The National Policy Frameworks on Integrated SLM to Apply in the Targeted Areas

Land Development Department

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1. Introduction

The negative impacts of climate change leads to reduce availability of natural resources and declining productivity. This causes food security crisis and increases poverty. Sustainable land management (SLM) is helping to increase average productivity, reducing seasonal fluctuations in yields, support diversified production and improved incomes. SLM is simply about people looking after the land – for the present and for the future. The main objective of SLM is to integrate people's coexistence with nature over the long-term, so that the provisioning, regulating, cultural and supporting services of ecosystems are ensured.

In consequence, actions are needed to combat and mitigate such problems. One approach is to mainstream Sustainable Land Management (SLM) to help resolve land degradation due to inappropriate, unsustainable and overuse of land. Challenges include 3 issues; 1) policies, strategies and institutions; 2) economics and finance; and 3) knowledge and technology, of which should be integrated by knowledge management, capacity building and partnership.

2. Aim of the Strategy

Sustainable Land Management (SLM) of Thailand will be to remove barriers and enhance opportunities to bring in sustainable land management at national, sub-national (regional) and local (landscape) levels. The Strategy will guide and direct all relevant stakeholders both state, private and community toward sustainable land management best practices based on the use of scientific, research, traditional knowledge, technology tools which are countrywide and/or worldwide available, practical and cost-effective.

Integrated Sustainable Land is to contribute to combat desertification, land degradation and drought of Thailand through mainstreaming SLM best practices based on evidence-based and informed decision making. Countries could manage land uses in sustainable manner through SLM best practices and technologies documented by the country herself and those shared worldwide. Decisions are made via prioritized actions to overcome barriers and enhance opportunities to practice the SLM.

3. Decision support for SLM Methodology Framework

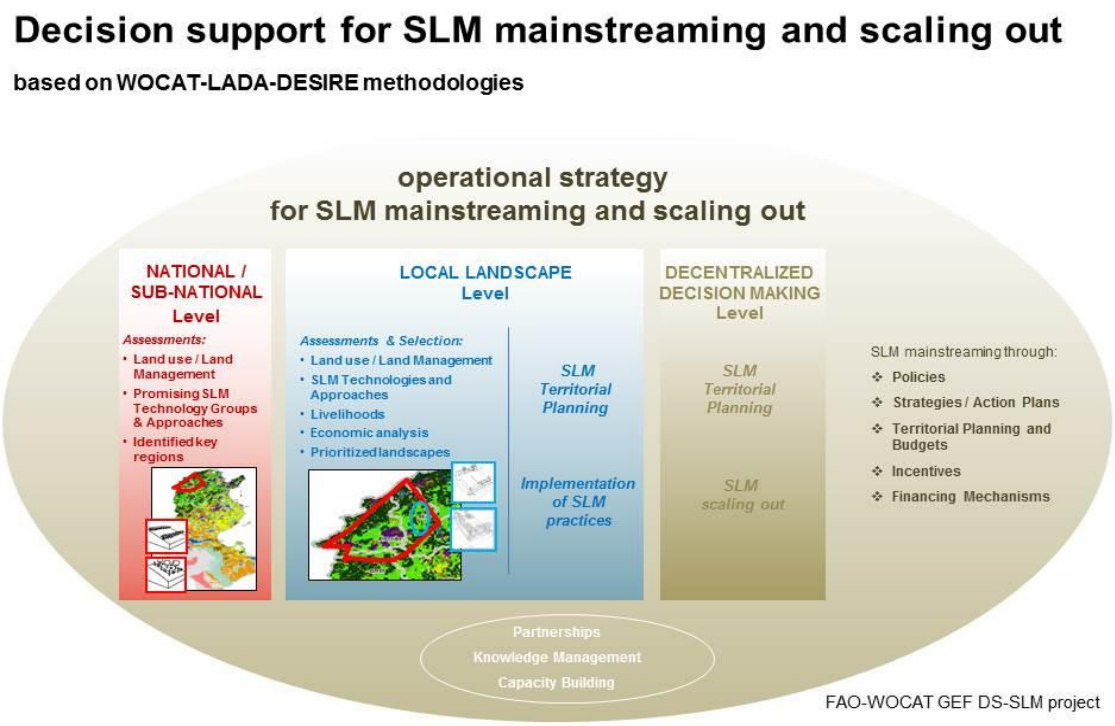

Figure 1: SLM methodology framework

The objective of the framework could support the process of using local and national assessments of land degradation and SLM best practices in key policy instruments in suit of Thailand's context. The Strategy should lead SLM in Thailand to be integrated into political, institutional, social and financial support toward sustainable development goals. SLM interventions must not be isolated or last only for limited periods or restricted to demonstration sites, but be mainstreamed and scaled out beyond via long-term national strategy and action plan. Thailand's SLM strategy will;

1) To improve and enhance understanding what and how SLM national best practices are important to economic, social and environment;
2) To provide long-term support for the implementation of SLM by an integration with national, sub-national, and local actions.

Thailand's SLM mainstreaming strategy aims to a living and learning strategic document over implementation period; not static. It is designed to be rather a simple, and practical than comprehensive and complete process in which SLM mainstreaming activities are integrated into existing and planned development strategy, action plans of Thailand either at national, sub-

national (regional) and local levels. The impacts of the strategy also initiate and activate innovative mechanisms of which support to long-term SLM in Thailand beyond DS-SLM project period.

4. Planning Steps for Thailand's Strategy

In order to formulate Thailand's operational strategy on the SLM, planning and implementation phases entail the following 3 steps;

4.1 Action of reviewing on barriers and opportunities of SLM in Thailand

National Workshops on Mainstreaming Sustainable Land Development into Policies, Strategies and Institutions at National Level. The questionnaire were corrected by stakeholders; including government line agencies, institutions, farmer representatives and private agencies. The stakeholders brainstormed to discuss, exchange and collect views, responses and actions to mainstreaming questionnaire. The mainstreaming questionnaire was formulated and designed to identify barriers, opportunities and decision making processes for sustainable land development intervention for Thailand. The barriers and opportunities are summarized and prioritized via key questions as following;

Table 1: The main barriers to implementing SLM in Thailand

a. What are the main barriers to implementing SLM in Thailand?

No	Barrier issues/topics	Priority scoring
1	Farmers are lack of knowledge, understanding and recognition of sustainable land management, so they use land improperly.	**Top high**
2	Policies and measures of relevant agencies are not integrated.	**High**
3	Farmers still have not had suitable agricultural technologies.	**High**
4	None of incentives to use sustainable land management	**High**
5	Lack of public relation, knowledge building, important recognition on sustainable land management at all levels; leaders to farmers, government agencies to private enterprises	**High**

No	Barrier issues/topics	Priority scoring
6	Insufficient budget and fund for land development and soil problems	**High**
7	Policies of each agencies still do not include sustainable land management lucidly.	**Moderate**
8	Insufficient collaboration among relevant sectors namely government, private and others.	**Moderate**
9	Lack of mechanism and process on traditional knowledge management resulting to SLM	**Moderate**
10	Limited tools used to support land use planning	**Moderate**
11	Some laws enforcement conflicts with policy on sustainable land management and land use planning; eg irrigation area is used for other purpose; not for irrigated land.	**Occasional**
12	Policy of agricultural zoning is not so effective due to a lack of incentive for farmers and stakeholders.	**Occasional**
13	Sustainable land management is not yet clearly planned implemented and integrated into land use planning.	**Occasional**
14	Limited process and efforts to disseminate knowledge and information to local and landscape areas	**Occasional**
15	None of lead agency to drive policy, measure and implement SLM.	**Occasional**
16	Encroachment of conservation areas and public land	**Occasional**
17	Government policy is not uninterrupted and often changed	**Occasional**
18	Database of different relevant line agencies is isolated and not integrated.	**Occasional**
19	Land property rights belong to different owners; government and private. Land use shall be permitted prior to any sustainable land use development. As a	**Occasional**

No	Barrier issues/topics	Priority scoring
	result, it obstructs conservation and sustainable development.	
20	Laws enforcement of land management and measures is constrained.	**Occasional**
21	Land use research is not updated and in line with current situation.	**Occasional**
22	Farmers have a deficiency of resources, and supports for their performance. High operation and expensive labor.	**Occasional**
23	Decision making process on land use policy is not yet participated by local community.	**Occasional**
24	Policy measure in land use and town planning is deficient.	**Occasional**
25	Problem on income, poverty and land ownership exists.	**Occasional**
26	No demonstration model of sustainable land management in practice.	**Occasional**
27	Soil erosion and nutrient loss are out of control measures.	**Occasional**
28	Short-term indicators are insufficient to monitor an achievement of sustainable land management which acquiring long-term indicators.	**Occasional**
29	Soil fertility varies spatially and regionally, so sustainable land management practices are rather difficult and challenged.	**Occasional**

Table 2: Opportunities exist for mainstreaming SLM – nationally, sub-nationally or locally (in Thailand)

b) What opportunities exist for mainstreaming SLM – nationally, sub-nationally or locally (in Thailand)?

