ADDRESS
South East Asia Regional Office
Jalan CIFOR, Situ Gede, Sindang Barang Bogor, 16115

CONTACT
Tel: +62 251 8625415; Fax: +62 251 8625416
www.worldagroforestry.org/region/southeast-asia
blog.worldagroforestry.org

LAND USE PLAN FOR PELALAWAN:
TARGETED SCENARIO ANALYSIS RESULTS

Deliverable 2
Support for Land Use Planning Scenario Analysis in Pelalawan District of Riau Province

Prepared for:

United Nations Development Programme

Submitted:

August 6th, 2019

Disclaimer

As the study is still on-going, some results are still incomplete and tentative and are subjects to further reviews and revision. The materials in this report are not for citation and distribution beyond internal progress reporting purposes

Table of Content

List of Figures

List of Tables

Glossary

A

AP : Activity Package
APL : Non-forest area (*Area Penggunaan Lain*)

B

BAU : Business as Usual
BPN : National Land Agency (*Badan Pertanahan Nasional*)
BPS : Central Bureau of Statistics (*Badan Pusat Statistik*)
BRG : Peat Restoration Agency of Indonesia (*Badan Restorasi Gambut*)

F

FCT : Feasible Conservation Target
FMU : Forest Management Unit

G

GRDP : Gross Regional Development Product

H

HCS : High Carbon Stock
HCV : High Conservation Value
HD : Village Forest (*Hutan Desa*)
HGU : Land-cultivation Permit (*Hak Guna Usaha*)
HKm : Community Forest (*Hutan Kemasyarakatan*)
HL : Protection Forest (*Hutan Lindung*)
HP : Production Forest (*Hutan Produksi*)
HPK : Convertible Production Forest (*Hutan Produksi Konversi*)
HPT : Limited Production Forest (*Hutan Produksi Terbatas*)
HTR : Community Plantation Forest (*Hutan Tanaman Rakyat*)

I

ISPO : Indonesian Sustainable Palm Oil

K

KK : Forestry Partnership (*Kemitraan Kehutanan*)
KPA : Nature Conservation Area (*Kawasan Pelestarian Alam*)
KSA : Sanctuary Reserves (*Kawasan Suaka Alam*)

L

LUMENS : Land Use Planning for Multiple Environmental Services

N

NTFP : Non-timber Forest Product

R

RDTR : Detailed Spatial Plan (*Rencana Detail Tata Ruang*)
RKU : Production Forest Plan (*Rencana Kerja Usaha*)
RPJMD : Regional Development Plan (Rencana Pembangunan Jangka Menengah Daerah)
RTRWK : District Spatial Plan (*Rencana Tata Ruang Wilayah Kabupaten*)
RTRWP : Province Spatial Plan (*Rencana Tata Ruang Wilayah Provinsi*)
RTRWN : National Spatial Plan (*Rencana Tata Ruang Wilayah Nasional*)

S

SEM : Sustainable Ecosystem Management

SM : Wildlife Reserves

T

TFP : Timber Forest Product

TSA : Targeted Scenario Analysis

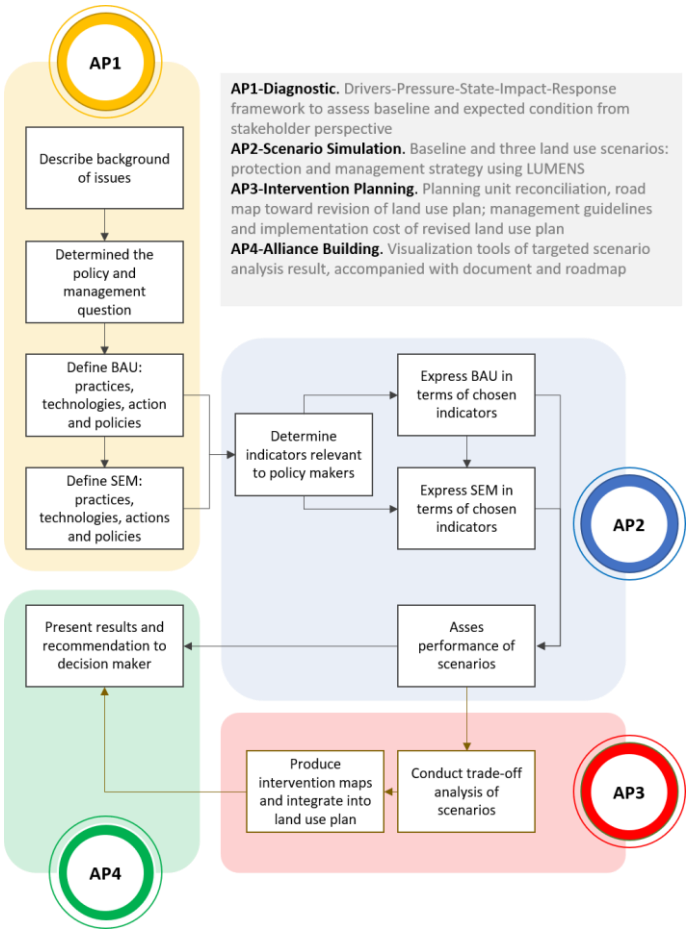
01

INTRODUCTION

1. Introduction

The economic growth of Pelalawan District, Riau Province, to a large extent depends on land-based economic sector. Expansion of oil palm, rubber and industrial timber plantation has boosted the Gross Regional Domestic Product (GRDP) of Pelalawan in the past half-decade. The analysis of time series of land cover map of Pelalawan shows that the past trend of land use expansion has been repeating itself more recently. Without a carefully developed land use plan in place, the expansion of intensively managed land uses can be out of control, which will cause adverse environmental impacts in the future. Therefore, to achieve sustainable development in Pelalawan, a land use planning that balances land requirement and land availability is one of the key processes. Allocation of land for economic purposes needs to be integrated with the allocation for landscape ecological protection. Existing protected and protection area has to be conserved and managed properly. Even more, in addressing degraded function of Pelalawan landscape, forest and landscape restoration needs to be carried out.

Figure 1.1 The overall workflow of the support for land use planning processes in Pelalawan



The support to land use planning processes is structured into four activity package (AP) as presented in Figure 1.1. AP1 carried out the diagnostic processes of Pelalawan land uses and based on that, produces three land use plan scenarios: (1) **the Overshooting Conservation Target** (OCT); (2) **the Feasible Conservation Target** (FCT); and (3) **the Compromised Conservation Target** (CCT). AP2 conducts a thorough assessment of the three land use scenarios using the Targeted Scenario Approach (TSA) framework (Aplizar F and Bovarnick A, 2013), combined with the Land Use Planning for Multiple Environmental Services (LUMENS) tools (Dewi et al, 2014). The work of AP2 is concluded with a consultation process with key stakeholders in Pelalawan in order to select the preferred option among the three land-use scenarios. AP3 develops detailed land use zonation, management guidelines and estimated costs of action plan of the preferred scenario option. The result is refined through a series of dialogues and consultation processes with the stakeholder in Pelalawan. At the final stage of the processes, AP4 will build alliances in order to mainstream the result of the land use planning process into the formal district regulation.

This report presents the simulation results of sustainable land use scenario in Pelalawan District, Riau conducted under AP-2. The report is structured into five sections:

1. Section 1 describes a hybrid methodology of the Targeted Scenario Analysis (TSA) and Land Use Planning for Multiple Environmental Service (LUMENS);
2. Section 2 defines sustainable development perspective of Pelalawan based on stakeholder consultation processes to define the economic, social, and environmental indicators for the TSA processes;
3. Section 3 explains Business as Usual (BAU) and Sustainable Ecosystem Management (SEM) scenarios for Pelalawan. The scenarios are translated into a sets of land use plan to be simulated under LUMENS;
4. Section 4 presents the Ex-Ante Analysis of SEM Indicators;
5. Section 5 describes the policy recommendation for Pelalawan's Spatial Plan.

1.1 Targeted Scenario Analysis

TSA is: **(1)** an analytical approach that captures and presents the value of ecosystem services within decision making, to help make the business case for sustainable policy and investment choices; **(2)** a balanced presentation of evidence, for a decision-maker, that weighs up the pros and cons of continuing with business as usual (BAU) or following a sustainable development path in which ecosystems are more effectively managed; **(3)** the main product is generated using the data amassed during a TSA. It presents a graph or graphs, with time on the horizontal axis and a measurable indicator, such as revenues or number of jobs, on the vertical axis.

The steps used by a TSA (Alpizar and Bovarnick, 2013) are:

1. **Defining the purpose and scope of the analysis**. This process includes identification of the critical decision maker's perspective; after that the analyst refines the focus of the policy question, specifies the scope of the analysis, and assesses and verifies available data to ensure that the TSA will be Sejahtera II scenario;
2. **Defining the BAU baseline and SEM intervention.** The mix of policies are determined in this step. The analysis defines the non-ecosystem-based strategies which are being used by relevant actors to address those impacts for the BAU baseline. While for the SEM, the process includes identifying the mix of policies, actions and technologies that could be used to change and reduce or reverse the

effects of BAU on the relevant ecosystem, and then determines the potential consequences of this course of action, as well as the investment and maintenance costs required to implement it;
3. **Selecting criteria and indicators.** The criteria are determined by the policy questions and the original objective of the TSA. The indicators will be used to show changes over time in the chosen criteria resulting from the BAU and the SEM;
4. **Constructing the BAU and the SEM scenarios.** The chosen indicators are measured to get the outcomes of this step. This process involves estimating how ecosystem services will be affected by the BAU and SEM interventions, considering the functional linkages between changes in ecosystem services and the chosen indicators, and finally, projecting changes in the chosen indicators;
5. **Making an informed policy or management recommendation.** This step's objective is to present the calculation of the outcomes that may result from each of the policy interventions and assessed these outcomes in terms of the criteria selected to assist decision-makers in choosing among the policy interventions.

1.2 Land Use Planning for Multiple Environment Services (LUMENS)

LUMENS is a framework accompanied with user-friendly, parsimonious and publicly available software to empower multi-stakeholder negotiation processes that are inclusive, integrated and informed in planning land uses for sustainable landscapes that can support livelihoods and development while maintaining and restoring environmental services, especially in tropical countries. The principles of LUMENS are:

- Inclusiveness: any land-based related activities should conduct inclusive process as early as possible, most importantly at the stage of diagnosis and option exploration.
- Integrative: this principle underlines the importance of having synergized processes and aligned objectives across conservation, development, and spatial land-use planning.
- Informed**:** the informed principle ensures that land-based-related planning decisions are made based on the knowledge that comes from data, information, and the understanding of processes and functions that are contextual.

Technical Processes of LUMENS include:

1. Development of planning unit;
2. Driver analysis and historical land use and land cover changes (LULCC) with respect to the planning unit;
3. Quantification of biodiversity and environmental services;
4. Baseline scenario development of future land use and projection of environmental services;
5. Development of scenarios intended to change the business-as-usual (BAU) trajectory;
6. Projection of future LULCC through spatially explicit modelling;
7. Trade-off analysis from the multiple scenarios between environmental services; and
8. Formulation of action plans, including necessary instruments to implement the agreed scenario.

