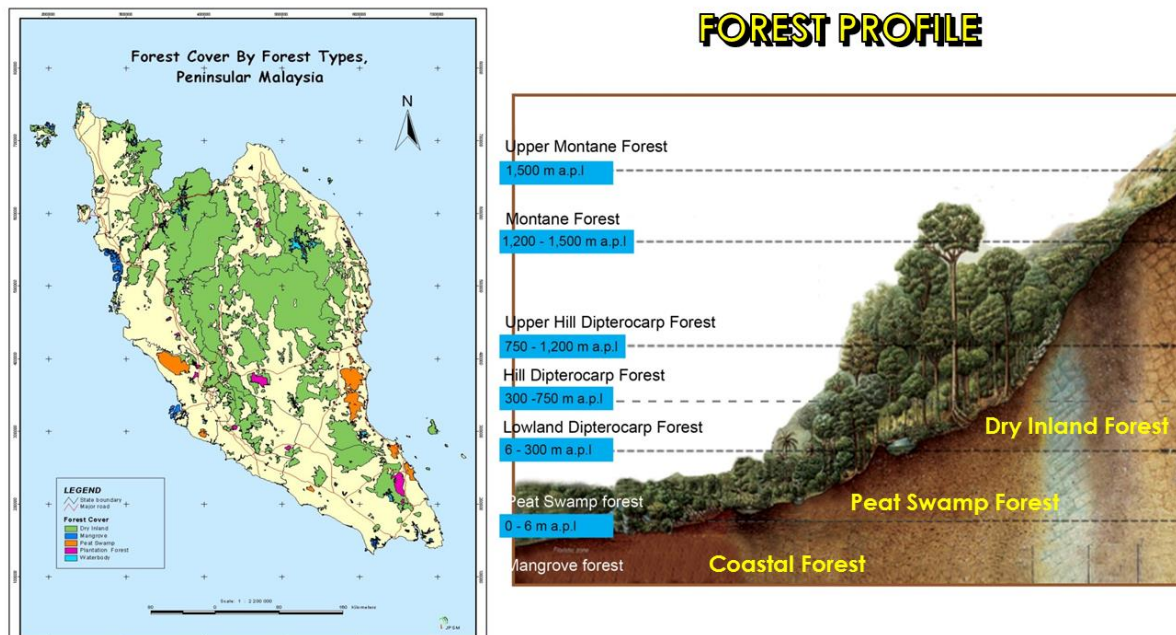


Figure 1. Overview of forest resources.

About 22% of the Permanent Reserved Forest (PRF) is not used for commercial production, but is designated as protected. Such protected forests are managed by the state and include: non-harvestable forest (areas above certain altitudes and slopes), virgin jungle reserves, recreational forest, catchment forest and reservoirs and forest for federal purpose. National Parks, Wildlife & Bird Sanctuaries cover approximately 1,9 million hectares of forest. The forest sector varies quite significantly from one region of Malaysia to another. Malaysian natural forests can be distinguished in three forest types: dry inland forests, accounting for the great majority of the Malaysian forests.

Sustainable Forest Management: Impacts and benefits

Malaysian forests are a major part of the nation's landscape and crucial to its economic progress. Uncontrolled and unchecked exploitation can cause irreversible damage such as loss of plants and animals, soil erosion, flooding and climate change. Sustainable forests management (SFM) maintains and enhances the long-term health of forests ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for current and future generations. One-third of the earth's land are home to over 80% of the world's biodiversity that embodies an irreplaceable genetic resource and Malaysia's challenge is to evaluate the opportunities for sustainable intensification that is to increase the provision of wood, non-timber products and biochemicals without compromising the resilience or health of the tropical forests. As competition for land increases and definition of sustainability evolves, Malaysia continues with forward thinking policies, where it improves forest practices to make the most of its rich forest resources. So, sustainable use of the forest is essential. Sustainable development will meet the needs of Malaysia's population without compromising the needs of future generations.