No.	Opportunities issues/topics	Priority scoring
1	Capital, investment and bonds to support land development and combating land degradation.	**Top High**
2	Training, knowledge management of SLM technologies	**High**
3	Support local level participation and engagement of farmers. Partnership at local level to scale out and to mainstream SLM.	**High**
4	Public relations, awareness raising to enhance an understanding of an usefulness of SLM practices and tangible benefits (income, risk reduction).	**High**
5	Knowledge and technology transfer to local farmers for SLM.	**High**
6	Policies and Plans of agencies at all levels aim to integrate for sustainable development.	**High**
7	Implementation toward common goal for SDGs and national strategy on land management	**High**
8	Effective land use planning and land use mapping	**Moderate**
9	National and regional network to coordinate, and collaborate to resolve regional problems and to assist and technical support	**Moderate**
10	Economic incentives for local farmers	**Moderate**
11	Integration of database of different line agencies	**Occasional**
12	Available support data and database categorization by soil physical properties and fertility.	**Occasional**
13	Data access, database and knowledge sharing of SLM	**Occasional**

No.	Opportunities issues/topics	Priority scoring
14	Prototype project; Royal Study Center Project to support an awareness of SLM nationwide	**Occasional**
15	Relevant agencies could formulate action plan for combating problem soils	**Occasional**
16	Legislation amendment aiming to link with local level management of land	**Occasional**
17	Personnel knowledgeable and expertise capable of direct responsibility	**Occasional**
18	State-owned land tangibly supports policies and practice.	**Occasional**
19	Land allocation for local farmers who do not own piece of land	**Occasional**
20	Climate resilience for plant production	**Occasional**
21	Biodiversity conservation	**Occasional**
22	Conservation of soil nutrients and fertility	**Occasional**
23	Research study to support SLM	**Occasional**
24	Collaboration with local academic in SLM	**Occasional**
25	Establishment of local area working group	**Occasional**

4.2 Institutional Analysis of policy instruments for Thailand

The institutional analysis of policy instruments of Thailand is implemented by an extensive review of existing policies, strategies and institutions in regard to land use and management and other related or influence factors with potential to overcome barriers and enhance opportunities for the SLM mainstreaming and scaling out. The institutional analysis for Thailand is extensively reviewed. Agencies name and their missions related to soil protection and land development in Thailand and since the vast number of legislations, regulations, laws related to both the topics of environmental protection and land resource degradation prevention across various ministries, departments, divisions and other government agencies only the major policies that implemented and adopted by most government agencies are briefly analyzed.

4.2.1Institutions and organizations relating to land management in Thailand

Following table presents the name and mission of Institutional and Organization relating soil resource and land management in Thailand. Currently there are 31 organizations or agencies including;

- 3 agencies under Prime Minister's office
- 12 agencies under Ministry of Agriculture and Cooperatives
- 7 agencies under the Ministry of Natural Resources and Environment
- 2 agencies under the Ministry of Foreign Affairs
- 2 agencies under the Ministry of Interiors
- 1 agency under Ministry of Digital Economy and Society
- 1 agency under the Ministry of Science and Technology
- 3 agencies as Corporate, Private and Social Organizations

Table 3 : Institutions and organizations relating soil resource and land management in Thailand

Organizations / Institutions	Mission and Responsibilities
Government	Current government's policy is reducing social disparities and create access opportunities to public service. The government objects to solve landless farmers and conservation area trespass problem by issuing the measure or regulation to prevent non-farmer land acquisition, unclear demarcation, overlapping territorial claims area. In addition, the government concerns on natural resource security and balance creation between conservation and sustainable use by protecting, rehabilitating conservation area, forest and wildlife. They also promote on biological resource and biodiversity conservation and sustainable use.

Organizations / Institutions	Mission and Responsibilities
Units under Prime Minister's Office	
1) National Economic and Social Development Board (NESDB)	NESDB is Thailand's central planning agency responsible for crafting strategies for balanced and sustainable development in the national interest. Their key functions are Formulate the five-year National Economic and Social Development Plan. The current plan is The Twelfth National Economic and Social Development Plan which consistent with the targets of the 20-year national strategy, Pursue national agendas to national implementation plan, Formulate strategies for key government policies and major development projects and Analyze budget proposals by state enterprises and related agencies (ministry, department, provincial strategy level)
2) Bureau of the Budget	Responsible for suggesting a policy and guidelines for budget allocation according to the policy guidelines of state and national economic and social development to cabinet, advising on budget management, seek funding source and prepare draft annual public/government budget act.
3) The Public Relations Department	Responsible for the promotion and dissemination of information and knowledge about the government policies in agriculture and environment including soil, water and forest to target group which objects to create good understanding and connection between public and government.
Unit under Ministry of Agriculture and Cooperatives	
1) Land Development Department	The agency is a main coordinating unit has a duty to conduct soil surveys and analyses as a basis for establishing land classification and utilization maps, land development, and to define land use areas, and soil and water conservation areas. Under the Act, the Land Development Department in responsible for collection of statistics as a basis for conduction land censuses. The vision of agency is to enhance soil fertility and agricultural productivity while promoting long term sustainability based on participatory principle.

Organizations / Institutions	Mission and Responsibilities
2) Rice Department	Responsible to study analyze and recommend policies and strategies for rice production and coordinate with international cooperation on rice. In addition, this agency has duty to research and develop an integrated rice production, process and packaging, rice production facility structure and agricultural machinery as well as improve productivity and quality of rice and increase value of rice and its product.
3) Royal Irrigation Department	Responsible to develop water resources and to increase irrigated area according their potential and natural balance, manage water allocation in equitable and sustainable manners, prevent and mitigate water hazards as appropriate mission and encourage people participation in water resources management and development
4) Fisheries Department	Responsible to develop and transfer new technologies to create innovation, promote effective aquaculture production at all levels, directly control the management of aquatic resources and diversity for sustainable use, and improve the quality of aquaculture production throughout the production chain to meet country and international standard.
5) Department of Livestock Development	Responsible to develop of human resources (Including staffs, farmers, Livestock volunteers and entrepreneurs) have knowledge , expertise in the livestock sector, develop of Livestock production all value chain to be efficiency and environmental friendly products and have standardization to Global, To develop knowledge Technology Innovation and Research for useful livestock all dimension including academics ,Database ,Production and Marketing and cooperate useful to build on knowledge of human resource in livestocks and seeking certification and be accepted in new markets, integration of both domestic and international and livestock volunteers.

Organizations / Institutions	Mission and Responsibilities
6) Department of Royal Rainmaking and Agricultural Aviation	The agency is established for climate change adaptation according to King's mission which has duty to suitably manage water in the atmosphere, precipitation amounts and distribution for agricultural development, Water Resources Management Conservation and rehabilitation of forest resources and integrated natural disaster mitigation, including aerospace management in rain-making missions, research and technology development.
7) Department of Agriculture	The agency is a Center of excellence in the field of crops research and development and a farm mechanization, in harmony with international standards and in adherence to the principles of natural resources conservation and environment protection. Their duties are conducting research and development studies on various agricultural disciplines concerning crops and farm mechanization and providing services on the analysis, inspection, quality certification and advises on soil, water, fertilizer, crops, agricultural inputs production.
8) Department of Agricultural Extension	Responsible to promote and develop farmers, farmer's family, farmer Organization and community enterprises to be strong and self-reliant. Promote and develop farmers' production capacity and manage agricultural products according to market demand and research and development on agricultural extension.
9) Agricultural Land Reform Office	Responsible to allocate lands for living and dwelling to farmers, revitalize the environment and make use of the resources in land reform areas. , develop infrastructures and support learning process and provide the financial support for farmer's occupation.
10) Office of Agricultural Economics	Responsible to lead organization in developing and formulating country's agricultural strategy as management tools for security, prosperity and sustainability, Study, analyze, research, and conduct reports on agricultural economics situations both domestic and international, monitor and evaluate importance projects undertaken by the Ministry of Agriculture and Cooperatives, prepare and provide agricultural data and information services

Organizations / Institutions	Mission and Responsibilities
11) **Bureau of foreign Agricultural Service**	Responsible to contact and coordination with the international assistance and cooperation in agriculture which relating to assigned agricultural administration work of international organization, support and coordinate with the Office of Foreign Agricultural Advisory.
12) **Division of Agricultural Technology for and Sustainable Agriculture**	Responsible to coordinate and link government networks, private institutions, NGOs Farmer Organization, and farmers operating on innovation and local knowledge to create sustainable agriculture development.
Units under the Ministry of Natural Resources and Environment	
1) **Department of water Resources**	Responsible to implements the basin-based integrated water resources management with all sectors participation to achieve efficiency, equitability and sustainability. The service delivery targets are to establish basin-based water resources management system in order to be able to supply adequate water for consumption and production, to conserve and rehabilitate water resources and to provide surveillance and warning system for water disaster, which emphasizes on participation of all stakeholders in all sectors.
2) **Royal Forestry Department**	Responsible for forest conservation, forest management, plan and coordination for forest and ecology restoration, encourage the community to participate in reforestation program, community forest management and economic forest plantation, conservation, protection, maintenance and management.
3) **Department of National Parks, Wildlife and Plant Conservation**	Responsible to promote and restore forest, wildlife and plant resources in conservation area to protect original forest protection and restore degradation forest area. With the strategy to promote, stimulate and raise awareness in community to recognize their importance and participate in local resource management and protection.

Organizations / Institutions	Mission and Responsibilities
4) Office of natural resources and environmental policy and planning	Responsible to develop environmental and natural resources conservation policies and plans, supports effective implementation, monitors and assess the environmental impact mitigation measures in accordance with the environmental impact assessment report in order to strengthen the economic in the country and support the sustainable development and good quality of lives.
5) Division of Overseas	Major organizations in the management of projects supported by Global Environment Facility with a mechanism to monitor implementation project results according to duration and objectives of convention which has 4 years period each. They also have duty for strengthening the capacity of the system and mechanisms to manage natural resources and the environment to promote policy, strategies, plans and measures for the conservation, restoration and control of the allocation of natural resources and the environment that linked to the creation of social and economic values.
6) Department of Groundwater resources	Responsible to oversee the development and management of Thailand 's integrated groundwater resources so as to ensure national security and future sustainable developments in water resources. In addition they have duty to perform hydrogeologic survey, study, and evaluate on groundwater resources potential, promote public awareness and understanding in appropriate use and conservation of groundwater resources and supply data, training, water quality analysis, develop and manage groundwater to business sector.
7) Department of Mineral Resources	The main governmental organization applying its geological knowledge and information to help increase life quality and the economic and social development. They serve the country as a geological fact-finding agency that predominantly studies and researches minerals, fundamental and applied geology in order to provide geological understanding about natural resources condition, as well as issues or problems related to geological process and phenomena.