LUMENS is accompanied with user-friendly, parsimonious and publicly available software in order to:

- Develop proper zones or planning units within the landscape that suit the purposes to achieve sustainable landscape, from the local perspectives, policy perspectives and scientific perspectives - Planning Unit Reconciliation (PUR);
- Quantify the Environmental Services (QUES) analysis of the landscape in terms of provisioning livelihoods and development, carbon, hydrological and biodiversity;

- Conduct trade-offs analysis between rural income, regional economics and food security using the environmental services - Trade-off analysis (TA); and
- Conduct Scenario Analysis and Simulation (SCIENDO) of land use changes based on interventions or changes in land use practices.

1.3 The Hybrid Method: Combined TSA and LUMENS Framework

The Targeted Scenario Analysis (TSA) and LUMENS are utilized to build and simulate the land use scenarios for Pelalawan. The approach will capture and present the value of ecosystem services within decision-making to help make the business case for sustainable policy and investment choices with product of a balanced presentation of evidence, which weighs up the advantage and disadvantage of continuing with business as usual (BAU) or following a sustainable development path in which ecosystems are more effectively managed (Alpizar and Bovarnick, 2013).

TSA and LUMENS framework are used simultaneously with some adjustments as follows:

- TSA provided overall guidance of consultation processes and dialogues;
- Stakeholders discussion on Pelalawan's development vision and mission as well as their ideal future were conducted using technical steps of LUMENS;
- SEM indicators were defined and selected based on consultation processes suggested in TSA;
- Ex-ante impacts simulation of SEM indicators was conducted using LUMENS

02

Perspective on Sustainable Development

2. Perspectives on Sustainable Development

The economic growth in Pelalawan District in the past seven years was largely driven by two economic sectors: agriculture and processing industry (Figure 2.1) (Indonesian Centre of Statistical Bureau (*Biro Pusat Statistic/*BPS). Combination of the two economic sectors account for more than 87% of the total 41 trillion IDR of Pelalawan's Gross Domestic Regional Product (GDRP). From the agricultural sector, the largest contributors to GDRP are rubber and oil palm plantations which accounts for 55% and 28% of the total 17 trillion IDR of agriculture GDRP (Figure 2.2).

The land use dynamics of Pelalawan District within the last 10 years have reflected the above economic activities and indicated some unsustainable land utilization practices. Natural forest areas have been disappearing and replaced by intensive land use systems such as oil palm plantations, rubber plantations and industrial timber plantations. More recently, the utilization of peatlands for intensive land use systems that required drainage has been taking place extensively.

Based on the Draft of Pelalawan Spatial Plan for 2019-2039, most area of Pelalawan is designated as state forest zone (*Kawasan Hutan),* either for protection forest, conversion forest or production forest areas. Most of the production forest are managed by large scale companies as industrial timber plantations. Only 30% of the district area was delineated as non- state forest zone (*Area Penggunaan Lain/APL*). Some considerable area of APL is licensed to oil palm companies. Tenurial issues have been a serious social problem and impacting the local stakeholder's vision toward conservation. Since accessible land are limited, most of land uses and land utilization practices were currently targeted at maximizing the economic outcomes of the landscape.

Figure 2.1 Economic growth in Pelalawan District 2010-2017 (BPS, 2018)

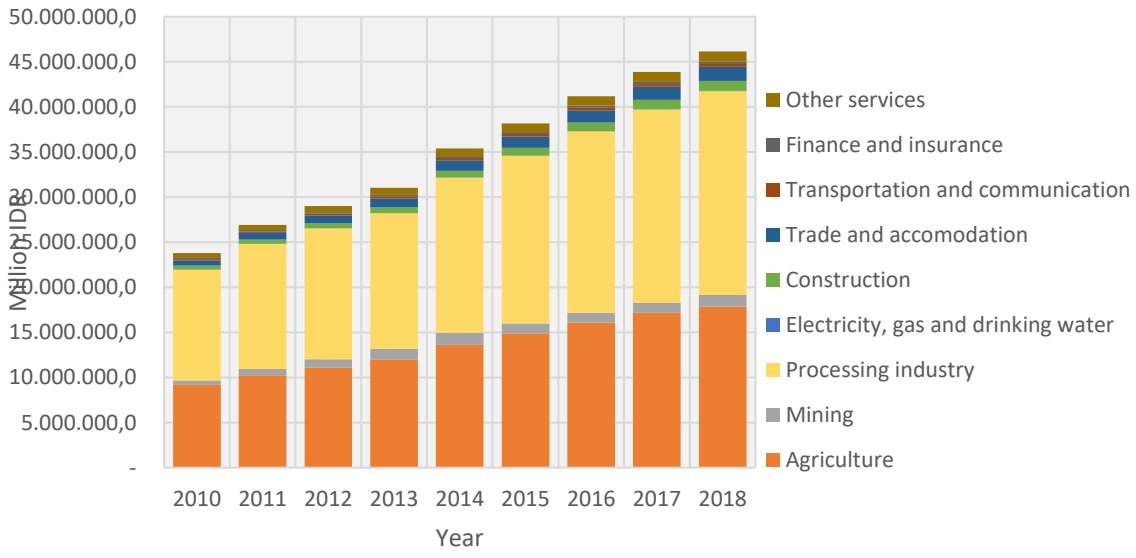
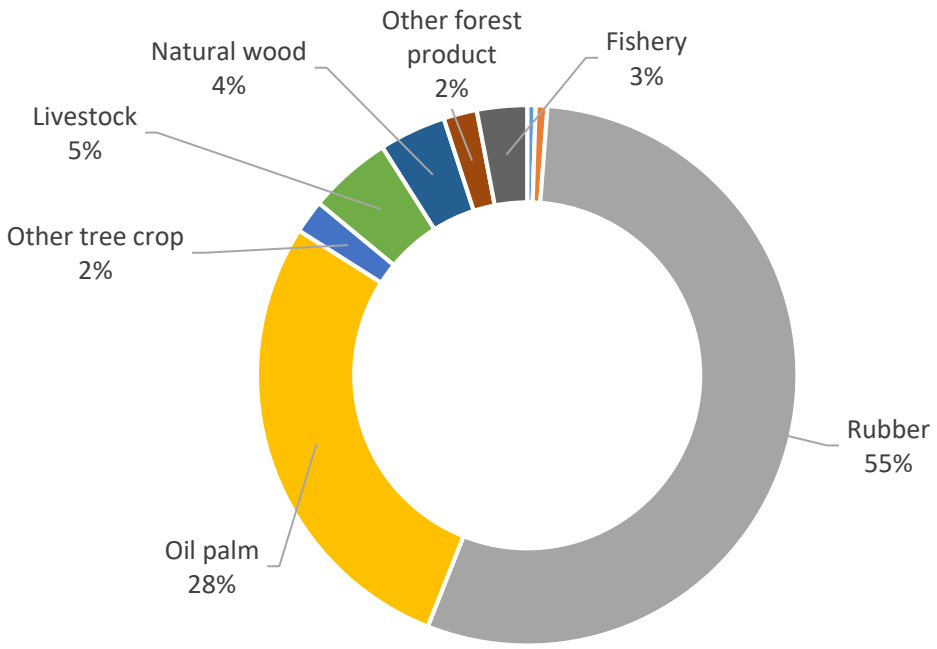


Figure 2.2 Contribution of several land-based activities to the agriculture GDP of Pelalawan



A series of stakeholder discussion and consultations were conducted to agree upon the conservation-sustainable livelihood targets and align them with the district's formal development vision and mission as stated in the Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah Daerah/RPJMD).* The process was quite challenging considering that achieving significant economic growth is the most important goal in the current Pelalawan's development orientations without any sufficient environmental safeguards. Moreover, social safeguards are limited, while highly needed due to the fact that there is a limited land utilization potential for local community due to the extensive large-scale operations under industrial timber plantation concession and estate crop plantation.

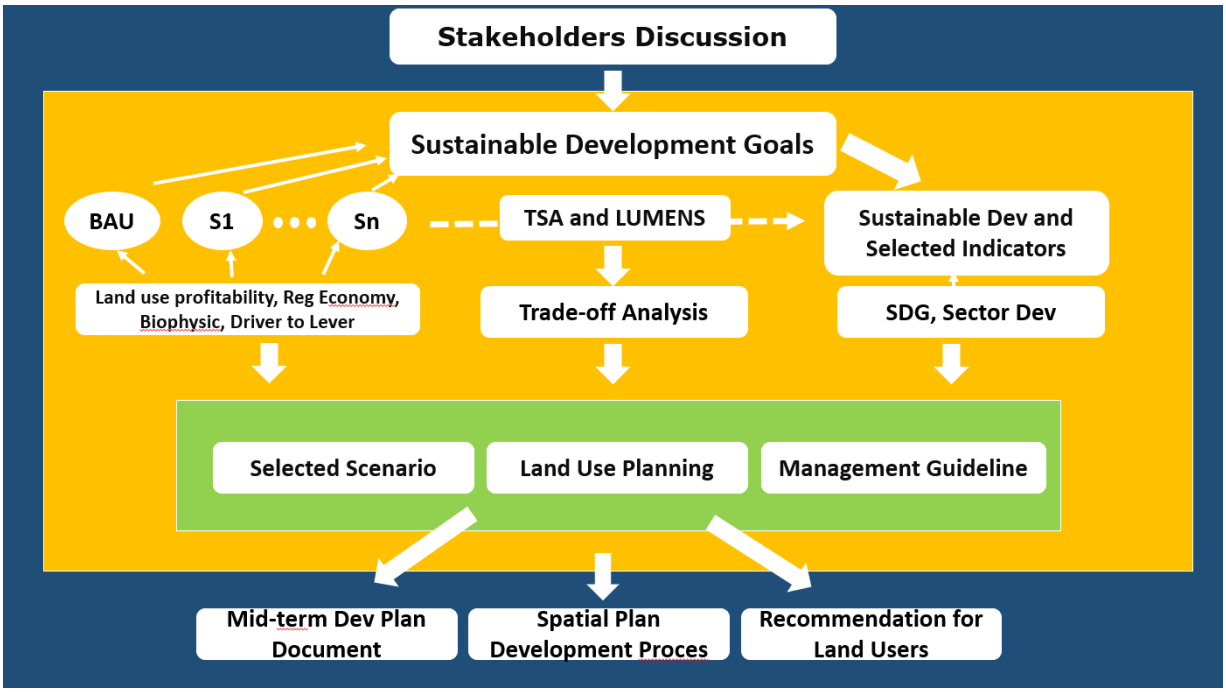
In developing SEM scenarios, it was important to understand the vision of Pelalawan stakeholders in achieving sustainability, breaking them down into specific objectives and building the set of indicators. The conservation targets were discussed as part of sustainable livelihood targets rather than conservation purposes per se. The terms *Sejahtera 1, 2 and 3* (Prosperous 1, 2 and 3, in English) were used to describe the Overshooting, Feasible and Compromised Conservation Target scenarios respectively. The SEM scenarios were to be aligned with the current formal development plan of Pelalawan and also to be formulated as a land use plan to ensure that these strategic economic sectors contribute significantly to growth while maintain ecosystem services for Pelalawan. The following section describes the overall discussion and consultation processes toward achieving an agreement on the conservation-sustainable livelihood targets.