Malaysia is one of the world's megadiverse countries that ranks 12th in the world, according to the National Biodiversity Index, with an estimated flora between 12,500 to 15,000 species of flowering plants. It has more than 1,000 species of fern and fern allies. Fauna is estimated more than 100,000 species. Knowing that Malaysia is the leading developed nation in Southeast Asia, the nation's leaders have crafted out strategies to protect the forests through selective logging where trees are only felled when they reached a certain height. Due to this understanding it allows young trees a guaranteed life span. In, Malaysia, SFM addresses forest degradation and deforestation while increasing direct benefits to people and the environment. At the social level, sustainable forest management contributes to livelihoods, income generation and employment. At the environmental level, it contributes to important services such as carbon sequestration and water, soil and biodiversity conservation.

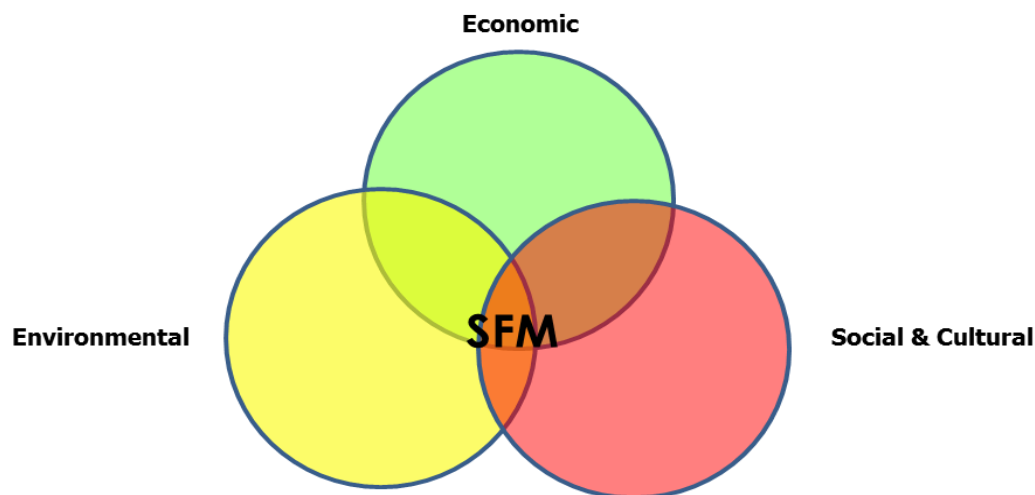


Figure 2. Pillars of SFM.

Economic viability requires that the benefits to the group in question exceed the costs incurred, and that some form of equivalent capital is handed down from one generation to the next. Environment entails an ecosystem being able to support healthy organisms, whilst maintaining its productivity, adaptability and capability for renewal; it requires forest management respects and builds on, a natural process. Socio-cultural reflects the relationship between development and social norms, an activity is socially sustainable if it conforms to social norms, or does not stretch them beyond a community's tolerance for change (Figure 2). In 2015, about 18.27 million hectares or 55.34% of Malaysia remains forested. Of this area, about 14.5 million hectares have been designated as Permanent Forest Reserve (PRF) and Permanent Forest Estate (PFE). With regards to land capability an overall land use, it is noted that there is a need for further development to meet the requirements of a growing population and the country's socio economic development agenda. One dimension of SFM is the contribution of national income through non-timber forest products such as herbs, tree resins for perfumes and ecotourism. The main components of SFM were planning criteria; community forestry; forest fire management; forest law enforcement; biodiversity and trans-boundary conservation; mangroves and restoration and planted forests.

Commitment from Communication, Education and Public Awareness (CEPA) Program

The once objective of the Convention on Biological Diversity (CBD) and other biodiversity-related conventions is the lack of public awareness on importance of biodiversity ranks as one of the most serious. Awareness is importance of biodiversity to human well-being, citizens and stakeholders are not likely to take the steps needed to mainstream biodiversity considerations

into their daily lives and practices. The lack of public awareness also contributes to the relatively low political priority given to biodiversity issues. The Convention's Communication, Education and Public Awareness (CEPA) programme is an important instrument for this target. The establishment of the United Nations Decade on Biodiversity by the United Nations General Assembly represents an opportunity, throughout the implementation period of the Strategic Plan, to link national awareness raising activities with a broader international process as a means of developing greater visibility and traction for such actions. Forest Landscape Restoration (FLR) is the ongoing process of regaining ecological functionality and enhancing human wellbeing across deforested or degraded forest landscape. CEPA is also committed to Ecological restoration that has been degraded, damaged or destroyed as a means of sustaining ecosystem resilience and conserving biodiversity. Their international agenda of restoration involves Strategic Plan for Biodiversity 2011-2020, Aichi Biodiversity Target under CBD Target 5, 12, 14 and 15 and National Biodiversity Strategic Action Plan (NBSAP Targets).