Organizations / Institutions	Mission and Responsibilities
Units under the Ministry of Foreign Affairs	
1) Department of International Organizations	Responsible to oversee all operation relating to united nation and international organization which not defined specific responsible agency in country and coordinate all activities regarding politic, economic, social, culture, education, science, environment and other development program.
2) Department of Treaties and Legal Affairs	Responsible to study, research, monitor and analyze trend and development of international law under United Nations and International Organization framework.
Units under the Ministry of Interiors	
1) Department of Disaster Prevention and Mitigation	Responsible to formulate policy, guideline and measures on disaster prevention and mitigation, Study, analysis, research and develop systems on disaster prevention, disaster warning and disaster mitigation, Develop information technology on disaster prevention and mitigation, Provide training to build capacity and improve skills on disaster management and disaster relief, and coordinate with domestic and international agencies/organizations.
2) Department of Local Administration	Responsible to promote and support the work of the local administrative organizations (LAOs) through the development and series of advices on the local development plan, personnel administration, finance, and administration in order to strengthen the capacity and efficiency of the local administrative organizations on public service provision.
Unit under Ministry of Digital Economy and Society	
1) Thai Meteorological Department	Carry on meteorological administrations and managements for the best economic, social, agricultural, and industrial benefits and protection of human lives and properties possessed by public members, private sectors, and governmental units against natural disasters. The main missions are to promote technical and research on meteorological and earthquake, build the network and coordination in both domestic and international level including meteorological and earthquake knowledge to reduce risk and impact from natural disaster.

Organizations / Institutions	Mission and Responsibilities
Units under the Ministry of Science and Technology	
1) **National Science and Technology Development Agency**	Responsible to strengthen research, development, design and engineering (RDDE) and technology transfer (TT), and to support necessary S&T human resource development (HRD) and infrastructure development (Infra), facilitated by efficient internal management.
Corporate, Private and Social Organizations	
1) Geo-Informatics and Space Technology Development Agency	Developing geo-informatics and space technology as a non boundary knowledge for the country development and responsible to develop space technology and geo-informatics applications to be beneficial to the general public, develop the satellite data base and the derived natural resources information center, provide data services relating to space technology and geo-informatics, provide technical services and develop human resources in satellite remote sensing and geo-informatics and conduct researches and development as well as to implement other activities related to space technology, including the development of small satellites for natural resources survey.
2) Thai Chamber of Commerce	To provide advice on trade, industry, agriculture and finance to members, proceed activities bases on King' philosophy and Sufficiency theory, promote integrated farming approach to agricultural enterprises and build pilot project that succeed in organic agriculture and self-sufficient theory implementation.
3) National Farmers Council	To propose policy on promotion and strengthening the farmers and farmer organizations of sufficiency economy, production, processing, marketing and protection of agricultural areas to government including Development of Integrated farming systems, Agroforestry systems, Natural agriculture systems, Mixed farming system, Organic farming system, and other farming process.

4.2.2 Policies and strategies relating soil resource and land management in Thailand

a) The 20-Year National Strategy (2017-2036)

The 20-Year National Strategy is a national development plan, setting out frameworks and directions for the all public sectors to follow. All this to be completed in order to achieve the vision of "Thailand, a nation of Stability, Prosperity, and Sustainability, is a developed nation according to the economic philosophy", or to achieve as the slogan of "Stability, Prosperity, Sustainability". The plan will be enforced for 20 years, from B.E. 2560-2570. The 20-Year National Strategy Draft summary that has been publicized consists of six strategies;

1) Strategy for National Security
2) Strategy for Strengthening National Competitiveness
3) Strategy for Human Capital Development and Strengthening
4) Strategy for broadening opportunity and improve Social equality and equity
5) Strategy for Eco-Friendly Development and Growth
6) Strategy for Reforming and improving public administration

The six primary strategies seek to enhance and develop the potential of human capital; ensure justice and reduce social disparities; strengthen the economy and enhance competitiveness on a sustainable basis; promote green growth for sustainable development; bring about national stability for national development toward prosperity and sustainability; and enhance the efficiency of public sector management and promote good governance. Following are summary of main context relating to soil resource management.

Table 4. Main context relating to soil resource management

Strategy	Subject Matter
Strategy for National Security	This aims to ensure national security and public contentment, with key emphases on national environmental management to promote security, safety, independence, sovereignty, peace, and orderliness at national, social, and community scales. This includes the development of human capital, tools, technologies, and Big Data systems in order to prepare the country for all types and levels of threats and disasters, together with existing and future security challenges prevention and mitigation through integrated resolution mechanisms in collaboration with public, private, and civil sectors as well as non-governmental organizations, neighboring countries, and worldwide alliances in line with good governance principles.
Strategy for Strengthening National Competitiveness	This aims to enhance national multidimensional capacity based on three concepts which are; (1) "Learning from the Past for Further Development" with a focus on the roots of the national economy; local identity, culture, tradition, and lifestyle; maintaining natural resource diversity; and pursuing multidimensional comparative advantages. (2) "Adjusting the Present" to prepare for the future through national infrastructure development in terms of transport and logistics, science, technology, and advanced digital systems as well as environmental adjustment to facilitate future industrial and service developments. (3) "Creating New Future Values" to enhance entrepreneurs' capacity; develop younger generations; adjust business models to meet fast changing market demand; implement strategies to accommodate anticipated future contexts with a focus on learning from the past and adjusting the present for further development. Example of key development are summarized as follow;

Strategy	Subject Matter
	- Development for production and service sector based on new eco-friendly innovative such as; 1) Agricultural sector: Exploring value-added agriculture in order to upgrade productivity in terms of quantity and value as well as product diversity within the following sectors including, farming that reflects local identity; safe farming; biological farming; processed agricultural products; and smart farming. 2) Industry and Service sector: Developing future industries and services in order to create future industries and services that can be key growth engines designed to push Thailand to become a developed country through advanced innovations and technologies.
Strategy for Human Capital Development and Strengthening	This aims to develop Thai people of all ages in a multidimensional manner to become good, skillful, and quality citizens. The scope covers promotion of physical, mental and intellectual qualities, adequate multidimensional developments, sustainable welfare at all stages of life, promoting public mindedness, and generating social responsibility.
Strategy for broadening opportunity and improve Social equality and equity	This aims to develop cooperation between private sector, general public, and local communities for strategy implementation and ensure the equitable and inclusive access to quality public services and welfare practices.
Strategy for Eco-Friendly Development and Growth	This aims to achieve sustainable development in terms of manifesting a healthy society, economy, and environment; implementing good governance, and integrated partnerships at both national and international levels. Example of key development are summarized as follow;

Strategy	Subject Matter
	- Conserving and rehabilitating biological diversity and rehabilitating rivers, canals, and other natural water sources nationwide. - Preparing effectively integrated 25 river basin management plan especially on flood prevention management system. - Creating national energy security and promoting eco-friendly energy usage etc.
Strategy for Reforming and improving public administration	This aims to reform and enhance the country's governmental administrative services by adjusting government agencies to have appropriate sizes suitable for missions and task, promoting decentralization and supporting of local administration organizations to become government agencies operating with high competency and good governance, revising laws that are no longer necessary or unsuitable to existing circumstances etc.

b) The 12th National Economic and Social Development Plan (B.E.2560-2564)

The current 12th National Economic and Social Development Plan (2017-2021) implemented the 20-Year National Strategy (2017-2036), while adopting the principle of the Sustainable Development Goals (SDGs) with the following objectives:

1. To conserve, restore as well use natural resources sustainably and fairly;
2. To build national water security and to manage the entire water resources system efficiently;
3. To manage the environment and reduce pollution to achieve better environmental quality;
4. To improve the capacity for greenhouse gas reduction and adaptation.
5. To lessen the impacts from climate change and improve the response to natural disasters.

c) Strategy of Land Development Department according to the 12th National economic and social development plan (B.E.2560-2564)

1) Strategy 1 : Driving of Land Use Plan Present Situation

   - To establish land use plans for land development planning nationwide.
   - To encourage farmers to apply land use plans for planning land development in their own and to obtain agricultural produces appropriately.

2) Strategy 2 : Soil and Water Conservation Situation

   - To prevent soil erosion in agricultural areas.
   - To improve and rehabilitate soils in agricultural areas.
   - To encourage farmers and associated groups to participate in soil and water conservation.

3) Strategy 3 : Land Development Research and Technology Transfer Situation

   - To encourage research and develop land development innovation to enhance agricultural productivity and to reduce production costs.
   - To encourage field utilization to rapidly and correctly transfer up-to-date land development technologies to farmers.
   - To encourage technical operation system for integrated participatory research that links to visually effective works

4) Strategy 4 : Constructing and Developing Land Development network situations

   - To establish networks of volunteer soil doctors and related networks for exchange of knowledge.
   - To encourage community participation, both urban and rural to be strong to support land development. Promote the potential of communities to participate in conservation and rehabilitation, land use and assisting in environmental preservation by having volunteer soil doctors as devices for land development in the communities

thoroughly as devices for land development in the communities thoroughly.

- To train department's field lecturers and soil doctor experts to build networks for transferring land development technologies continually and sustainability.
- To encourage farmers to form groups.