2.1. Stakeholder consultation processes

The current Pelalawan's formal development target of RPJMD is economic growth from land-based economic sector without much consideration of environmental carrying capacity aspects. Social issues also arise due to competition over land, with only limited space is available for community to manage. Three workshops and focus group discussions were conducted in order to raise the awareness of local stakeholders about the importance of sustainable development that considers economic, environment and social pillars simultaneously. The consultation processes consist of ten distinct steps:

1. Presentation of the key principles of sustainable development to the key stakeholders in Pelalawan to stress the importance to include sustainable aspects in the development vision and the potential negative environmental impact that will be a barrier of long-term economic growth along with social impacts, if *Business-As-Usual* development scenario is implemented;
2. Series of presentation from each sector of government agencies (*Organisasi Perangkat Daerah*/OPD) regarding their sectoral goals and programs in contributing to sustainable development of Pelalawan;
3. Facilitated discussions in aligning conflicting views of OPD's to be compiled as input for their development activities;
4. Formulation of common visions across OPDs as Pelalawan sustainable development goals. Reaching consensus on the goals was an important step to further identify SEM scenarios and indicators;
5. Participatory process in defining the list of SEM indicators of the sustainable development goals that are specific, measurable and achievable;
6. Initial analysis on potential options and scenarios for SEM were presented to Pelalawan stakeholders in order to obtain their inputs and suggestions;
7. The SEM scenarios were refined based on stakeholders' suggestion and shaped into three land use planning scenarios: The Overshooting Conservation Target (OCT), Feasible Conservation Target (OCT) and Compromised Conservation Target (CCT);
8. Simulation of the scenarios using LUMENS software to obtain ex-ante impacts on the agreed SEM indicators;
9. The scenarios and indicators were presented back to Pelalawan stakeholders. Feedbacks on the scenarios and selection of the best options for land use planning in Pelalawan were stimulated;
10. The preferred scenario was further refined and translated into policy recommendation and action plan.

Figure 2.3 Framework for stakeholder consultation processes in developing the land use plan scenarios for Pelalawan



2.2. Agreed Sustainable Development Goals of Pelalawan

Through the discussions, the stakeholders agreed on some key elements of sustainable development goals of Pelalawan. Even though the agreed goals are not formalized and legally binding, they should be used to support the formal development planning process such as the preparation of the Pelalawan's RPJMD and RTRW because of the legitimate process of the multi-stakeholder discussions.

The goals of the sustainable development that have been agreed by the stakeholders consist of:

1. Sustainable economic growth;
2. Inclusive and equitable growth across sectors;
3. Social, economic and environmental security;
4. The safe, healthy, conducive and productive ecosystem in providing environmental services; and
5. Reduction of Green House Gas Emissions.

Figure 2.4 SDGs as references of the proposed key performance indicators of Pelalawan District

The process to discuss and agree on the goals of sustainable development in Pelalawan District was preceded by a discussion of the general development goals, i.e., 17 sustainable development goals at the global level. Series of discussion with local stakeholders have been conducted to map Pelalawan's development targets and their associated key performance indicators with the SDGs. The scope of the district's targets is mainly derived from the district's midterm development plan 2016-2021, with a few indicators and targets proposed during the discussions. To accurately match the national context, the indicators were mapped into national goals and targets as defined in the latest national SDG guideline (BPS, 2018).

Based on the information on the district's current development vision and missions obtained from discussion and desktop study, 5 out of 7 missions are in line with SDG (Table 1.1). Twenty-six key performance indicators have been proposed; all of which are linked with at least 13 SDGs (Figure 2.4). However, only seven indicators are directly related to the environment. An ambiguous classification of a national indicator, "access to land (indicator 5.A.1)", has been found in the national SDG guideline; people's access to land would fit better if mapped into the SDG number 10, which is concerned with equality, instead of SDG number 5, which is more focused on gender. All of the indicators are grouped into five general objectives for more straightforward interpretation by the local stakeholders

Table 1.1 Interlinkages between Agreed Sustainable Development Goal, District's Mission, and SDG indicators

Objective	District' s Mission	Key Performance Indicators	SDG(s) in link
Sustainable economic growth	VI. Improvement of investment and district's key resources management with a firm bottom-up basis and sustainable civic involvement	1. Economic growth (Measured by GRDP)	8
		2. Inflation	8
		3. Unemployment	8
Inclusive and just growth across sectors	I. Improvement of human resources with high competence, strong faith, and strong Melayu culture	1. Environment quality index	6, 14, 15
	II. Improvement of people and the ecosystem's health	2. Human development index	4
	IV. Boost infrastructure development	3. Health index	3
	V. Improvement of rural bureaucracy and autonomy	4. Education index	4
		5. Accessibility to road index	9
		6. Bureaucracy reform index	16
		7. Land ownership ratio	5 (should be 10)
Social, economic, and environmental security		1. Average people's saving/asset/wealth index	10
		2. Conflict resolution	16
		3. Per capita expenditure (million/year)	1
		4. District security index	16
		5. Farmers income	2
		6. Smart city index	11
		7. Rural development index	10
Healthy and productive ecosystem for optimal ecosystem service provision	II. Improvement of people and the ecosystem's health	1. Fire-prone area	15
		2. Deforestation rate	15
		3. Erosion and sedimentation	6
		4. Degree of Integration of Focal Area (habitat)	15
Greenhouse gas emission reduction		1. Emission from land-use change & cultivation	13
		2. Emission from peatland degradation and cultivation	13
		3. Emission from waste	13

03

Business as Usual Baseline and SEM Intervention

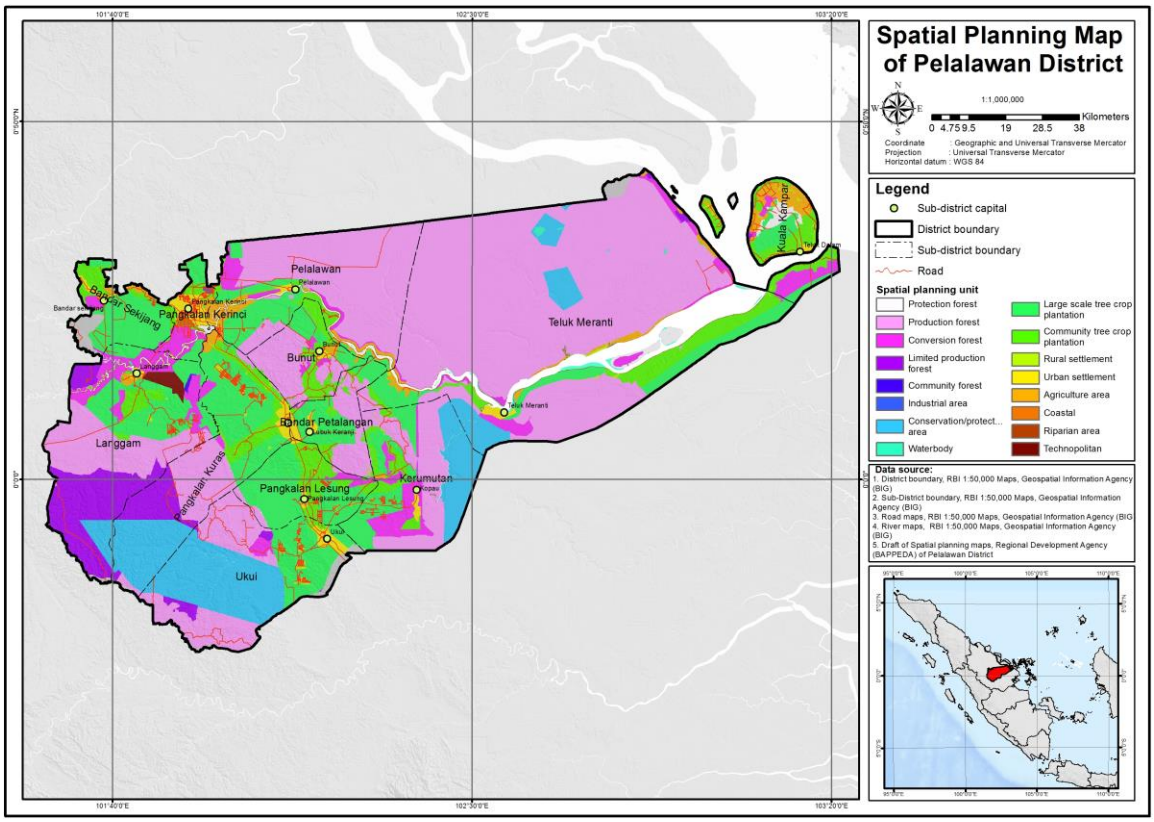
3. BAU and SEM Scenarios

Based on the consultation processes described in Chapter 2, land use planning scenarios were developed. The scenarios are classified into two classes: (1) The Business as Usual (BAU) scenario and; (2) The Sustainable Ecosystem Management (SEM) scenario. The BAU scenario was used as a baseline to measure the performance of SEM scenarios against agreed indicators as mentioned in Chapter 2. This section will present detailed descriptions of both BAU and SEM scenarios.

3.1 BAU Scenario

The BAU scenario was developed based on the current draft of Pelalawan's spatial plan (RTRW) (Figure 3.1). In the current plan, 9.8% of the total area of Pelalawan (130,112 ha) were allocated for conservation/protection area, and the remaining areas were allocated for designated cultivation area. In spite of the conservation and protection status designated by RTRW map, this particular BAU scenario allows future land use transition to keep the patterns of the past land use/cover change (LUCC) (2015-2018). Therefore, it is very likely that some forest degradation and conversion occur in protected and conservation area as it happened in the past due to weak governance and law enforcements.

Figure 3.1 BAU scenario map based on current draft of Pelalawan Spatial Plan



3.2. SEM Intervention

The Sustainable Ecosystem Management (SEM) scenarios consist of two distinctive intervention:

1. Intervention-1: Protection of important and high ecosystem value areas; and
2. Intervention-2: Forest and landscape restoration in conservation and protected areas.

The interventions were selected based on the review of the current policies and regulation related to ecosystem protection and restoration in Indonesia. The list of regulations that were used as the basis of the scenario intervention is presented in Table 3.1. The scenario intervention maps were developed based on several geospatial data of Pelalawan. The data are:

1. Pelalawan Spatial Planning Map (RTRW) is based on: (1) Agrarian & Spatial Plan Minister Regulation No. 1/2018 on Guidelines to Prepare Provincial, District and City spatial plans, and (2) Public Works Minister Regulation No. 16/2009 on Guidelines to Prepare District Spatial Plans.
2. Maps of Peat Hydrological Units (KHG) based on: (1) Environment and Forestry Minister Regulation No. 130/2017 on Peat Ecosystem Function (FEG). Damage in protected peat areas cannot be compared to the cultivation areas due to the time they need to recover. Government Regulation No. 57/2016 states that protected peat ecosystem functions are considered damaged if: (a) there is artificial drainage in the peat ecosystem with a predetermined protection function; (b) there is exposure to pyrite and / or quartz sediments under the peat layer; and/or (c) there is land cover volume and/or area reduction. A cultivated peat area is categorized as damaged if it meets these conditions: (a) groundwater level on peat land is more than 0.4 m below the peat surface at the compliance point; and / or (2) exposure to pyrite and / or quartz sediments below the peat layer.
3. HCV/HCS maps: Forestry Law No. 1/1999, Law No. 26/2007 on spatial planning and Law No.5/1990 on biological resources and ecosystems conservation. Through these documents, land status is divided into two types: protected and cultivated. The protected area is allocated for flora and fauna conservation, and therefore needs to be in line with the protected and conservation forest maps, as well as HCV and HCS maps as stated in these Laws for the data used in planning process. Moreover, it also in line with the SDGs that encourage economic growth and development by ensuring that natural assets are available to provide environmental services and sustainably welfare.