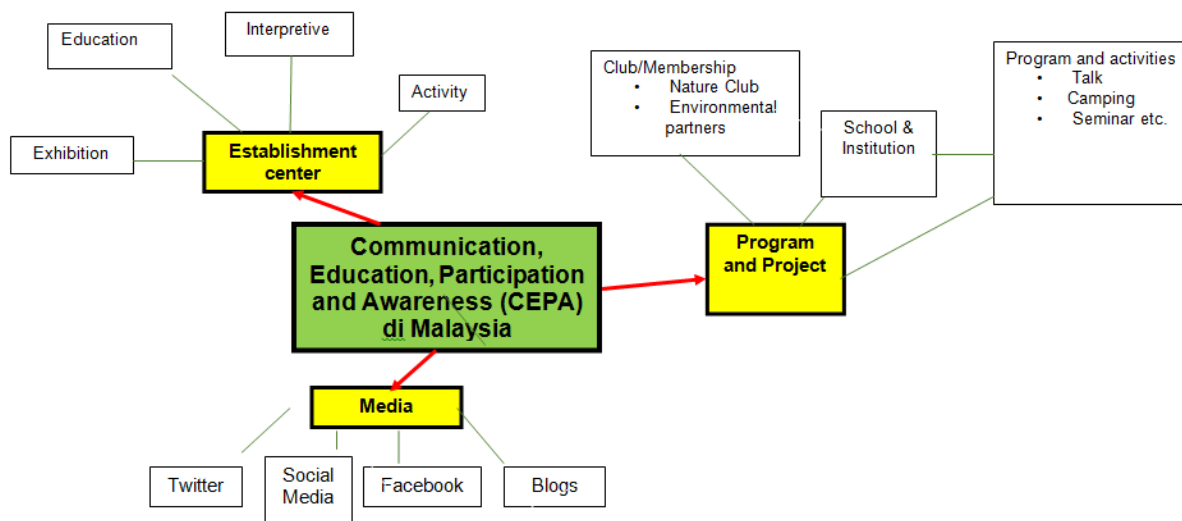


Figure 3. Implementation of CEPA in Malaysia.

Communication and education is an important role on biological diversity especially for understanding human life. In this way, it is one of the valuable assets in realizing of sustainable development. Understanding the local community has made them more motivated and committed to help achieve the goals of the Biodiversity Convention, through the implementation of the National Biodiversity Strategy and Action Plan which is coordinated by CBD. However, effectively communication is still a challenge for each focal point country's and coordinator of the National Biodiversity Strategy and Action Plan. They needs to counter back all aspects especially on their communication delivery. Based on the sixth meeting of Convention on Biological Diversity Conference (CBD), through article 13, Communication, Education and Public Awareness (CEPA) was accepted in the work programme. One of the elements in this work programme is to provide related inputs on CEPA for convention members. This CEPA is to aims promotion and encourage understanding about importance and needed steps to conservation biological diversity, as well as disseminating them through the media and nurturing these topics in educational programs and also forging cooperation with other countries or international organizations in developing programs, education programs and public awareness regarding conservation and sustainable use of life diversity.

Figure 3 represents the programme implementation by CEPA in Malaysia. IUCN Commission on Education and Communication was summarize that CEPA which is has meanings to be used as a tool's and processes that can bring a changes to the community's understanding of the environment: - *Communication*: On the exchange of existing information through dialogue session between sectors and stakeholders to enhance understanding of issues and support cooperation planning and action in preserving the environment. *Capacity Development*: To enhancing individual skills and social groups through training and it can develop policies and procedures for an organization so that its function gives more impacts on the preservation of the environment. *Education*: To enhancing understanding, explanatory values, improving attitudes of environmental concerns and to self-motivate and improving skill preserving the environment. *Empowerment*: To developed agency or competency to take responsibility on decision making. Public Awareness: First step on to forming understanding and concerning public about main issues or some agenda issues. *Participation*: To sharing different knowledges on learning process which is someone can take responsibility and action on preserving environment. Participation can bring any meanings. It is enhancing empowerment to stakeholders to negotiate, approval, declining decision makers and to taking risk or share. *Action*: Needed if role of awareness not enough on biodiversity changes. *Action Learning*: One the process which is framed to enable capacity in taking effective action. It is related to research, learning and appropriate management.