5) Strategy 5 : Organization Development Situation

- To improve the operation system and enhance the land development organization's administration and be effective and compatible for the changes in government system and surrounding factors.

d) Policy and plan for management of land and soil resources of the country B.E.2560-2579

This policy is used for management of land and soil resources during B.E.2560-2579 which consists of 4 strategies as follow;

1) Strategy 1: Balance of nature, Sustainable land and soil conservation

Objective is to preserve, maintain and restore the country's forest areas, increase abundance and maintain a natural balance. The goals of this strategy are summarized below.

- There are 40% of forest area in the country (Conservation area 25% of the country area accounted area is 80.75 million rai and 15% of the economic forest area of the country accounted area is 48.45 million rai.)
- In 74.74 million rai of conservation area, conservation and protection of forest remains 62.21 million rai and restoration of degraded forest area is 6.01 million rai.
- In 25.66 million rai of the National Forest and Economic Forest, area reserved for forest protection is 62.21 million rai and restoration of degraded forest area is 14.27 million rai.

2) Strategy 2: The use of land and soil resources for maximum benefit

Objective is to define land use appropriate to land potential and soil performance to achieve highest benefit for society, economy, natural resources and the security of the country. The goals of this strategy are summarized below.

- To decrease an improper land use with land potential and soil performance
- To decrease abandoned or unused land.
- To restore land with following problem soil;
    - Organic soil 0.34 million rai
    - Saline soil 4.4 million rai
    - Acid soil 5.1 million rai
    - Likely sandy soil 32.7 million rai
    - Sandy soil is 11.1 million rai
    - Shallow soil 29.6 million rai
    - Slope complex soil 103.4 million rai

    Remarks: 1 ha = 6.25 rai

In addition, it has target for strengthening the agricultural production base to be strong and sustainable to create food security, improving soil quality deterioration. Solving the problem of soil erosion to increase productivity per unit of agriculture. Increasing the efficiency of land use in special economic zones. In line with the potential of the area and the needs of the people while controlling the potential impact of land use in special economic zones. Define guidelines for dealing with problems, determine appropriate measures in affected areas and disasters from climate change areas that has potential risk for natural disasters.

3) Strategy 3: Agricultural areas with sustainable agriculture.

Objective is to give the poor a place to live and to live. The self-sufficiency of the philosophy of sufficiency economy and solve the problem of land invasion. The goals of this strategy are summarized below.

- To decrease the number of poor people without land for farming and resident.
- To decrease the problem of land encroachment.
- To decrease social disparities in access to land use.

4) Strategy 4: Land and soil management

Objective is united and integrated effective Land management and land resources according to the principles of good governance. The goals of this strategy are summarized below.

- To integrated and united efficient management of land and soil resources.
- To establish a knowledge management mechanism that effectively supports land and soil management.

These 4 strategies also considered the proper land conservation, protection, and restoration to prevent the degradation of land and soil resources, reduction of forest area, upstream forest, raising awareness of all related stakeholders.

5. Assessment of decision-making processes for SLM of Thailand

Institutions and organizations responsible for sustainable land management in Thailand is numerous (see in section 2.2). They have currently established various policies, strategies at national and sector development plans in relevance to land degradation mitigation measures and actions. The assessment results infer that Thailand has already well prepared, and established for the SLM at policies and regulations either national and sector development policies or strategies and action plans. In other words, decision-making process and instruments for mainstreaming the SLM by policies and regulations is not insufficient.

Nevertheless, what decision-making processes and instruments are still challenges to mainstreaming the SLM in Thailand shall be assessed and identified. With an aim to apply the SLM in Thailand more successfully and effectively at different scales; regional, local and farm scales. We have questioned wide stakeholders at national workshops and obtained stakeholders' views and suggestion on challenges of decision-making process for the SLM in Thailand as such;

5.1 Which key decision-making processes need strengthening to facilitate SLM implementation (in Thailand)?

It is found out that both decision-making processes at local/landscape and national level is important to implement the SLM countrywide. Both should be integrated and supportive. Among priority key decision-making processes are financial mechanism, incentive measures, capacity building for local stakeholders and partnership development. Local planning and decision in linkage with national and sector planning is also crucial. The details and priority of decision-making processes for SLM in Thailand are collected in Table 5.

Table 5. Details and priority of decision-making processes for SLM in Thailand

No	Decision Making process/Entry point	Priority scoring
	Local/Landscape level	
1	Financial mechanism and incentive measures should be supported by provincial government, central line agencies and local administration to mainstream and support decisions on SLM	**Top High**
2	Capacity building for local stakeholders as a priority in recognition of their key role to mainstream SLM	**High**
3	Partnership building to support decisions to introduce SLM and also strengthen them to mainstream at local level	**High**
4	Local planning and decision making lead to SLM adoption by farmers in more effective manner	**High**
5	Establish and promote policy and plan for land use be integrated into local action plan	**Moderate**
6	Promote and building local capacity and understanding of SLM	**Moderate**
7	It is necessary for local participation and engagement for land use planning and policy formulation to ensure an understanding and solutions	**Moderate**
8	Support mechanism for technology and knowledge transfer and provision to local farmers is crucial.	**Moderate**
9	Learn local-level land use problem to improve and change national-level policy	**Occasional**

No	Decision Making process/Entry point	Priority scoring
10	A must to understand local need prior to set objectives of SLM activities at local area	**Occasional**
	National Level	
11	Establish policy and land use planning in accordance with and mainstreaming SLM from national to agency action plan and eventually to regional, sub-regional and local action plan. It shall be iterated and continued at each level.	**Top high**
12	Introduce innovative financial mechanisms to mainstream and build incentives at national level. In consequence, it will impact to financial mechanisms at regional and local level and to create opportunity for donors/foreign support (ex GEF).	**High**
13	Decision on SLM at national policy is crucial for line agencies' and stakeholders' commitment to implement SLM.	**Moderate**
14	Laws and regulations improvement should be in line with and support to SLM.	**Occasional**
15	Land use allocation and land use zoning should be appropriate and unambiguous.	**Occasional**
16	Support mechanism for technology application.	**Occasional**
17	Public relation mechanism and process, laws, finance and incentives are all important for SLM entry	**Occasional**
18	Integration of different line agencies and stakeholders implementation of SLM	**Occasional**
	ALL sectors	
19	Data integration from line agencies at all levels in order to deliver and disseminate knowledge and further mainstreaming	**Moderate**
20	Financial mechanisms and allocation for all sectors and at all levels	**Moderate**
21	Support mechanisms for technology and knowledge transfer to all level of stakeholders	**Moderate**
22	Synergy on SLM policies of all responsible agencies to strengthen and concert their actions.	**Occasional**

b) How might information on land degradation status, impacts, responses and SLM technologies and approaches, contributing most effectively to a more informed decision-making process (of Thailand)?

How critical importance of knowledge management and capacity building for the SLM in Thailand is stressed. Decision-making processes shall be supported by SLM knowledge; best practices, database and dissemination promoted for the farmers, and land owners. How to use knowledge and information to help the SLM in Thailand is recommended by priority in Table 6.

Table 6. The use knowledge and information to help the SLM in Thailand

No	HOW TO	Priority scoring
1	Disseminate knowledge on SLM for all levels with a focus to farmers and local communities' participation and engagement as far as possible.	**Top High**
2	Establish SLM database to share knowledge and data targeting all parties be able to access and use	**Top high**
3	Promote mechanism for public relation to build a recognition and benefit of SLM at all levels with an aim to align with same direction.	**High**
4	Integration of policy, action plan, and data through similar platform and mainstream strategies, and work plan of all agencies	**High**
5	Establish knowledge system/learning center/demonstration trial field to raise an importance and impact of SLM	**High**
6	Promote and develop relevant technology for SLM of which be utilized and applied to resolve soil problems eg remote sensing, LUS map, satellite imaginary (for agriculture and climate)	**Moderate**
7	Initiate pilot project for combating land degradation and soil problems, then disseminate how to for farmers	**Moderate**
8	Apply information technology to distribute and scale out knowledge. Train on IT instrument for farmers. Introduce smart phone application to support stakeholders and any interested parties help a support for decision making	**Moderate**

No	HOW TO	Priority scoring
9	Backing projects which help mitigate negative impact on land and soil and further for SLM support	**Occasional**
10	Determine a policy on water resources development in suit of area context.	**Occasional**
11	Support budget required for mainstreaming SLM; an establishment of credit, loan and/or funds for local farmers	**Occasional**
12	Laws enforcement and standardization	**Occasional**
13	Public hearing on SLM implementation via public participation in decision-making	**Occasional**
14	Share natural resources and land use approach for each local group	**Occasional**
15	Promote technical role on policy advisory at all levels	**Occasional**
16	Establish national SLM institute (by government)	**Occasional**
17	Set up KPIs in support of SLM	**Occasional**
18	Mandate responsible key agencies, and build a collaboration between institutions and key government agencies	**Occasional**
19	Coordination among government agencies with local farmers to help solve specific soil problems	**Occasional**

b) How can farmers be supported in implementing and scaling out SLM practices (in Thailand)?

With a focus to assist farmers to practice the SLM in their land, there are a number of actions and activities which must be taken into accounted namely training and knowledge transfer, appropriate financial incentives, exchange platform, demonstration and network for farmers etc. Recommended activities and actions are collected from stakeholders at national workshops in Table 7.