Table 3.1 Policies for Management Guidelines

	Intervention-1 Protection of important and high value ecosystem	Intervention-2 Restoration of degraded land in protected area
Law No. 5 /1990 on Forest Resources Conservation		v
Law No. 41/1999 on Forestry	v	v
Law No. 32/2009 on Environmental Protection and Management	v	
Government of Indonesia Regulation No. 83/2011 on River		v
Government of Indonesia Regulation No. 6/2007 on Forest Management and the Development of Forest Management and Utilization	v	
Government of Indonesia Regulation No. 57/2016 *junto* Government of Indonesia Regulation No. 71/2014 on Protection and Management of Peatland Ecosystem	v	v

Minister of Agriculture Regulation No. 11/2015 on Indonesian Sustainable Palm Oil Certification	v	
Minister of Environment and Forestry Regulation No. 76/2015 on Criteria for National Park Management Zones and Block Management of Nature Reserves, Wildlife Reserves, Forest Parks and Nature Parks		v
Minister of Public Work and Housing No. 28/2015 Designation riparian border and lake riparian		v
Minister of Agrarian and Spatial Planning Regulation No. 7/2017 on Management and Guidelines in Applying for Business Licenses	v	
Minister of Environment and Forestry Regulation No. 6/2016 on Procedures for the Release for Conversion of Forest Area	v	
Minister of Environment and Forestry Regulation No. 83/2016 on Social Forestry	v	
Minister of Environment and Forestry Regulation No. 7/2017 on the Development of Plantation Forest	v	
Minister of Environment and Forestry Regulation No. 16/2017 on Technical Guideline for Peatland Ecosystem Recovery		v
Director General of Watershed and Protected Forest management, Ministry of Environment and Forestry Regulation No P.4/Pdashl/Set/Kum.1/7/2018		v

a. Overshooting Conservation Target (OCT) Scenario

The OCT scenario incorporated protection and conservation functions into the RTRW map by taking into account the indicative peat ecosystems function (*Peta Fungsi Ekosistem Gambut*/FEG) as well as the High Conservation Value/High Carbon Stock (HCV/HCS) areas identified in Pelalawan (Figure 3.2). The FEG map indicates additional protected area on peatlands. Natural forest cover in the conservation or protection land in the current RTRW, HCV/HCS and FEG are subject to strict protection. Degraded land uses, e.g., shrub, grass, and cleared land in protected/conservation area will be restored into natural forest cover or other land uses which are suitable for restoration purposes such as agroforestry. The restoration target also aims to restore agricultural land uses that were not developed in accordance with the spatial plan regulations.

As indicated in Figure 3.2, the OCT scenario would reduce the designated cultivation zone in Pelalawan to cover only 47% of the total district area. This scenario assumed that degraded peat ecosystems are to be protected and restored. This scenario also suggested that the use of peatlands by the community and large-scale companies for various cultivation activities must be halted. Under the OCT scenario, the potential newly created conservation/protected area to be proposed (against the BAU) in the spatial plan/RTRW is showed in Table 3.2.

Figure 3.2 Overshooting Conservation Target Map

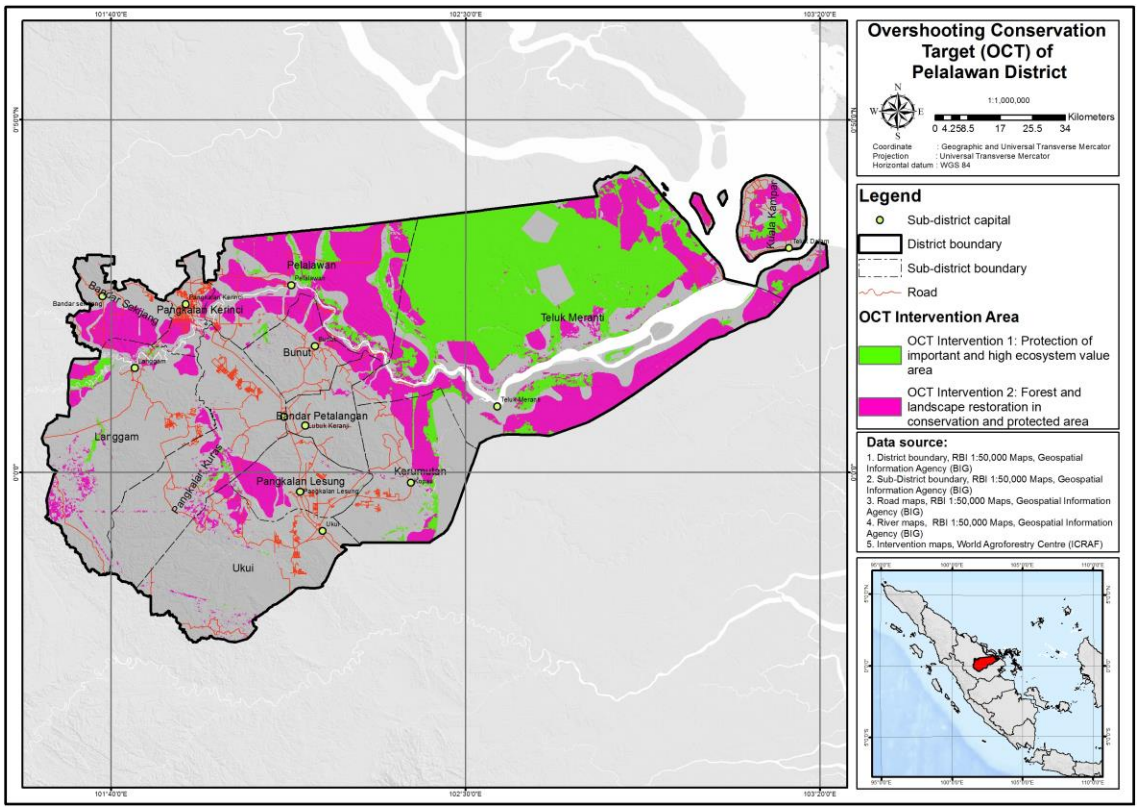


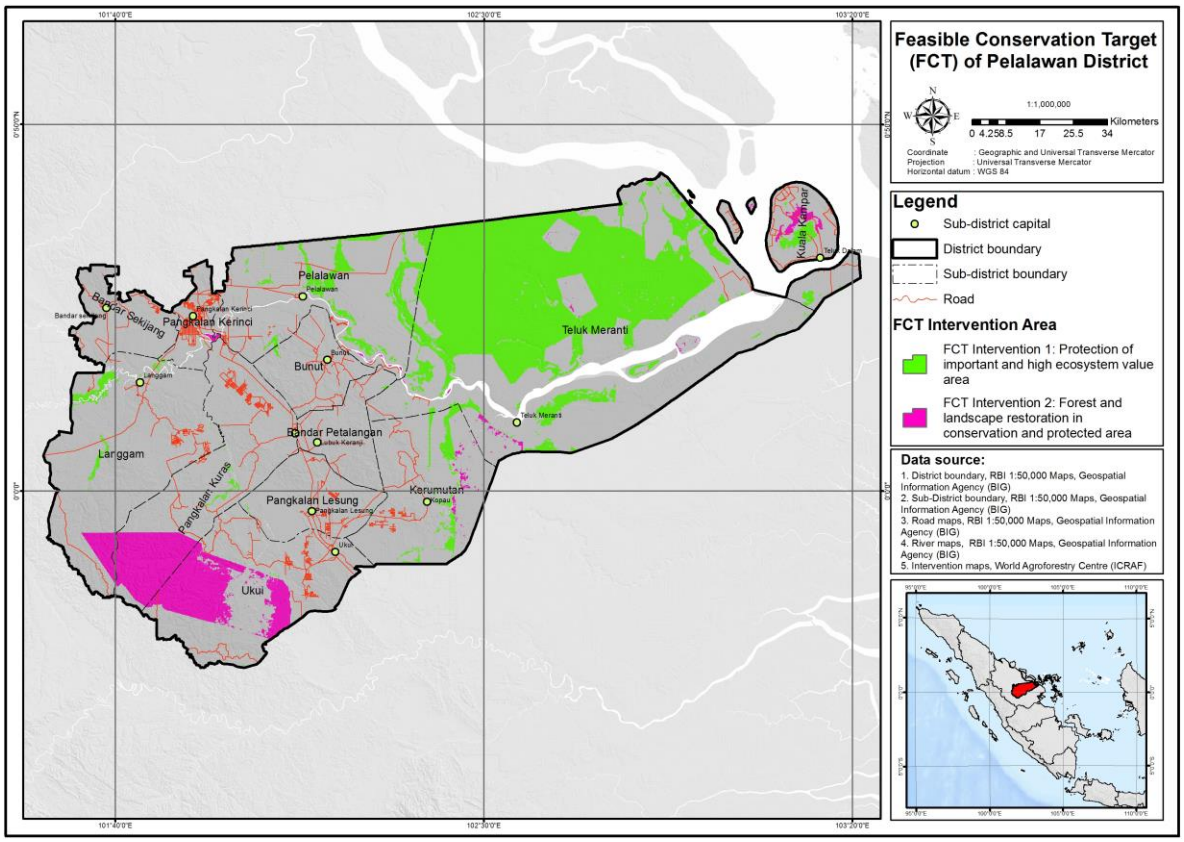
Table 1.2 Overshooting Conservation Target Area

Spatial plan zone	Intervention 1: Protection of important and high ecosystem value area (Hectare)	Intervention 2: Forest and landscape restoration in conservation and protected area (Hectare)
Protection forest	71	67
Production forest	236,325	166,196
Conversion forest	6,718	18,663
Limited production forest	1,467	7,979
Community forest	0	114
Conservation/protection area	508	169
Waterbody	134	260
Large scale tree crop plantation	3,539	75,287
Community tree crop plantation	877	22,093
Rural settlement	107	935
Urban settlement	5	657
Agriculture area	1,843	9,633
Riparian area	423	383
Grand Total	**252,028**	**302,570**

b. Feasible Conservation Target (FCT) Scenario

The intervention scope of FCT scenario is similar to the OCT scenario, except in terms of its restoration targets. While OCT included the restoration of cultivated peatlands categorized as protected peat area in the FEG map, in FCT Scenario, such area was excluded from the restoration target. This is largely because the land swap mechanism of the cultivated land on the protected peats is still unclear. In other words, (1) strict protection status would be applied across forested areas within protected/conservation areas defined in RTRW and FEG, and (2) restoration outside the current protected/conservation areas would take place only in abandoned, non-productive land, such as shrubs and cleared land.

Figure 3.3 Feasible Conservation Target Map



In general, FCT scenario (Figure 3.3) provided flexibility or accounted for existing land use conditions in the district. Various land management/cultivation activities that have been carried out will be excluded from the proposed conservation area. This alignment process is important to match the discrepancy between plans and the real conditions. If the delineation of conservation areas does not take into account the real field condition, restoring these areas back to the original functions ecologically will be very difficult due to social and political barriers in evicting the communities and other land users from their current managed areas. Nevertheless, this scenario still accounted for the presence of HCV/HCS and protected peats to be recommended as conservation areas as shown in the table below. Under FCT, some potential, new conservation/protected area was proposed (against the BAU) in the spatial plan/RTRW. Table 3.3. describes in detail the FCT's two intervention areas.