Security of Tenure and Sustainability and Stakeholders Engagement

Under Article 74 (2) of the Malaysian Constitution, forestry comes under the jurisdiction of the respective State Government. Therefore, each state authority to enact laws in the forestry sector and forestry policy itself. Federal Authorities only provide advice and technical assistance to states, the maintenance of the experiment stations and demonstration, training and research. Forestry Departments in various states face dramatic challenges to protect and manage its forest resources. Strengthening forest tenure is clearly needed, although complicated and touchy, step towards advancing forest stewardship in Malaysia must move forward. Tenure is a common term referring to a variety of arrangements that allocate rights to, and often set conditions on, those who hold land. Having a stipulated time frame or tenure determines who is able to use what resources, for how long and under what conditions. "Ownership" refers to a particular kind of tenure in which rights are allocated to the landholder. Having a security of tenure for forest land has been identified as crucial components among the many new policies and institutions introduced for sustainable forest management. Security of tenure ensures that the landholder has the rights to manage and use forest land and resources. When rights to forest land and resources are contested, overlap or are not enforced, forest users and rights holder have few incentives. It may also lack legal grounds, to invest in management and protection, which ultimately undermines efforts to ensure forest sustainability. Our responsibility is to treat the earth well. It was not given to you by your parents; it was loaned to you by your children. In 2010, Selangor State Government has announced a 25 year moratorium on logging in forest reserves. Forestry Act (Selangor) Amendment to require public consultation in any process of conversion or degazettement. Ministry Water, Land and Natural Resources (KATS), Malaysia strongly support the all states to strengthen Forestry Act to protect their forest and follow the Selangor states initiatives.

MyTreevolution

MyTREEvolution is an integrated Corporate Social Responsibility (iCSR) Project, organized by the CEO@Faculty 2.0 fellows. This iCSR is part of the CEO@Faculty Program 2.0, "Coached by the Pros" initiative, aiming to raise awareness on environmental issues related to

carbon footprint reduction through planting of trees. It targets a total number of 20,000 electronically tracked trees planted all over Malaysia in the effort to kick start 45% carbon footprint reduction by the year 2030, in line with the government's pledge during the United Nations Framework Convention on Climate Change, Paris, 2015. The program is an integrated effort between public universities of Malaysia, government agencies, corporate partners, and NGOs who are passionate about ensuring sustainable tomorrows of Malaysia's future generation. MyTREEvolution plans for two major activities in order to achieve its target of carbon footprint reduction through planting of trees. They are: Planting of Trees at university campuses and other land areas as requested by stakeholders and partners. Forestry Department Peninsular Malaysia together with Sarawak Forestry Department and Sabah Forestry Department as the major trees sponsor and Awareness Campaign through social media, including a video competition on carbon footprint reduction through planting of trees [18]. In November and December 2017, MyTREEvolution in collaboration with Forestry Department Peninsular Malaysia (JPSM), Forestry Department of Sarawak, Sarawak Forestry Corporation, Malaysia Airports Berhad and Cube Global Sdn Bhd, has completed three projects at the following universities: Universiti Putra Malaysia (UPM) Universiti Malaysia Kelantan (UMK), Universiti Malaysia Sabah (UMS), Universiti Malaysia Sarawak (UniMAS), and Universiti Malaya (UM).