Table 7 Recommended activities and actions are collected from stakeholders at national workshops

No	How to support farmers	Priority scoring
1	Provide training on knowledge transfer for local communities, build farmer leaders for SLM practices, model SLM community, then scale out to other farmers and areas	**Top high**
2	Create appropriate incentives eg financial support, rewarding incentive, commodity price guarantee, certification scheme of SLM practice (for farmer participation in SLM project)	**Top high**
3	Networking and partnerships to exchange lessons on SLM practices and to collaborate with others to ensure its sustainability.	**High**
4	Transfer SLM knowledge and technology to apply for mitigation of land use and soil problems. As a result, farmers could increase farm productivity, incomes, quality of life.	**High**
5	Pilot demonstration project/area for land rehabilitation, soil improvement. It will help demonstrate to farmers' new decision on SLM practices	**High**
6	Commit to allocate budget to local agencies to mainstream SLM to farmers	**High**
7	Support an establishment of SLM fund/credit for farmers	**Moderate**
8	Promote project/activity to introduce SLM practice through a participatory approach	**Moderate**

6. Partnerships and Capacity Building Development for the SLM in Thailand

It is highly recognized that activities for sustainable land management in Thailand must be mainstreamed through a collaboration with relevant governmental agencies with Department of Land Development (national focal point). Partnerships and alliances with private, non-government organizations, and non-profit associations are crucial for an integration of resources and efforts in the process of mainstreaming and scaling out of the SLM. Collaborations, partnerships and alliances shall be established and bonded strongly and formally to assure long-term support for SLM practices for farmers.

These are among partnerships, collaboration, alliances including capacity building for the SLM in Thailand for different policy instruments;

1. Knowledge dissemination
2. Training and capacity building
3. Financial resources
4. Technical and innovation practices
5. Traditional & local knowledge
6. Public communication
7. Best practice model and demonstration
8. Farmer network and exchange platform

7. Formulation of operational SLM strategy for Thailand

Operational strategy on mainstreaming and scaling out the SLM for Thailand is formulated based on an assessment and analysis of institutions, organizations, policies and strategies, key decision-making processes and instruments for the SLM. Hence, it takes into account of barriers to overcome, opportunities to enhance, and partnerships, collaborations and capacity building for the SLM. In consideration of Thailand status and condition to apply the SLM and recognition of local, traditional and national wisdom, knowledge and practices for the SLM, the Strategy is formulated by;

7.1 Strategy Objectives

The strategy objectives are set up to mainstream SLM into key identified decision-making processes and instruments in need for Thailand. They are prioritized to suit for Thailand with an aim to overcome barriers and enhance opportunities of the SLM at different levels; national to local/landscape level.

7.2 Institutions and Stakeholders

Each strategic objective will specify and design for what expected results, what components/activities to implement, which decision-making process/instrument to enter, and what and where target group is.

Importantly, the Strategy will be ornamented and supplemented with whom is responsible for (institution/organization/stakeholder). At what level the strategic objective aim to achieve; national, sub-national, regional, landscape or local level.

7.3 From SLM operational strategy to ACTION PLAN

Specific activities, roles, target, timelines and budgets to implement SLM operational strategy for Mainstreaming and Scaling out the SLM in Thailand should be translated into ACTION PLAN. This is to develop an action plan with identified relevant institutions, organization and stakeholders and to define activities and budget (if necessary) and to mandate role and responsibilities for sharing and achieving the strategy objectives and activities.

8. Challenges ahead for SLM in Thailand

Following are summary of challenge on sustainable land management in Thailand.

- Limitation of budget on land development project
- Change and inconsistency of policy in country, provincial and local level
- Lack of SLM competent staffs and capacity building
- Development of marketing system and market demand on agricultural product
- Lack of monitoring and evaluation system for SLM implementation
- Motivation and encouragement for farmers to aware the value of SLM
- Farmers' expectation and understanding on SLM
- Intervention from international institution may affect SLM policy positively and negatively.

9. SLM Mainstreaming and scaling out: Concept and Feasibility

Rationale

Land is a basis for life. Without land, life is not possible. With an extensive land degradation, life is threatened as its long-term food security is eroded. Its impact is particularly pronounced considering the fact that the world population continue to rapidly rising from currently 7.6 billion to 9.8 billion in 2050 and 11.2 billion in 2100. According to IFPRI, it is estimated that one-fourth of the global land areas are degraded and 1.5 billion people lives are affected. To prevent further degradation and/or reverse it, measures to promote sustainable land management policies and practices are needed. Integrating SLM consideration into all levels of institutional decision-making processes and scaling out SLM practices to every land user group. SLM practices contributes to sustaining the sustainable development. Specially, SLM contributes to achieving the Sustainable Development Goal (SDG) 15 of life on land. It also contributes to the achievement of other related goals including SDG 1: No Poverty, SDG 2: Zero

Hunger, SDG 6: Clean Water and Sanitation and SDG 13: Climate Action. UNDP consider SLM as an SDG accelerator because of its ability to simultaneously meet several SDG goals in a cost-effective manner. The ultimate goal of SLM project is to concretely contribute toward achieving the world with land degradation neutrality (LDN).

Scope

This concept paper focuses on developing strategies to achieve the goal of SLM practices into policies of both public and private entities, stakeholders as well as land users at all levels. It will evaluate feasibility of various options and propose a preliminary design of incentive schemes to pay for ecosystem service for further action and detailed assessment. Priority will be given to market-oriented approach that will intrinsically motivate stakeholders to consistently behave in ways that align well with SLM objectives in a sustainable and sound manner.

9.1 SLM Mainstreaming Approaches: Thailand Context

In Thailand, one-third of total land areas (approximately 17.25 million hectares) or three-fourths of agriculture land are degraded in one form or another. Restoration of degraded land has mainly been shouldered by the government sector. However, the capacity of the government to address land degradation is limited. The allocated budget is sufficient to restore approximately 32,000 hectare of degraded land per year. At this rate, the government would hypothetically need more than 500 years to fully restore the degraded land. It is, therefore, important that all sectors including private enterprises, non-government organizations, other involved institutions, communities and land users collectively contribute toward preventing, reducing, restoring, and adapting to land degradation for the wellbeing of current and future generations.

9.2 Approaches that are potentially applicable to mainstream SLM

9.2.1 Regulatory Control: There are several laws governing land uses. These laws were under jurisdictions of various government agencies. Regularity control is the government's main instrument in controlling the use of land with varying successes.

9.2.2 Property Right: The key argument of the property right approach is that the lack of property right will result in overexploitation of common resources which in this case is land. The overexploitation of common land was termed "tragedy of commons" by Garrett Hardin in 1968. In Thailand, four-fifths of farmers own land with different types of land titles. The case of tragedy of commons is most applicable to farmers illegally cultivate forest land.

9.2.3 Common Pool Resource Institution: The common pool resource institution is an alternative to the property right approach. The theory of common pool resource institution was developed by Elinor Ostrom, the first female Nobel Prize winner in economics. In Thailand, the practice of common pool resource institution has naturally evolved out of cultural norms and indigenous wisdoms. A success in point is the development of communal forest management to restore forest by local community in the Mae Kuang watershed in Chiangmai.

9.2.4 Market-based Incentives: Market based incentives include tax advantage, subsidy, premium price, contract farming. Subsidy has been the most popular mechanism to entice land users to adopt new practices. Subsidy, however, is costly. If not appropriately applied, subsidy could distort relative prices and cause misallocation of resources and, hence, social welfare losses. There are other innovative financing practices that can potentially achieve the same result without using public fund and without the subsidy's side effects. Examples are developing standard and certification system that incorporates SLM, using public-private partnerships to develop SLM friendly value chain and payment for ecosystem services and access to credit or microfinance.

10. Incentives to mainstream SLM

10.1 Incentives to Private Sector

Instead of incentivize land users which are extremely large in number, the transaction costs would be much smaller to provide incentives to firm to promote SLM practices voluntarily. These followings are financing options that can be used to motivate private sectors to participate in scaling SLM practices:

a. ***Tax advantage***. A simple method of getting firms involved in mainstreaming SLM is to provide tax incentives. However, an important prerequisite is that the firms have developed sufficient capacity to determine what technologies would be most suitable to the local condition in order to actualize maximum benefits from a given investment,

b. ***Stock Exchange of Thailand Sustainability Index*****.** Stock market of Thailand has developed sustainability index to promote responsible and sustainable investment that pays attention to environment, society and good governance. By making SET and public companies recognizing SLM as an element of sustainability, public companies would be more willing to invest their CSR activities in land and water conservations.

c. *SLM Friendly Public-Private Partnership*. Some agri-businesses have potential to contribute directly to reducing land degradation. An example is pulps and paper companies. In the Northeastern region, wide areas are affected by salinity. Growing Eucalyptus trees has potential to control soil salinity by helping to control ground water level. There is a potential for public sector to establish win-win solution by engaging the firm to promote Eucalyptus tree plantations in salinity affected areas.

d. *Carbon Credit Offset.* "Cool Vege" is a successful scheme a Japanese farmer group has used to earn extra income from selling carbon credit to private enterprises. The "Cool Vege" are vegetable grown on soil mixed with biochar. Being carbon minus, biochar has a nice property to sequester carbon and remain stable in soil for more than 1,000 years. Interested companies participate in the scheme by paying farmers a small amount per each package of vegetable sold. Vegetables grown under the scheme are packed and labeled as "Cool Vege". Some company paid additional money to have its company's logo on the printed package. Such can be readily applied to produces using SLM practices.

e. *Payment for Ecosystem Services (PES)* USAID has piloted a very successful PES in Chiangmai by having private drinking water companies pay farmers to restore and maintain forest near their water sources. This PES can be applied to address water degradation from overuse of agro-chemicals in the upstream areas of watershed. In some watershed, high level of pesticide residues has been detected in river fish. By asking upstream farmers of the watershed to practice organic agriculture, then the problem of water contamination can be avoided. The organic agriculture inherently incorporates SLM in its practices. Important beneficiaries of the cleaner surface water where tab water is made are Provincial Waterworks Authorities of the downstream provinces and their customers. Payment can be collected from consumers by adding a small fee to their water bills.

f. Impact Investor through Cloud Sourcing. Impact investing is an emerging investment whereby investors seek to invest with the intention to generate concrete social, economic and environmental benefits. Impact investing comes in all sizes and forms from venture capital or debt to microfinance. Cloud sourcing is an important channel to mobilize fund from impact investors. Some SLM practices provide strong social benefits. Investment based on private returns alone will result in under-investment in SLM. Impact investing has a potential to close this gap and improve social welfare.