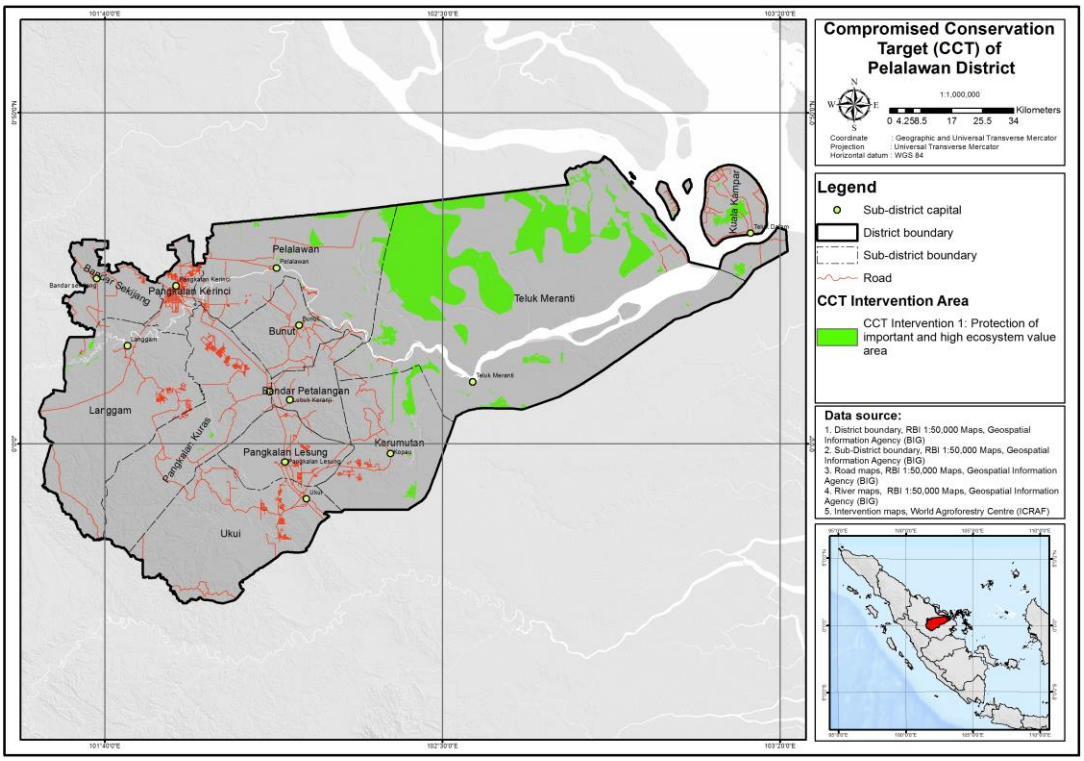
Table 3.3 Feasible Conservation Target Area

Spatial planning	Intervention 1: Protection of important and high ecosystem value area (Hectare)	Intervention 2: Forest and landscape restoration in conservation and protected area (Hectare)
Protection forest	0	3,638
Production forest	236,611	0
Conversion forest	6,641	0
Limited production forest	1,479	0
Conservation/protection area	0	65,705
Large scale tree crop plantation	3,563	0
Grand Total	**248,294**	**69,377**

c. Compromised Conservation Target (CCT) Scenario

This CCT scenario (Figures 3.4) proposed the protection and conservation functions on the RTRW map to be combined with the indicative FEG protection and forest cover. This scenario would protect the area based on the designated conservation or protection zones in the current spatial plan (RTRW) map. Within these zones, forest cover would be maintained while land use/covers other than forests (e.g. shrub, grass and cleared land) would be ecologically restored. In addition, beyond the conservation or protection zones of RTRWP, those areas that fall under the protected peatland zone (FEG-Lindung) designated by the Ministry of Environment and Forestry (MoEF) and are still forested, would be proposed as new protected areas to be incorporated into the RTRW.

Figure 3.4 Compromised Conservation Target Map



Under the CCT scenario, the potential newly created conservation/protected zone to be proposed (against the BAU) in the spatial plan/RTRW showed in Table 3.4.

Table 3.4 Compromised Conservation Target Area

Spatial planning	Intervention 1: Protection of important and high ecosystem value area (Hectare)	Intervention 2: Forest and landscape restoration in conservation and protected area (Hectare)
Protection forest	30	0
Production forest	121,446	0
Conversion forest	1,441	0
Limited production forest	221	0
Conservation/protection area	378	0
Large scale tree crop plantation	3,288	0
Community tree crop plantation	224	0
Urban settlement	2	0
Agriculture area	16	0
Grand Total	**248,294**	**0**

04

Ex-Ante Analysis of SEM Indicators

4. Ex-ante Analysis of SEM Indicators

4.1 Agreed List of Indicator

In the TSA, the selection of indicators is a very important step to determine the best choice of the several scenarios offered to the stakeholders. The determination of indicators was carried out by capturing the input and opinions of stakeholders presented in cross-OPD session in Pelalawan District. This process, as explained above, use the sustainable development goals of Pelalawan District as the main reference.

Based on the agreed five sustainable development goals, the stakeholders presented various proposed indicators in accordance with their authority. The indicators were then collected into further discussion and tested using the "SMART" principle summarizes key criteria, asking "Is the indicator specific, measurable, attainable, relevant and trackable?" Specific means that there is clarity about what is being measured, and whether the appropriate level of disaggregation is specified. Measurable means that the changes are objectively verifiable. Attainable/Achievable means that changes are anticipated as a result of the activities/interventions. Relevant means that the indicator captures the essence of the desired result, and Trackable indicates that the data are actually available at reasonable cost and effort.

By taking into account the SMART principle, several proposed indicators were selected using the agreement of the stakeholders. The final decision was made by also considering the current availability of the data. The main revelation found during the entire process was that despite the very strong priorities of economic development achievements agreed upon by most participants, environmental indicators were agreed as an important and integral part of sustainable development in Pelalawan District. These indicators (Table 4.1.) must also be measured and monitored in the future.

Table 4.1 List and definition of SEM indicators

No	SEM Indicators	Definition
1	Deforestation (ha/yr)	Total annual conversion area of natural forest into other non-natural forest land uses. The total area was obtained through comparison of simulated land use maps under different scenarios.
2	Percent of tree cover (%)	Total area of all tree-based system classes in the simulated land cover maps divided by the total area of Pelalawan. This includes both monoculture tree crop plantation such as rubber and oil palm, and also mixed tree-based system such as agroforest area.
3	Area of agroforest (%)	Total area of agroforest in the simulated land use maps of Pelalawan. Agroforest is considered as land use type which can provided economic benefits while still providing some ecological function through tree cover. Types of agroforest in Pelalawan are rubber agroforest, coconut agroforest and mixed garden.
4	Habitat integration (unitless index)	Habitat fragmentation measured using Total Edge Core are Index (TEC) described in Dewi et al, 2012. TECI was calculated using edge contrast weights for each land-use/land-cover type in Pelalawan District. The TECI of a sub-landscape ranges from 0 to 100. The TECI approaches 0 when every dense forest pixel in the sub-landscape is surrounded only by non-contrasted pixels, that is, by other dense forest pixels. The TECI approaches 100 when all edges for each pixel in the sub-landscape are of maximum contrast, for example, in a sub-landscape where any dense forest pixel is surrounded by settlement pixels.

5	Greenhouse gas emission (Mton)	Total of greenhouse gas emission associated with the agriculture, forest and other land uses activities in Pelalawan. The emission was calculated using stock difference approach (IPCC, 2008), calculated using carbon stock value from field measurement in Pelalawan and ICRAF internal database of carbon stock for various land uses in Indonesia
6	Gross Domestic Regional Product (GDRP)	GDRP estimation was calculated using simulation of Input-Output model based on 2017 I-O Table of Pelalawan. The forecasting method is based on the method described in Hubacek, 2001 paper. Land distribution coefficient for each of the economic sectors within the I-O table was estimated using simulated land use/cover map of Pelalawan.
7	Income per capita (AE)	Using a method similar to GDRP forecasting, income per capita was calculated as a shared of GDP divided by the estimated population of Pelalawan using 2015-2017 population growth.
8	Labor absorption	Based on GDRP forecasting, labor multiplier was calculated for the baseline scenario of 2017. Future labor absorption was based on the labor multiplier and the simulated GDRP of Pelalawan.
9	Emission intensity (ton CO2/juta IDR)	Emission intensity was calculated as a ratio of simulated GHG emission and GDRP.

4.2. Ex-Ante Analysis

The crucial part of simulating the ex-ante analysis is projecting Pelalawan's land use dynamics in the future (i.e., until 2039) in a spatially explicit manner. The land cover 2039 was used for the ex-ante analysis. The projection of land use/cover changes was built using land cover maps of the periods of 2012, 2015 and 2018. The simulation produces three yearly land use/cover projection map series until 2039 for each intervention scenarios. The analysis result showed that the forest land cover in Pelalawan District would be disappearing and degrading if the BAU scenario was going to be used for the development plan. Similar trend was shown for the Compromised Conservation Target (CCT), where the forest degradation rate was higher than the other scenarios. Based on the forest degradation rate of the BAU scenario, the forest degradation area chronologically was shown for the period 2018-2024.

Figure 4.1 BAU scenario land cover maps of Pelalawan District

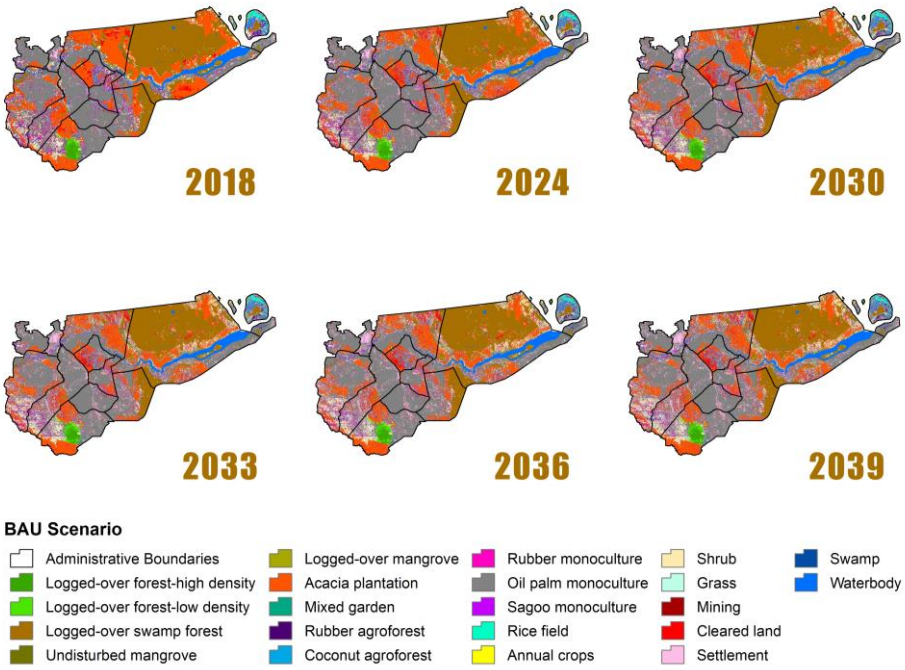


Figure 4.2 Overshooting conservation target scenario land cover maps of Pelalawan District