Mangrove restoration program through Mytreevolution

The objectives of this program was to enhance awareness of the value of mangroves to the participant, demonstrate approaches for successful mangrove restoration; expose the participant with R&D processes behind the mangrove restoration, and develop alternative livelihoods to the locals. Participant were exposed to 3 modules throughout the program, provided information on 'behind the scene' for the mangrove restoration to the participant. The important feature of the module includes mangrove tagging and replantation technique. Over 150 volunteers from various background and age were participated and benefited from the program. The program from myTREEvolution was collaborated with On Semiconductor Sdn. Bhd, Universiti Malaya (UM), Forestry Department Peninsular Malaysia, UTM, and Center for Coastal & Ocean Engineering (COEI). Natural mangrove habitat: 600 mangrove seedlings were identified and tagged by the volunteers. Tree Tag is an emerging smart phone-based supply chain traceability system developed by Earth Observation Systems that tracks the location of logs transported from the forest to the mill. It requires all authorized personnel from those cutting trees to those processing logs to report activities and volumes, raising alerts when there is suspicious activity. Only trees previously authorized for logging can enter the system. In addition to testing the app, solar-powered charging station, Renogy Firefly portable solar kit, and satellite wireless, Inmarsat IsatHub was also used. This combination would bring computing power and connectivity into the hands of forest workers in the remote wilderness. 1500 new mangrove seedling were planted during the activity. Planted seedling were tagged and identified for future monitoring.

Tree tagging

The "Internet of Trees" (IoTrees) solution aims to use different sensors to measure key parameters in forest areas in regular basis, with no need of human intervention and to send this information via wireless communication to a central platform. The IoTrees project aims to develop a durable smart low-cost dendrometer to measure the tree diameter and send the measurement information seamless to the Forest HQ platform where the user can interact with the forest data to estimate the forest growth and monitor crop health. This solution will reduce the cost of data collection and will result in more frequent forest measurements improving the

sustainable monitoring of forest resources. The new information will enable better and more proactive decisions on the management of the forest. Decisions will be more timely and easier to make, such as when to harvest and when to apply vegetation control of pest control. Future predictions of forest growth will be more accurate and more reliable because of the more frequent measurements.

Given the remote depopulated nature of forests it is typical that forests do not have any wireless network coverage. Satellite communication systems will provide access to the data regardless of the location of the forest measurement plots. The SatCom solution will overcome this problem and provide the necessary communication to the measurement sensors. The measured trees will be geo-localised ensuring that satellite and drone monitoring imagery can be coupled. This will result in improved micro and macro level analysis of the forest. The IoTrees dendrometers with the enabled LPWAN and SatCom solutions will be unique to the market.

Tree Inventory

Figure 4 depicts the workflow of data storing and visualization in geotrees. Volunteers update urban street tree records have been common due to the recent advancement and low cost of mobile technology. Tree inventory important for monitoring the existing planted trees, such as tracking a tree’s survival and growth - charting trees’ status monitoring carbon sequestration, combat pests and diseases in urban trees and monitor forest fire risk. In Malaysia, motivation to conserve the green space through replanting trees is soaring due to various campaigns at schools and in the community and corporate sectors. However, limited resources to conduct a tree inventory after planting or replanting events have led to difficulty in monitoring the conditions of trees that have been planted. This projects implements citizen tree inventory using: Mobile data collector (GeoTrees) and QR codes (tree tag). The advantages of this tree inventory are Low cost, using volunteers’ device (smartphone) and easy to use. The GeoTrees app consists of mobile geotrees (android app) and geotrees web portal. The data’s were collected using mobile geotres and stored in phone database, then sync database using internet and the data visualization can be found in geotrees.

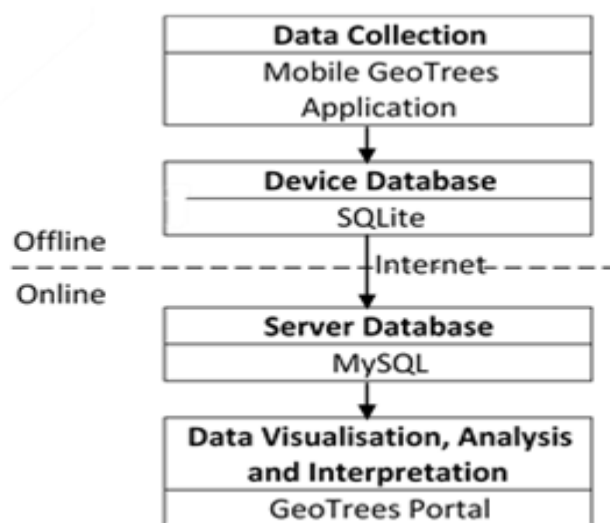


Figure 4. Workflow of data storing and visualization in geotrees.