10.2 Incentives to Farmers and Land Users: Although the number of farmers is large, it is possible to reduce transaction costs of promoting SLM practices by focusing on some key nodes. Some possible nodes for intervention are:

a. *Standards and Certification*. The low hanging fruit for the DS-SLM project to take advantage of is to modify the existing standards to incorporate SLM practices. Currently, there are two well-known standards run by MOAC, i.e. Good Agriculture Practice (GAP) and Thailand Organic Standards (TOS). Particularly, GAP standard should be made to incorporate SLM as an additional requirement and differentiate it by calling it GAP+, for example. Alternatively, the Project may consider developing a new standard specifically for SLM and have a Label of SLM Friendly Products to inform customers. To reduce cost of certification, one may use participatory guarantee system (PGS) as a certification tool. Even for an existing PGS Organic Standards, they can be made to modify their group standards to incorporate SLM. Changing PGS is simple and easy because it only involves decisions of a small group of members.

b. *Access to Finance*. Bank of Agriculture and Agriculture Cooperatives (BAAC) is the key lenders to farmers. By providing SLM farmers with a special lower interest rate or better repayment terms, farmers are more likely to adopt SLM practices. In the past, BAAC has cooperated on an *ad hoc* basis. It would be beneficial to farmers if BAAC institutionalizes this favorable lending condition to all farmers practicing SLM. Practicing SLM can be considered an indicator of responsible farmers and therefore, deserve a favorable lending condition from BAAC.

c. *Organic Agriculture.* OA is by itself an SLM technology. A premium price received on OA products is, in fact, a payment for ecosystem services and for SLM. Unlike OA, conservation agriculture (CA), another SLM technology, has no distinct market and premium price. Incidentally, by 2021, MOAC has a policy to expand OA areas by 1 million rai (160,000 hectares). The move to align SLM with OA will accelerate the achievement of -SLM outcome.

11. Sustainable forest resources management

Forests are very important natural resources in the ecosystem. They help facilitate both directly and indirectly for people and animals to have lived together for a long time. At present, there are a lot of problems occurring regarding forest resources such as the problem of illegal deforestation resulting in reduced forest areas. The forests of Thailand have been destroyed rapidly according to the proportion of the increasing population and the economic driving force of the liberal capitalist system that focuses on trade by using forests as an important variable. There has been increasing environmental degradation, which will have a negative impact on the

overall ecosystem (Kaviset et al., 2018). Implementation of the sustainable conservation of forest resources requires social and legal measures. This also includes promoting local people to participate in conserving and taking care of forests to maintain them in their original conditions for the benefits of living based on integrating related technologies such as biological technology, the geographic information system, computer etc. All of these things are the foundation of building new innovations in conserving forest resources efficiently (Chatcharee, 2005). Therefore, this article presents things regarding forest resources in Thailand, problems of forest resources, principles of implementation and methods of forest conservation, suggestions in forest resource conservation to be used as data leading to planning and determining policies to promote sustainable forest resources management.

12. Forest resources in Thailand

The loss of forest areas in Thailand caused by trespassing is one important cause whereby there is forest encroachment for the purpose of cutting down trees for use. Clearing forest areas for doing farming and building dwellings, including taking advantage of encroachment for tourism (Office of Natural Resources and Environmental Policy and Planning, 2017). In 2016, Thailand had forest areas covering 102.17 million rai or accounting for 31.58% of the area of the country. Comparing changes of forest areas in 2016 and 2015 revealed that forest areas had reduced only a little bit accounting for the area of 66,143 rai due to : 1) Damages caused by fire occurring in 2015 accounted for 60,453.11 rai ; 2) Bringing satellite images from Google Earth to be taken into account in preparing data on the conditions of the forest areas during 2016 made the data images more modern during 2015 ; 3) The recording times differing in each season may have caused discrepancies in the interpretation of satellite images ;and 4) Regarding forest areas during 1-5 years covering the area of around 330,000 rai, if the tree canopy is large enough or has a large enough canopy but the plant spacing for plating is large, light reflection appearing red will not occur. The red color shows being forest areas in the satellite images. Regarding the trend of the forest areas for the past 5 years, it was found that forest areas tends to decrease. However, the rate of decreasing forest areas tends to improve due to the act that the government has placed importance on increasing forest areas in order to achieve the goal prescribed in the 20-year strategic plan determining that Thailand should have forest areas for at least 40% of the area of the country within 2036, which is equivalent to 129,411,479.68 rai (Royal Forest Department, 2018).

13. Types of forests in Thailand

Types of forests vary depending on the distribution of rainfall. The duration of rain and the amount of rainfall cause each forest to have different moisture levels. Forests can be categorized into 2 main types, namely evergreen forests and deciduous forests (Tawatchai, 2006).

13.1. Evergreen forests

This type of forests look green all year round due to the fact that almost all of the trees growing in the forest are the type that does not shed leaves, Important types of forests that fall into this category include:

1. Tropical Evergreen Forest or Rainforest

Tropical evergreen forests are found in every region of the country and are found at the most in Southern Thailand and Eastern Thailand. In these areas, there is more rain and humidity than other regions. Rainforests are often scattered in areas where there is a lot of moisture such as along valleys, rivers, streams, water sources and on mountains. They are categorized into types of rainforests as follows:

1.1 Moist Evergreen Forests

They are dense forests that look lush and green throughout the year. There are hundreds of different types of plants crowded together. They are often found scattered starting from the altitude of 600 meters from the sea level. Important trees are various rubber family trees such as Yang (*Dipterocarpus alatus* Roxb.), *Dipterocarpus gracilis*. Secondary trees are Fagaceae such as *Lithocarpus annamesis* A. Camus, Evergreen Chinkapin.

1.2 Dry Evergreen Forest

It is the forest in a relatively flat area with little moisture such as in the northern and northeastern regions. It is usually located 300-600 meters above the mean sea level. Important trees are Black rosewood Pod mahogany, Yang (*Dipterocarpus alatus* Roxb.), Shorea (Red Sal Wood) and Iron Wood.

1.3 Hill Evergreen Forest

This type of forests occurs in highlands or on mountains starting from the altitude of 1,000-1,200 meters up, Most of the trees ae gymnosperms, namely *Dacrydium elatum* (Roxb.). Moreover, there are secondary trees, namely *Phoenix acaulis* Ham, *Acrocarpus fraxinifolius* Wight ex Arn. and *Mahonia siamensis* Takeda.

2. Pine Forest

Pine forests often occur on high mountains, Moist of the areas are located at the altitude from the mean seal level of 200-1800 meters up in the northern, central and northern regions. Pine forests are characterized by sparse forests. The important plant species of this forest are Merkud pine and Pinus Kesiya. Other trees growing together are plant species of hill evergreen forests such as various types of hardwood trees or some redwood species which are Dipterocarp etc.

3. Mangrove Forest

They are sometimes called "saline wetland forests" or wetland forests. There are dense trees, each with supporting roots and breathing roots. This type of forests appears in muddy land next to the sea or in the mouths of large rivers which are flooded with salt water. In the southern region, there are mangrove forests on both sides of the coast. They are found along the eastern seashore in every province in Khlung district, Chanthaburi province. Most of the plants that grow in mangrove forests are small plants that are used for burning charcoal and making firewood. The important species are Mangrove, *Bruguiera gymnorrhiza*, White Kidney Beans, *Ceriops decandra, Xylocarpus sp,* Samae Talay (*Avicennia marina* Forsk), Lamphun. Undergrowth plants are often mangrove fern, Sea holly, *Taripariti tiliaceum* and *Phoenix humilis* etc.

4. Peat swamp forests or Swamp forests

This type of forests often appears in areas with a lot of fresh water flooding with water drainage. Swamp forests in the central region trees grow far apart from one another such as Balsam, Salix tetrasperma roxb, Cornbeefwood, Moke (*Wrightlia religiosa*), Calamus *Godefoyi becc*., Rattan (Indocalamus), Salacca, reed and *Saccharum arundinaceum retz*. In the southern region, peat swamp forests occur in areas where water is stagnant throughout the year. The largest area is found in Narathiwat Province. Peat forest soil is decayed plant remains that have been deposited over a long period of time. It can be divided into 2 characteristics: in areas with brackish peat near the seaside where Cajuput trees (Samet) grow densely. There are various types of reeds called "Samet Swamp Forest or Samet Forest". The other characteristic is the forest with many different types of plants mixed together. The important plant species of this pear swamp forest are Queen's crape myrtle Inthanin Nam Wa Chik Sok Nam Krathum Nam, java plum, cornbeef wood, *Saraca indica* L., Hambabalos (Bis.). Undergrowth plants consist of rattan, *Calamus caesius*, lipstick palm and other types of Betel nuts.

5. Beach Forest

It is a sparse, deciduous forest that grows along the beach where water does not flood onshore the land and hillsides along the sea. Important trees which can grow must be a salt tolerant plants and usually hvae a characteristic of a shrub with bent stems and thick, hard leaves namely, Australian pine, Tropical Almond, Cork Treer, *Calophyllum inophyllum*, *Cerbera odollam* Gaertn., *Pongamia pinnata*. There are pandanus and grass growing as undergrowth plants. *Sindora siamensis*, Oactus, opuntia elatior Mill and teasels such as *Acacia pennata* (L.) Willd. subsp. pennata, Madan (*Garcinia schomburgkiana* Pierre.) etc. are found along the hillside.