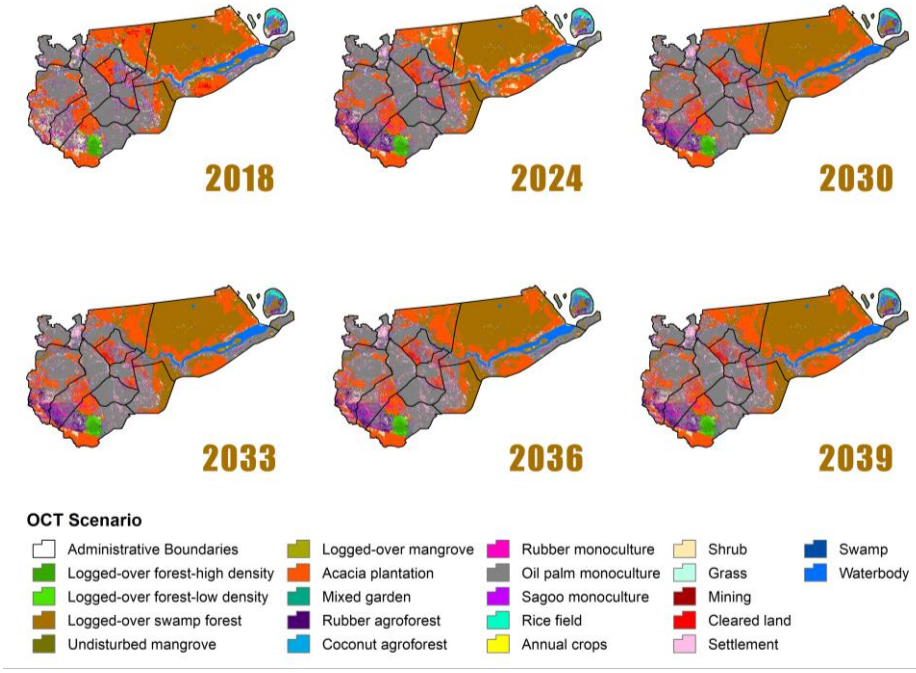


Figure 4.3. Feasible conservation target scenario land cover maps of Pelalawan District

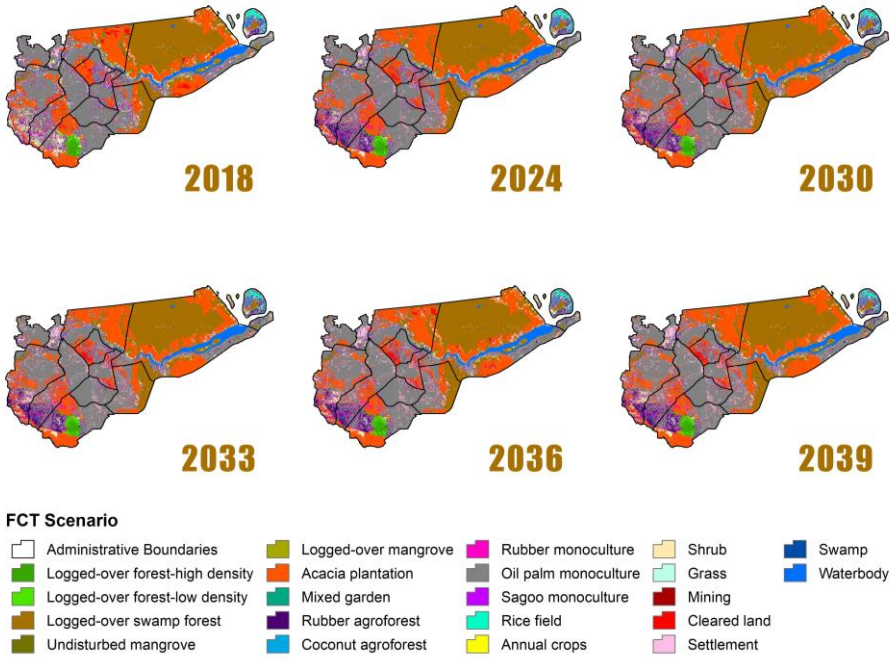


Figure 4.4 Compromised conservation target scenario land cover maps of Pelalawan District