Case studies:

UTM Mytreevolution: Tree planting and monitoring campaign is run by UTM Campus Sustainability. It Involves UTM lecturers, staffs and students with 276 trees have been planted from various species in four zones.

International Peace Camp Phase 1: Conducted in Seri Rampai, Kuala Lumpur By KL Jungle Ambassador, US Embassy, USNS Mercy, MyTREEvolution, UTM, UPM Involves Student Volunteers (from all over Malaysia), US Navy, Malaysian Army 110 trees have been planted from various species along Sg Bunos.

International Peace Camp Phase 2: Conducted in Seri Rampai, Kuala Lumpur by KL Jungle Ambassador, MyTREEvolution, UTM, UPM Involves Student Volunteers from nearby schools and 204 trees have been planted.

Lestari Bakau 2018: Conducted in Pantai Cahaya Negeri, Port Dickson By ON Semiconductor, Forestry Department, UM, UTM, MyTREEvolution It involves Factory Workers, Student Volunteers Promote awareness of mangrove degradation 800 Rhizophora Mucronata (Bakau Kurap) were planted.

Key performance indicator on forest planting activities

Table 1 shows forest tree planting activities by the forestry department peninsular Malaysia 2016-2018. The implementation of this KPI through the number of forest trees planted for Peninsular Malaysia of 7.2 million trees was planted in 2018 which is the source of plant material was obtained from government and private nurseries. Measurements were made through Forestry Department of Peninsular Malaysia and State Forestry Department records. The Permanent Reserved Forest Area (HSK) in Peninsular Malaysia amounted to 4.9 million hectares where 183,267 hectares were identified as degraded forest areas. The degradation of forest quality is due to natural factors (forest fires, storms) and human factors (invasion, moving crops and uncontrolled opening forest areas). The Restoration, Reclamation and Rehabilitation Programme in Peninsular Malaysia are aimed to restore 4,750 hectares of forest land affected by natural disasters and human deeds. A total of 1,640 hectares of degraded forest areas (35%) of the total degraded forest areas was identified will be restored throughout the RMK-11. The degraded forest area should be restore though replanting forest tree activities so that it can prevent from mud floods and landslides problem which is it can affected the lives and community livelihood. This programme or project will be concentrated to Cameron Highlands, Janda Baik, Kelantan River Basin area and other degraded forest areas including those exposed to natural disasters and exploration across Peninsular Malaysia.

Year	Number of tree planted
2016	5,538,807 trees
2017	5,886,049 trees
2018	7,218,670 trees

Table 1.
of forest
planting
between
2016-
FDPM

Number
tree
activities
year
2018 by

Conclusions

The tropical rainforest of Malaysia will continue to play its vital role and contribute significantly to the socio-economic development of the country. Therefore it is imperative to manage this valuable forest resource in compliance with the fundamental principle of SFM. Undertaking SFM will continue to support and address the requirement of sustainable development, by taking up balancing approach in incorporating wider scope of current economic, social and environmental aspects. In future, way forward strategies are to enhance on the use of modern technology equipment to carry out the best method for FDPM to monitor number of forest trees planted in the forest. Urban forest, green space require constant monitoring – hence systematic tool to register and recording the maintenance activities is essential before further decision and analysis could be made. Moreover, awareness on environmental issues related to carbon footprint reduction through MyTreevolution. Since November 2017, our records planted and monitor up to 12,000 natural planted forest with assistance closely with seven government Malaysian universities. Next phase, involves the initiatives from more universities and private colleges, as the necessity in a combination of translational community services.