13.2 Deciduous forest

The trees that grow in this type of forest almost all shed their leaves. In the rainy season, this forest looks lush and green. In the dry season, most of the trees shed their leaves, making the forest look more open. Forest fire often occur, burning leaves and small trees. Important types of forests that fall into this category include:

1. Mixed Deciduous Forest

Mixed deciduous forests have a characteristic of a sparse forest. The soil area is sandy loam. The mixed deciduous forest in the northern region has teak trees growing, mixing togehter everywhere, covering all the way down to Kanchanaburi Province in the central region. As for the northeastern and eastern regions, there are very few and scattered mixed deciduous forests. The important plant species of this forest are teak, Monkey Flower Tree. Black rosewood, Bungor (Lagerstroemia floriburda Jack), Thai Bungor, Wodier tree, Dilleniaceae, Toona ciliata, Ebony tree, *tetrameles nudiflora R.Br., Dalberjia cultrato, Dalberjia oliveri Gamble, Bambusa Bambos, Bambusa nutans Wall.ex Munro, Dendrocalamus sericeus and Thyrsostachys siamensis* etc.

2. Deciduous Dipterocarp Forest

The Deciduous Dipterocarp Forest or also known as Pa Daeng, Pa Phae, Pa Khok. The general appearance is a sparse forest. There are always Arundinaria cililta, cycad and Arundinaria pusilla. Arid areas with sandy loam or laterite gravels are commonly found in the plains and on the mountains. In the northern region, most of them grow on the mountain with shallow and very dry soil. In the northern region, they are found at the most along hills and sandy plains. The important plant species of this forest are burma sal, Burmese sal, *Hairy Keruing, Dipterocarpus tuberculatus Roxb., Dipterocarpus intricatus Dyer., White Meranti, Cratoxylum formosum (Jacq.) Benth, Cratoxylum formosum (Jacq.) Dyer., Sindora siamensis*, Monkey

Flower Tree, Myrobalan Wood, *terminalia corticosa* pierre ex Laness. As for undergrowth plants, *Arundinaria pusilla, Arundinaria cililta*, cycad and other types of grasses are found a lot.

3. Savannas Forest

Savannas forests are found in every region in areas where forests have been cleared and destroyed. The land lacks fertility and has been abandoned. Therefore, types of grasses occur for replacement. When the dry season comes, there is fire, making the trees nearby die. Due to this, the area of Savannas forests expands every year. The plants which are found the most in the Savannas forest are Cogon Grass, Para Grass, *Saccharum procerum* Roxb. and *Arundinaria pusilla*. Areas where there are some humidity and good drainage often have Sorghum halepense, Tall reed and fire tolerant plants may be found growing such as *Stephania reticulata, Cratoxylum formosum (Jacq.) Benth and Cratoxylum formosum* (Jacq.) Dyer.

14. Problems of illegal deforestation

From the forest data since 1961, Thailand had forests up to 171, 017,812 rai accounting for 53.33% of forest areas in Thailand. Later, from the 2006 survey, Thailand had forest areas of about 99,157,875 rai or 30.92% of the country's area by assessing the interpretation of the satellite images (Royal Forestry Department, 2018). There are many problems with deforestation in Thailand, including illegal cutting of wood to sell, encroachment on land for use in business or agriculture. The problems have been persistent for a long time and have a tendency to cause forest areas to continue decreasing, causing many consequences such as flash floods, landslides, rushing down flash floods polluted air or even global warming which has become a big problem these days. Deforestation is considered public destruction, causing impacts on the economy, society, environment, and quality of life both directly and indirectly because these are important resources of the nation, available for everyone to use together for various benefits. Therefore, whoever destroys the forest is destroying the nation (Sittichai and Yada, 2019). Thailand's protected forest areas have gradually decreased over the past several decades. The main factors that lead to the shrinkage of natural forest areas include:

1. Granting forest concessions without control
2. Increasing population causes more needs for land uses, resulting in more forest encroachment.
3. Infrastructure development uses land to carry out government projects.
4. The announcement of many forest conservation zones, reserved forest areas and protected forests which overlap with people's land for making a living

5. The proliferation of chainsaw and backhoe technology has accelerated the pace of forest areas destruction.
6. Commercial agriculture clears forests or burns them to create shifting cultivation of hill tribes in the watershed areas.
7. Land speculation since 1987 has involved hiring people to encroach on the forest in order to seize land for further resale.
8. The problem of deforestation is caused by businessmen or capitalists collaborating with government officials.
9. Cutting roads into forest areas or building communities around forest areas
10. Changing the condition of mangrove forest areas to other activities. For example, the areas are used for coastal aquaculture.

From what has been said, it can be seen that the problems of each type of natural resource are connected to one other, including the important cause which comes from humans, especially for the forest land, of which conditions are degraded and which tends to decrease significantly each year due to many important causes. For example, these causes are illegal logging, forest burning, forest encroachment and deforestation in order to obtain land for housing and doing farming, and use of land to carry out government projects such as organizing self-construction settlements, irrigation, hydroelectric power, road construction and national security affairs, etc. Moreover, regarding the encroachment of capitalists into many reserved forest areas, wildlife sanctuaries and national parks for business purposes such as various buildings, including hotels and resorts, mangrove forests which have been transformed into shrimp farms, causing impacts on coastal aquatic breeding habitats (Apichat, 2007), these things have greatly reduced the forest area. The reduction of forest areas has affected the overall ecosystem as well.

15. Royal Initiatives on Forest Conservation

The Royal thought of His Majesty King Rama IX with his thorough understanding of the state of nature as well as the relationship between humans and nature has led to various ideas and theories regarding the conservation of natural resources and the environment. In addition to the theory of solving drought and water shortage problems, water source development, wastewater treatment, land development in various areas such as hardpan, sandy soils, peat, etc., things of great importance are the conservation of forest resources. His Majesty the King gave the concept of combining the need for conservation and restoration of forest resources along with economic and social needs with the theory of forest restoration development, the theory of conservation and development of mangrove forests to prevent farmers from encroaching and

destroying the forest until its quantity decreases. and increasing quantities of forest areas in Thailand steadily and permanently. There are several royal initiatives of His Majesty the King royal initiatives in conserving forest resources as follows:

15.1 Planting 3 forests to give 4 benefits

Three forests to give 4 benefits is knowing how to use natural resources based on royal intuitions wisely to benefit all people for the longest time and thoroughly. The first forest planting is planted for use in plants that grow fast such as eucalyptus, Cassod tree, Burmese rosewood, Agasta, giant acacia and neem. Uses are cutting branches to make firewood for burning charcoal, construction and handicrafts. The second forest planting is planted for use as food in plants which are various fruit trees suitable for the area and the environment such as coconut, jackfruit, mango, papaya, banana, including vegetables as well as home grown vegetables. The third forest planting is planted for uses whereby the area used for planting must be calculated according to the users' proportion. There must be replanting and a rotational system to ensure there is always wood available for use. The fourth benefit is a by-product of planting all three types of forests which helps conserve the soil and watersheds as well. In planting a forest, different types of trees must be planted, mixed with perennials, fruit trees, and firewood trees, which will help prevent soil erosion in the rainy season and preserve soil moisture. As a result, a mixed forest will occur, which builds balance for the nature sustainably and can meet the needs of the people. This is consistent with the basics of the threes principles of conservation, namely: 1) Sustain yield concept which deals with the fact that the rate of cutting trees and the rate of growth must be balanced in order to have an endless supply of usable wood: 2) Multiple use concept which deals with the fact that the objective of forest management should be multi-purpose. Forests are not only a source of wood but also a habitat for wildlife, recreational resources and water sources. They can maintain soil fertility and the rate of increasing nutrients in the water called "Eutrophication" not to change so quickly; and 3) Longrun policy which deals with the fact that the policy of long-tern forest management is important.

15.2 Reforestation without planting

Due to the fact that King Rama IX was so concerned with the greatly reducing amount of wood, he tried to find a method to increase the quantities of forests in Thailand to increase steadily and permanently. He used methods as follows: If a suitable area is selected, the forest is left there without doing anything. Then, the forest will grow to be a complete forest. The forest is not supposed to be disturbed, the trees and the trees are not harassed. They are just protected to grow naturally by themselves. Regarding The condition of the deciduous dipterocarp

forest which has been deteriorated, nothing has to be done with it because the stump will branch out again. Although the tree does not look nice, it will become a big tree. Another method is reforestation on highlands. Seed-type plants are used to plant on elevations. When they grow and produce pods, the seeds will break, float down, and then grow into new plants. This is a natural propagation by planting watershed forests or natural reforestation.

1. Replanting trees that were originally growing or what original plants were available should be planted according to the types that were lost and died.
2. Refrain from planting trees that are different from their original habitat. Do not bring in foreign trees of foreign species to plant without having clearly studied them first.

15.3 Reforestation

Currently, Thailand has only forest areas left accounting for 30% of the country's area or approximately 99 million rai. If we want to increase the forest area to approximately 40% of the country's area, the Thai people will have to help plant 48 million rai of forests by using no fewer than 100 million seedlings to plant each year. It will take up to 20 years to completely increase according to the set goals. King Rama IX has given recommendations for reforestation in encroached, cleared and degraded forest areas according to the geographic and environmental conditions of the appropriate area as follow:

Reforestation in degraded forest areas "...Reforestation in degraded areas or watershed areas that have been encroached and cleared until they become bald mountains require urgent reforestation. Planting fast-growing trees to cover the water channels line first should be experimented with in order to make the moisture gradually increase and spread out on both sides of the water course, which will allow trees to grow and help prevent forest fires because fires will easily occur if the forest lacks moisture. For the following year, plant trees in the next area. Then, the moisture will spread even further and the trees will grow well throughout the year…"

Reforestation along the hillside "…Many types of trees must be planted to provide multi-purpose benefits, namely water, fruit trees, construction trees, and firewood, which farmers need to use regularly and when trees are cur to bring wood to be used, they must immediately be replanted in rotation…"

Replanting forests in the watershed areas on mountaintops and high hills "… requires reforestation by planting perennial trees and growing firewood. The firewood can be cut and used by the people, but must be replanted periodically. Perennial trees will help keep the air

moist, which is one step in the system of giving natural rain. It also helps bonding on the mountain to prevent collapsing when it rains…"

15.4 Mountaintop reforestation

The condition of the forest on the high mountain which is deteriorating, will have an impact on the lower watershed. Plants with seed pods should be selected to allow for a natural process of planting to the foot of the mountain. In addition, reforestation occurs at the reservoir area to develop watersheds and water sources to be clean to increase income for the people and provide habitats for wildlife. An example of projects that involves reforestation is the Chaipattana Mae Fah Luang Reforestation Project at Doi Tung, Chiang Rai province and at Nong Phlap, Hua Hin district, Prachuap Khiri Khan province, the project of building forest plantations in various development study centers, Siri Charoenwat Forest Plantation Project, Chonburi province, Project to plant forests to enhance nature in and outside Phu Phan Ratchaniwet District, Sakon Nakhon province.