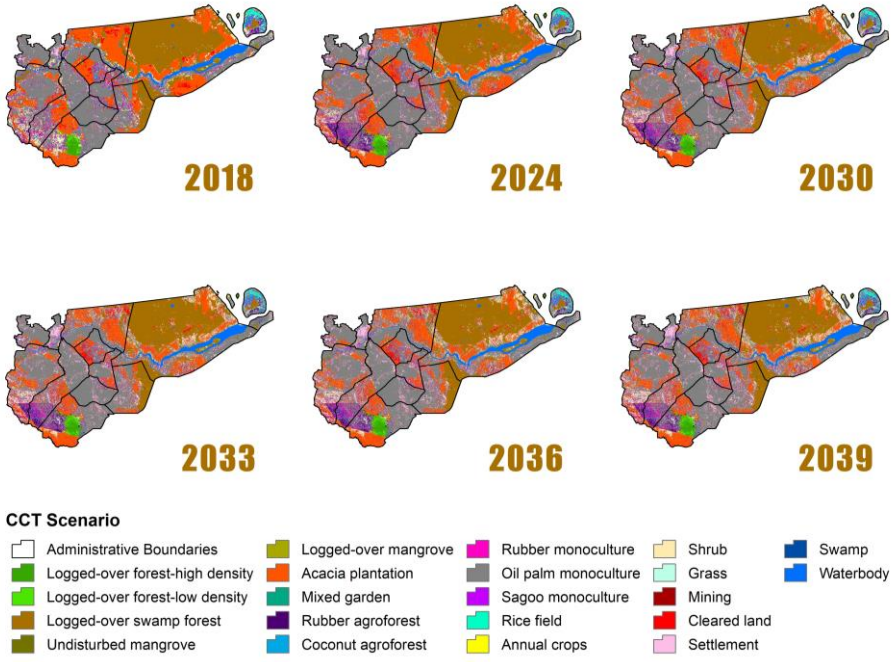


Figure 4.5 Natural forest cover of Pelalawan District year 2018 - 2039

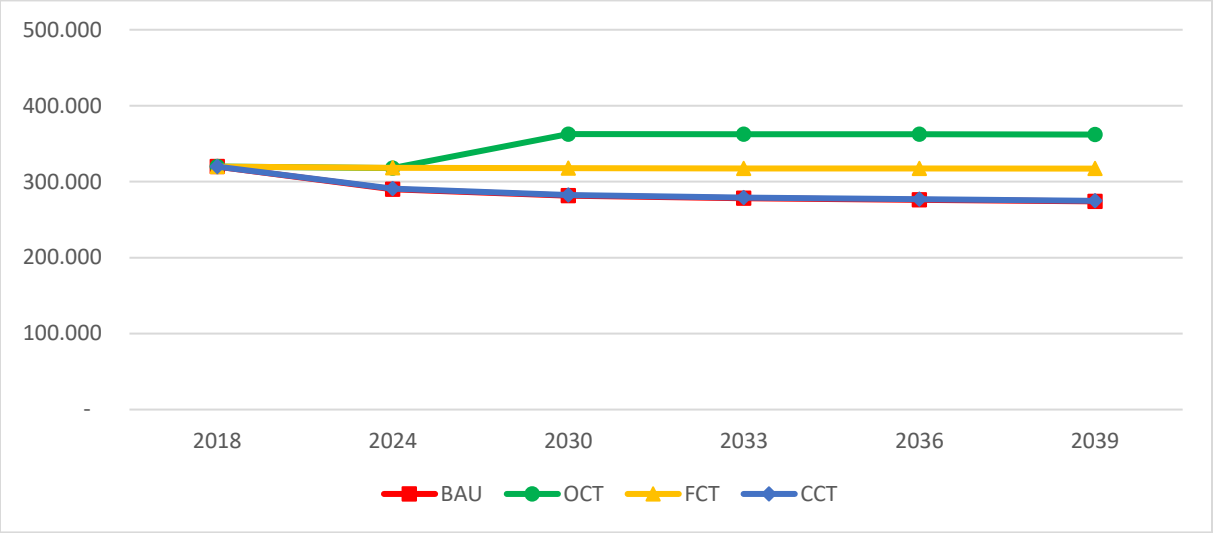


Figure 4.6 Non-productive land cover of Pelalawan District year 2018 - 2039

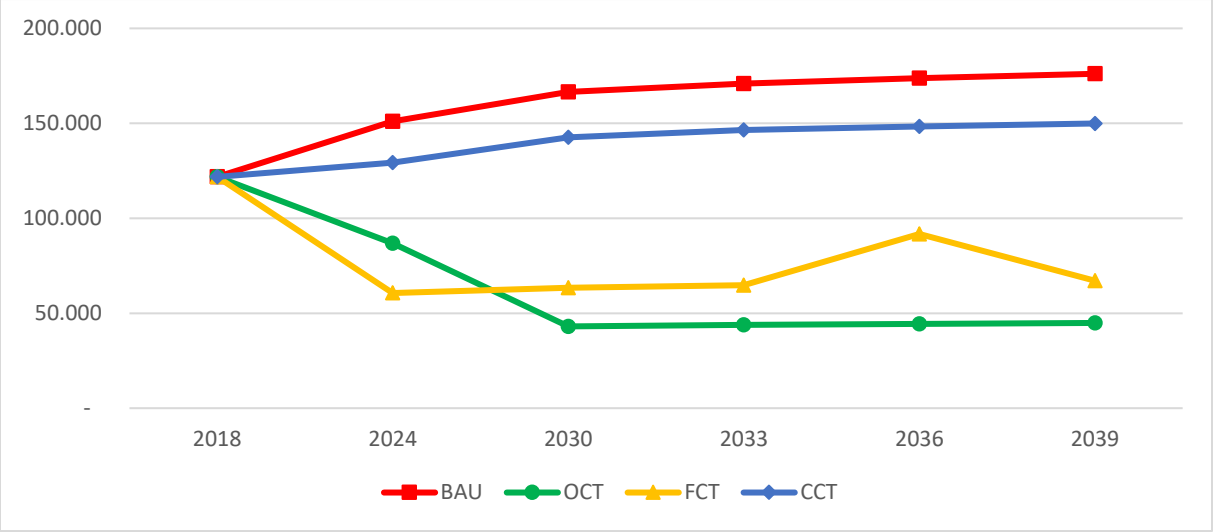


Figure 4.7 Agriculture land cover of Pelalawan District year 2018 - 2039

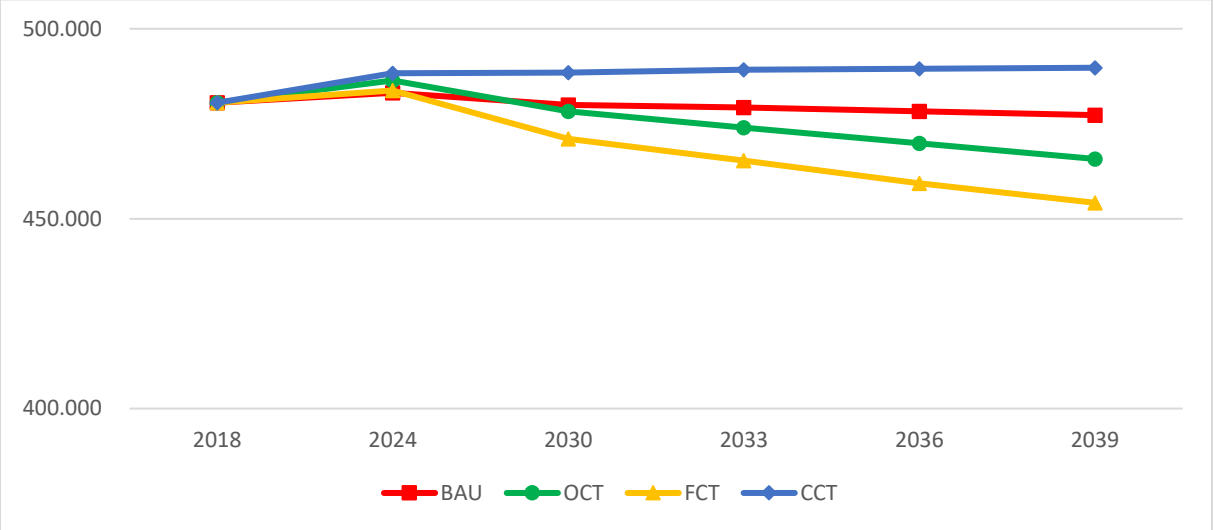
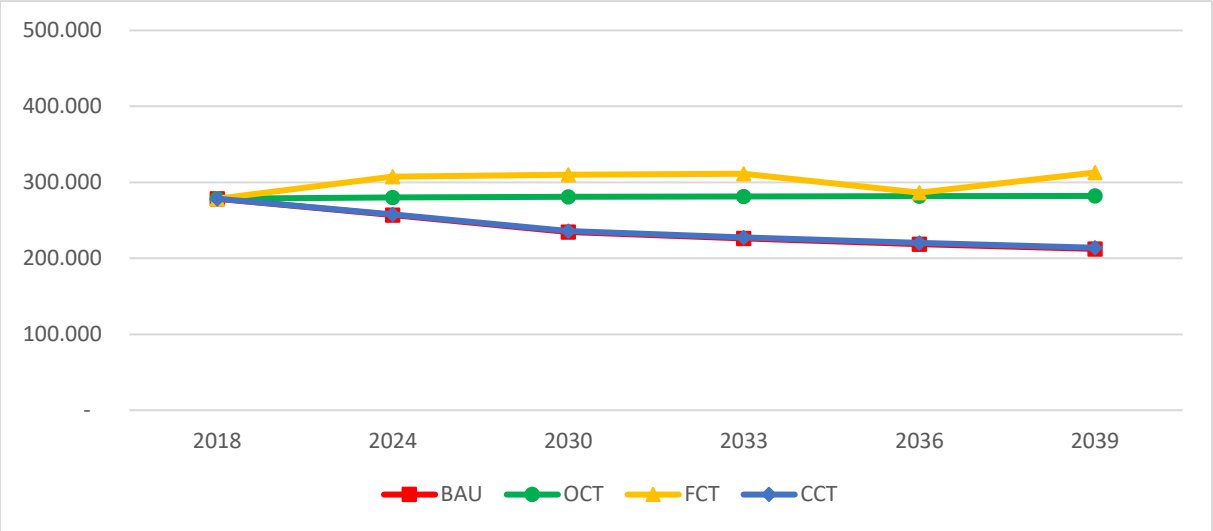


Figure 4.8 Forest plantation land cover of Pelalawan District year 2018 - 2039



The currently-scarce natural forest cover was foreseen to undergo a steady decline in the future under the Business as Usual (BAU) scenario (Figure 4.1). Under the CCT scenario, the forest area would also undergo a decline in the near future but then stabilize, compared to the steady decline shown by the BAU scenario. This was influenced by the land allocation in BAU and CCT scenarios that do not restrict expansion of intensive land uses in protected areas. OCT scenario focused on the protection of the natural forest and restoration of degraded lands. Under this scenario, natural forest cover was recovering significantly in magnitudes that depended on the amount of land to be set aside and/or restored in each scenario. Such optimistic scenarios were developed on the basis of a set of assumptions formulated from various scientific sources (Rahayu, 2019 & Kobayashi, 2015). Both sources agreed on the near-linear carbon accumulation rate throughout the regeneration of peat forest. It has been estimated that the succession from cleared land into medium density forest could occur in 15 years. Kobayashi (2015),

however, a rapid recovery of peat forest could only be achieved when regeneration processes were being assisted through intensive anthropogenic activities.

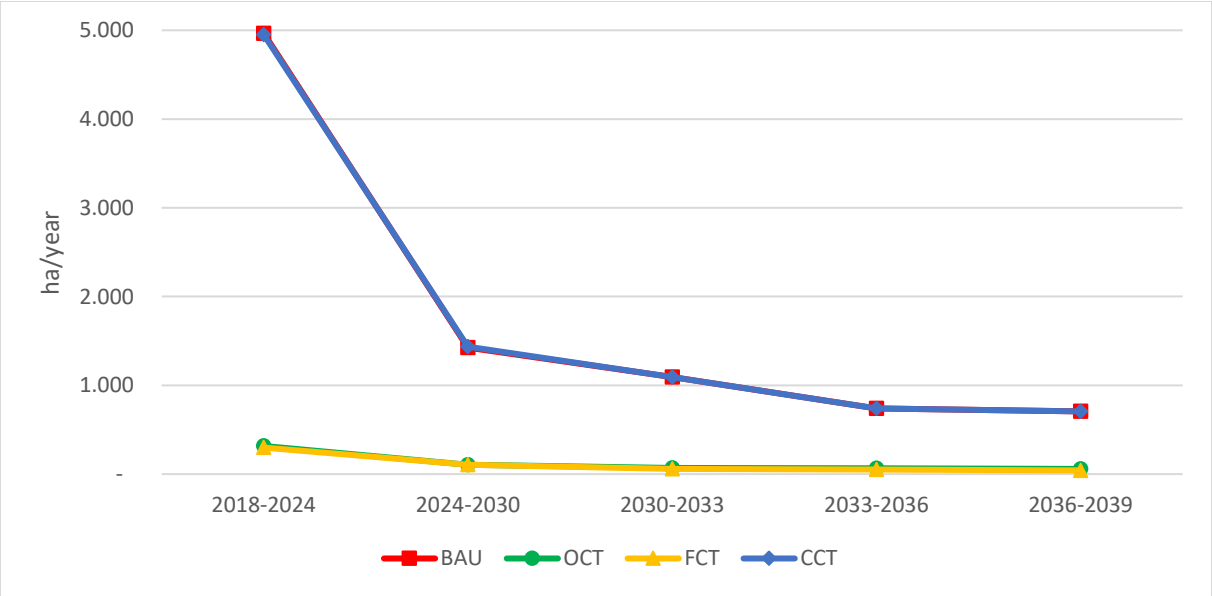
In the course of the natural regeneration processes, especially the ones taking place on formerly cultivated lands, a considerable occurrence of non-productive (i.e shrub, grass and cleared land) could be seen from the data. The sudden expansion would be directly followed by a rapid decrease as the succession reached the later stage into forest regrowth. Eventually, by the end of the simulation period in 2039, OCT and FCT scenarios would have a relatively smaller area of non-productive land compared to BAU.

On the other hand, the natural forest area expanded under FCT, OCT and CCT scenarios. Such phenomenon was the consequence of the expansion of protected areas followed by restoration activities. Under the conservation scenarios, the crops in such areas were cleared out and then restored into natural forest. Ambitious scope of the OCT scenario, which assigned protection status and restoration actions on the currently unprotected area of high conservation value or high carbon stock, was the main factor which caused the significant decline of cultivation land area. The FCT scenario was a scenario with conservation considerations that were more tolerant of existing conditions; the determination of new protected areas was carried out while still considering other land uses. So that in this scenario forest cover tended to remain stable, while the area of forest plantations could continue to grow.

4.2.1 Deforestation

In the BAU and CCT scenarios, the rate of deforestation occurred continuously in each analyzed period. Especially in the period 2018-2024, the rate of deforestation had the highest rate compared to other periods. Deforestation rates in this period were recorded at 4,967 ha/year in the BAU scenario and 4,950 ha/year in the CCT scenario. This value was equivalent to the deforestation rate of 1.55%/year in both scenarios. Trends in deforestation rates continued until the end of the analysis period at a slow rate. Different conditions were found in the OCT and FCT scenarios: in both scenarios (more conservative than other scenarios), the rate of deforestation could be held back by various protective measures. Natural forest cover would continue to decline but at a very small rate and continued to slow down in the range 0.1-0.02% / yr in each period of analysis.

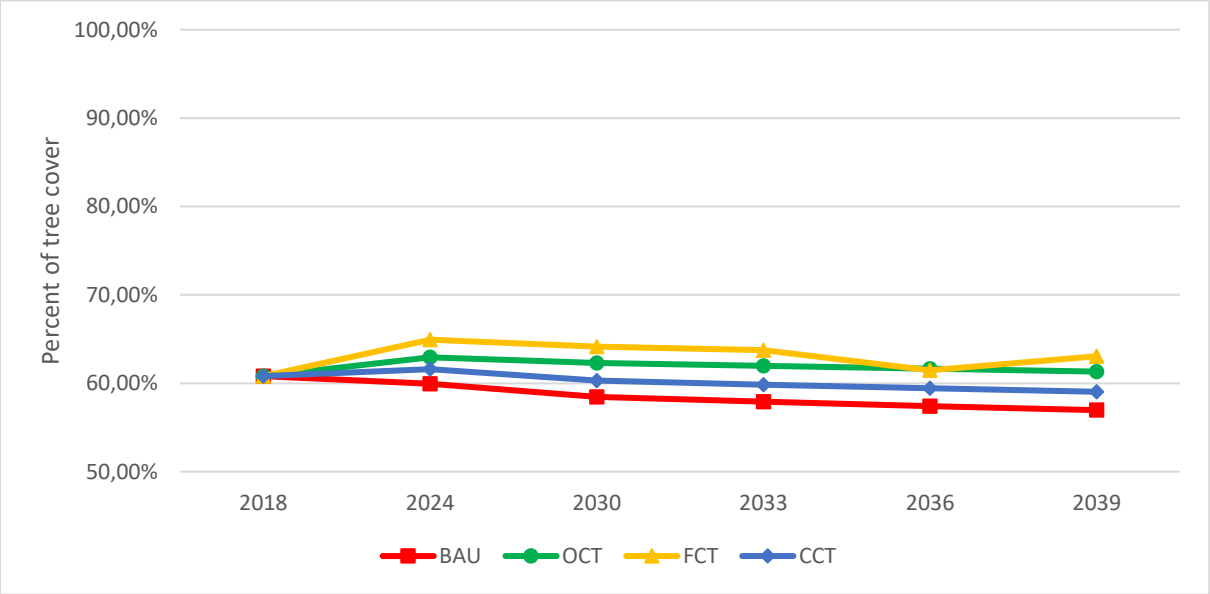
Figure 4.9 Simulated deforestation rate of Pelalawan District



4.2.2 Tree Cover

Compared to the BAU scenario, all SEM scenarios had a higher percentage of tree cover area with a magnitude corresponding to the set aside based on the assumptions built in each scenario. The FCT scenario had the largest tree cover area compared to other scenarios with fluctuating trends. At the end of the analysis period, each scenario had the following values, BAU (56.96%), OCT (61.33%), FCT (63.05%), and CCT (59.04%). Even though the non-forest plantation in the FCT scenario had the smallest area, the high percentage of tree cover in this scenario was influenced by the area of forest plantation allocated. Interesting conditions can be found in 2036, where the area of tree cover decreased but then increased again at the end of the 2039 period. This was due to the influence of forest plantations, which were predicted to rejuvenate in that year so that it affects the area of tree cover.