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References

- Asmawi, M. Z., Ngaimin, N., Mahamod, N. Z., Noor, N. M., & Omar, H. (2017). Assessing the Forestry Environmental Condition Using GIS-AHP Approach in the Forest Research Institute Malaysia (FRIM) Campus, Malaysia. *Advanced Science Letters*, 23(7), 6372-6376.
- Annual Report, Forestry Department Peninsular Malaysia 2017.
- A.W. Norida, A.S. Abdul-Rahim & H.O Mohd Shahwahid (2017). The Impact of Sustainable Forest Management (SFM) Practices on Primary Timber-Based Production in Peninsular Malaysia. *Jurnal Ekonomi Malaysia*, 51(2), 143-154.
- CEPA programe kit 2017. [https://www.bsbcc.org .my/bear-talk-blog/cepa-cepa-kit-programme-2017](https://www.bsbcc.org.my/bear-talk-blog/cepa-cepa-kit-programme-2017). Accessed on 7 June 2019.
- Dewi, S., Van Noordwijk, M., Zulkarnain, M. T., Dwiputra, A., Hyman, G., Prabhu, R., & Nasi, R. (2017). Tropical forest-transition landscapes: a portfolio for studying people, tree crops and agro-ecological change in context. *International Journal of Biodiversity Science, Ecosystem Services & Management*, 13(1), 312-329.
- Dumont, E. S., Bonhomme, S., Pagella, T. F., & Sinclair, F. L. (2017). Structured stakeholder engagement leads to development of more diverse and inclusive agroforestry options. *Experimental Agriculture*, 1-23.
- Fauzi, M. F., Idris, N. H., Din, A. H. M., Osman, M. J., & Ishak, M. H. I. (2016). *Indigenous Community Tree Inventory: Assessment of Data Quality*. *International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences*, 42.
- Forest Planting Activities Malaysia, 2016. <https://www.landskapmalaysia.org>. Accessed on 7 June 2019.
- Forestry statistics report, Forestry Department Peninsular Malaysia 2017.
- Geotrees Inventory 2018. <http://geotress.rotu.mt/v3/app/table-infoo.php?id=RIMBA00133>. Accessed on 7 June 2019.
- Hezri, A. A. (2016). *The sustainability shift: Refashioning Malaysia's future*. Areca Books.
- Ibrahim, I., Aziz, N. A., & Hanifah, N. A. (2012). The laws of wetness: the legislative framework in Malaysia regarding wetlands conservation. *Procedia-Social and Behavioral Sciences*, 50, 574-581.
- Keat, N. J., Nath, T. K., & Jose, S. (2018). Indigenous agroforestry practices by Orang Asli in peninsular Malaysia: Management, sustainability and contribution to household economy.
- Lagan, P., Mannan, S., & Matsubayashi, H. (2007). Sustainable use of tropical forests by reduced-impact logging in Deramakot Forest Reserve, Sabah, Malaysia. In *Sustainability and Diversity of Forest Ecosystems* (pp. 414-421). Springer, Tokyo.

- Lewis, R. A., & Davis, S. R. (2015). Forest certification, institutional capacity, and learning: An analysis of the impacts of the Malaysian Timber Certification Scheme. *Forest Policy and Economics*, 52, 18-26.
- Malaysian Timber Council, Sustainable Forestry in Malaysia 2017. [http://www.mtc.com.my/resources -SustainableForestryinMalaysia.php](http://www.mtc.com.my/resources-SustainableForestryinMalaysia.php). Accessed on 7 June 2019.
- McLain, R., Lawry, S., Guariguata, M. R., & Reed, J. (2018). Toward a tenure-responsive approach to forest landscape restoration: A proposed tenure diagnostic for assessing restoration opportunities. *Land Use Policy*.
- MyTreevolution website. <http://www.mytreevolution.my/>. Accessed on 7 June 2019.
- MyTreevolution Integrated CSR, 2017. <https://ceofaculty20.wixsite.com/mytreevolution/the-project>. Accessed on 7 June 2019.
- Padfield, R., Waldron, S., Drew, S., Papargyropoulou, E., Kumaran, S., Page, S., & Zakaria, Z. (2015). Research agendas for the sustainable management of tropical peatland in Malaysia. *Environmental Conservation*, 42(1), 73-83.
- Tan-Soo, J. S., Adnan, N., Ahmad, I., Pattanayak, S. K., & Vincent, J. R. (2016). Econometric evidence on forest ecosystem services: deforestation and flooding in Malaysia. *Environmental and resource economics*, 63(1), 25-44.
- Yeap, C. A., Lim, K. C., Noramly, G., CARANG, R., CARANG, A., & PANDAK, M. (2016). The Malaysian Nature Society Hornbill Conservation Project. *Malayan Nature Journal*, 68(4), 149-159.