15.5 Conservation and development of mangrove forests

His Majesty the King gave the royal idea to the Deputy Minister of Agriculture and Cooperatives (Mr. Kosit Panpiamrat) during the first royal rice sowing ceremony in Chitlada Park. The royal idea was summarized as follows: "…mangrove forests are beneficial to the ecosystem of the seaside area and the Gulf of Thailand, but at present the mangrove forests of Thailand are being invaded and destroyed by those seeking personal gains. Therefore, we should find ways to protect, conserve, and increase their propagation, especially the mangrove tree, which is a strange mangrove tree and is quite difficult to propagate because it must relying on the tidal system for growth. Therefore, we ask the relevant government agencies, namely the Forestry Department, Fisheries Department, Royal Irrigation Department, and Hydrographic Department to jointly find suitable areas for experimenting with mangrove propagation and planting mangrove forests further…" (Suyanee , 2003).

16. Sustainable forest resource management with the BCG economic model

From changes in the past 10 years, the rate of economic expansion of Thailand has an average growth rate of only 3 percent per year. Therefore, Thailand needs to change economic and social development models by relying on the country's strong base consisting of biological diversities and cultural diversities to promote and develop Thailand to own high value products and services that raise the value in the chain producing goods and services. The modern digital innovation technology that helps eliminate limitations is used to enable a leap forward in further

development, to create sustainable economic growth, to distribute incomes, opportunities, and wealth throughout. This comes along with maintaining a balanced resource base and biodiversity by using a new economic model called the “BCG economic model” which is developing 3 economies, namely the Bio Economy, Circular Economy, and Green Economy simultaneously to drive Thailand concretely (Suwan, 2023).

16.1 BCG's alignment with the sustainable development goals (SDGs) and the Sufficiency Economy Philosophy which is an important principle in the economic and social development of Thailand. The BCG economic model serves to integrate the development from upstream to downstream. Knowledge in science, technology, and innovation is used to create added values from the diverse base of biological and cultural resources through a quadruple mechanism. The main activities under the BCG economic model include: 1) To conserve, restore, develop, and increase resources, biological and cultural diversities; 2) To administrate, manage, use and consume sustainably; 3) To reduce and make use of waste from the production process of goods and services; 4) To add added value throughout the value chain from the agricultural sector which is the upstream to the production and service sectors; and 5) To build immunity, self-reliance, and increase capacity for rapid recovery. Driving national development with the BCG economic model 2021-2026 has been determined to consist of 4 strategic areas: Agriculture and Food, Health and Medicine, Energy, Materials and Biological Chemistry, Tourism and Creative Economy, which had a 2018 combined gross domestic product of 3.4 trillion Baht, accounting for 21 percent of the gross domestic product (GDP). Employment accounted for 16.5 million workers or approximately half of the total employment of the country. This has relied on taking advantage of biological and cultural diversities, which are an important basic capital for national development and in increasing good life qualities for the people.

16.2 Application of the BCG economic model in the forestry sector BCG is a broad framework. It covers various dimensions of the Royal Forest Department's mission in various areas which may include promoting reforestation, community forests, recreational forests, and forestry research and development. This can be both timber forest products and non-timber forest products from forestry plantations or community forests, such as herbs, honey, dammar, mushrooms, bamboo shoots, etc. In the green economy, forest areas also generate income for entrepreneurs, communities, or households in the form of natural tourism and are recreation areas. Entrepreneurs earn income from developing tourism businesses in the form of ecotourism: In addition, forests also serve as a carbon sink to absorb carbon dioxide and are also in line with Thailand's entry into the state of net zero emissions or the state of carbon neutrality by using low costs compared to other sectors. However, the main part of BCG is that the forestry sector as a

whole has a high impact in the economic, social and environmental dimension. That is, products from wood or economic forests, which mean the economic wood industry are considered to be the most cost-effective and efficient method for Thailand because trees absorb carbon in the air and store it in the wood. When wood is used as a product, it naturally stores carbon. When new trees are planted following the rotation, the trees will continue to absorb carbon. Mature trees or those with low growth will absorb less carbon than younger trees which grow faster. Therefore, the economic wood industry involves creating incomes and absorbing carbon at the same time (Suwan, 2023). The guidelines that will lead Thailand to achieve the mentioned goal must be based on the fact that the economic wood industry or increasing forest area according to BCG guidelines is the most appropriate way along with creating income and benefits for the country.

16.3 The economic timber industry leads to a carbon neutrality economy under the BCG Model in the forestry sector Due to the intensifying problem of climate changes the world is placing importance on increasing forest areas. Today's technology has been developed until it can make wood become a miraculous material from the nature. It has properties many times better than metal, cement, plastic, and other materials. It is a reliable source of energy. environmentally friendly and can be used with almost no limitations The world trend therefore turns to using more wood from sources with sustainable forest management called Sustainable Forest Management-SFM. SFM must take into account the balance of various sectors in terms of economy, society and environment. Meanwhile, trees planted in Thailand grow five times faster than in temperate zones, a sustainable advantage that has led to the development of key tools in country development combined with the fact that most Thai farmers often face repeated losses. The main reason is due to the risk of climate and marketing Environmental stability needs to be created by increasing green areas to 55%, and farmers need to shift to growing other more stable crops. Growing economic trees is the most appropriate answer. Another thing is that Thailand is entering an aging society. Saving for retirement is therefore necessary. However, saving in the form of cash has low returns. Growing economic trees is considered a low-risk, low-cost form of savings. Although impacts from various areas, including from COVID-19, have caused an increasing number of unemployed people, the integrated economy wood industry still lacks many workers in this area. Therefore, it is the answer to these problems and will be a new economic tool that can generate incomes for the country. The main framework for BCG operations in the forestry sector or economic timber group consists of 5 important parts: 1) Determining the structure and facilitators, namely forest bonds, economic trees Special Economic Zone using trees as financial security for farmers, carbon in the forestry sector; 2) Governance (Regulatory affair); 3) Human resources; 4) Cooperation among the public, private

and educational institutions (Collaboration); 5) Marketing, which includes an economic trees database.

16.4 Driving Thailand's development with the BCG economic model in the forestry sector is an important, connecting mission of Thailand after announcing its intentions at the COP26 meeting, in line with other countries around the world that is moving towards a green economy It is considered a challenge for Thailand in terms of increasing economic forest areas that requires driving and integrating related activities, namely upstream, midstream, downstream, and various sectors that rely on the natural resource base and those developed further from community forests, natural forests, and ecological services in the form of recreational forests. This also includes sustainable forest management and the integrated economic trees which are considered to be in perfect harmony with BCG in the forestry sector (Suwan, 2023).

17. Operation guidelines of sustainable forest resources management

From the mentioned-above guidelines for sustainable forest resource management, it can be concluded that the operational guidelines for conservation, restoration, development and utilization of forest resources in balanced need to be consistent with the goals of natural resource development in order to achieve sustainability by emphasizing the participatory process of all sectors and proactive integration which consist of the following guidelines.

1. Establishing government policies, plans and guidelines that are important and urgently necessary to conserve forest resources in both the short and long term for integration between government agencies at all levels and relevant officials so that they can hold on to and implement them

2. Sustainable management of forest resources based on the BCG economic model, which integrates from the beginning to the end, using knowledge in science, technology, and innovation to create added value from a diverse base of biological and cultural resources. The development of BCG in the forestry sector is therefore consistent with Sustainable Development Goals (SDGs) and is in line with the philosophy of Sufficiency Economy.

3. Regarding, reforestation and forest protection, a local public sector network should be established to create awareness and develop groups to have serious and strong cooperation, have knowledge, understanding and awareness of how to participate with officials in protecting and maintaining the forest in its original condition, preventing it from deteriorating for the benefit of living in their own locality.

4. Regarding forest fire protection, knowledge about the dangers of forest fires should be provided and participation with communities should be used to divide up responsibility zones around forest areas to organize activities to build firebreaks. Other things which should be done are supporting budgets to reward communities that can effectively prevent forest fires through patrolling and monitoring by using satellite images to determine hotspots to ensure greater accuracy.

5. Supporting research and development of technology for conservation of forest resources by providing information and transferring knowledge, technical assistance and providing education to those involved at all levels in order to manage forest land correctly according to academic principles worthily with maximum benefits

6. Using legal measures such as limiting the use of an area, issuing regulations controlling or permitting the use of natural resources and the environment in a sustainable and fair manner (Nattawat, 2013)

7. The principles and operations of forest resources management require the use of socio-legal measures, disseminating information and providing education, including encouraging local people to participate in care and maintenance. The factors leading to success depend on the cooperation of the community which must be based importantly on the distribution of opportunities for sustainable use of forest resources

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