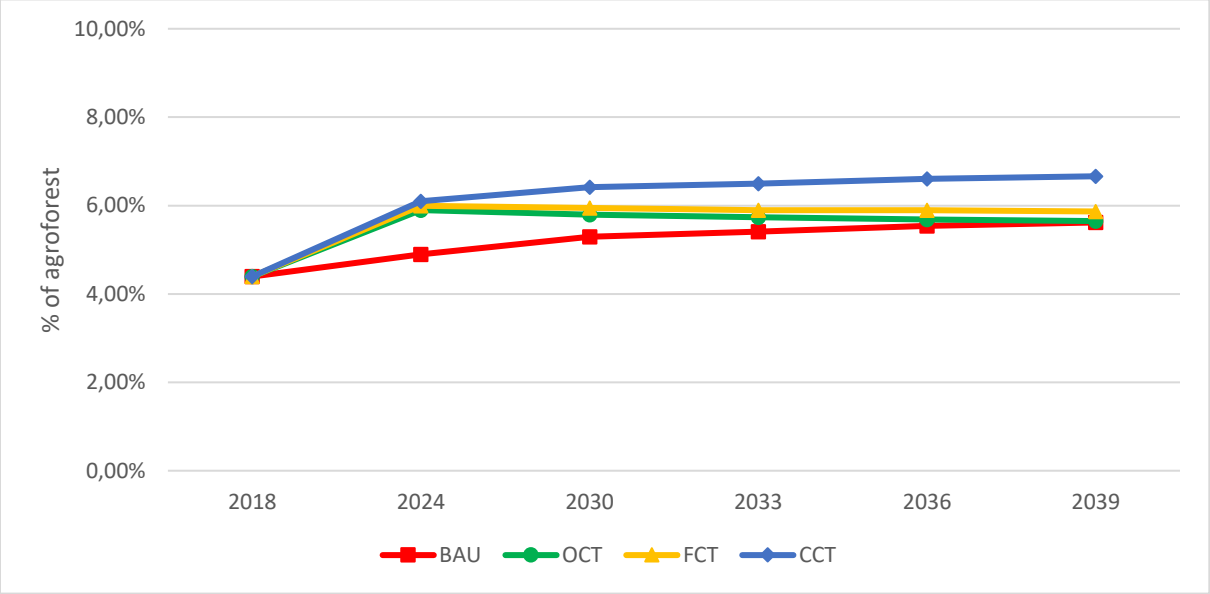
Figure 4.10 Tree cover percentage of Pelalawan District year 2018 – 2039



4.2.3 Agroforestry

The comparison between all the scenarios, built into the percentage of agroforest cover, showed quite interesting results. The CCT scenario had a higher percentage value trend than other scenarios. This trend occurred since the period of 2024 where the increase occurred with the assumption of high use of not-productive land into agroforestry. The FCT scenario had a value that was a relatively stable trend. While the OCT scenario had a similar trend in the period of 2024 but continued to decline until the end of the 2039 period.

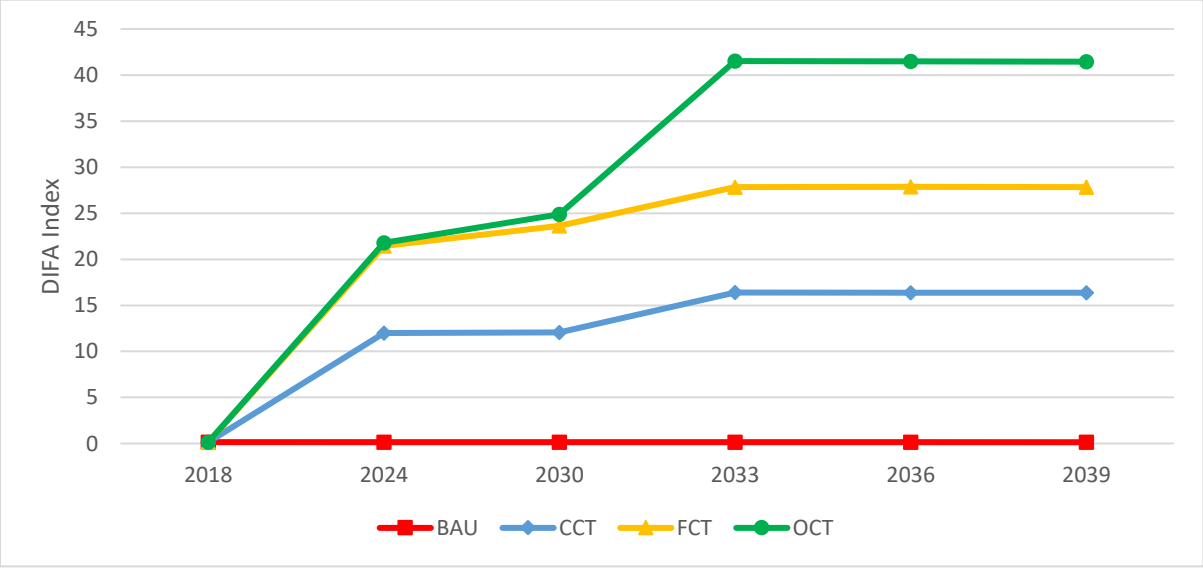
Figure 4.11 Agroforest area of Pelalawan District year 2018 – 2039



4.2.4 Habitat Integration

A home for Tesso Nilo National Park and a number of nature reserves, Pelalawan District plays an important role in conserving habitats for biodiversity. However, the protected status of the land has often been violated and forests have been converted into plantations. Massive habitat destruction has been pushing the extent of natural habitat cover into a concerning limit that, if being left uncontrolled, will lead to extinction of key species. The shrinkage of habitat, which is often followed by its fragmentation, is one of the driving factors of escalation of wildlife-human conflict in Pelalawan, a situation that will push species further into the brink of extinction.

Figure 4.12 Pelalawan's DIFA dynamics in four different scenarios



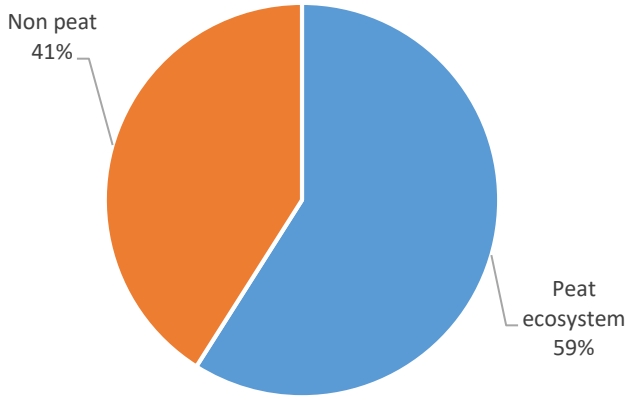
Habitat loss and fragmentation concepts, which are rather difficult to fathom except by biologists, were measured as a simple index developed by Dewi et al. (2013). The index, referred to as Degree of Integration of Focal Area (DIFA), depicts the effects of land use/cover changes on the integration of natural habitat. DIFA value is sensitive to the land use/cover changes occurring on habitat patches and its surroundings. Higher DIFA value is observed in landscapes with bigger habitat area and more integrated habitat patches.

The severity of habitat disintegration in Pelalawan District was represented by the near-zero DIFA values in the present time and in the future in the BAU scenario. The possibilities to restore the habitat integration into a safe level, between DIFA value 10-30 (Hanski, 2011), were demonstrated in SEM scenarios. in all the conservation target scenarios says that, by 2024, the DIFA value of overshooting conservation target (OCT) scenario was expected to reach a safe level of 21.7 followed by feasible conservation target scenario of 21.4 and compromised conservation target (CCT) scenario of 12.02. Based on the scenario, the year of 2033 became the optimum of DIFA level for all SEM scenarios with the assumption that all SEM scenarios went according to plan (see Figure 4.12).

4.2.5 Green House Gas Emission

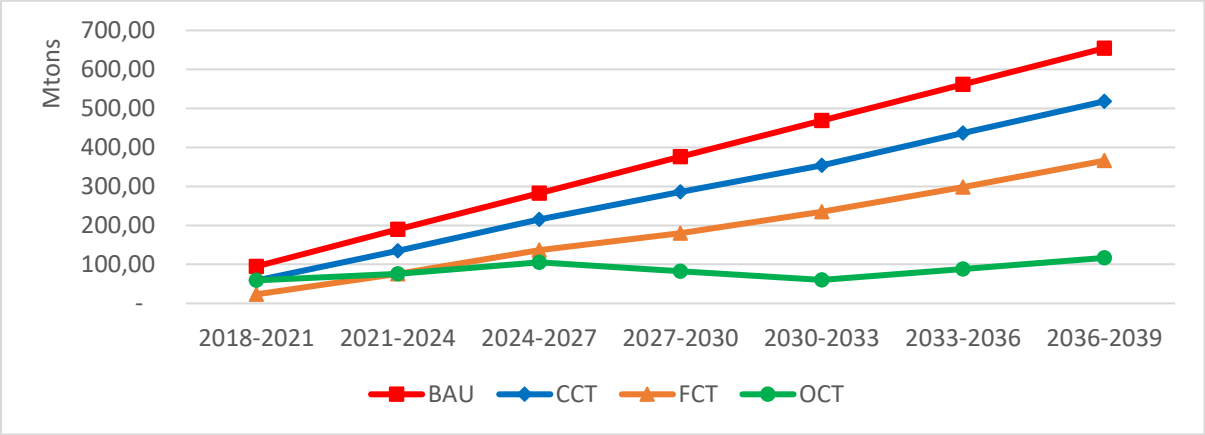
Pelalawan District is one of the developing districts in Riau province. As a developing district, Pelalawan district relies on the management of productive land into economic value commodities. As a result, land use changes in Pelalawan district have become quite dynamic over the past few years. This land use changes have an impact on the release of carbon into emissions. On the other hand, land use change from low stock carbon to high stock carbon can result in sequestration. To calculate carbon emission and sequestration, this study used stock difference method. Calculation of emission sources in Pelalawan district was divided into two categories, for peat ecosystem and non-peat ecosystem areas. Peat and non-peat areas were determined based on peat ecosystem function map. Figure 4.13 shows that 59% (785,840 ha) of the area of Pelalawan District comprises peat ecosystems and 41% is a non-peat ecosystem area. Peatlands have abundant organic content and are formed over a long period of time so that land use change can cause a significant release of emissions.

Figure 4.13 Peat ecosystem proportion in Pelalawan District



Carbon emissions estimation was conducted based on carbon stock data at the plot level and the simulated land cover maps under OCT, FCT and CCT scenarios. Land cover changes in past period were used as an assumption to build model projections of future land cover. Land designation and peat ecosystem function maps were used as the unit analysis in this calculation. The cumulative emission during period analysis of 2018-2039 showed that, scenario of overshooting conservation target (OCT) had the lowest cumulative emission in the last period was 116.7 Mtons followed by the feasible conservation target (FCT) scenario (365.9 Mtons); the compromised conservation target (CCT) scenario's and the business as usual (BAU)'s were equal to 518.1 Mtons, and 654.8 Mtons respectively (see Figure 4.14).

Figure 4.14 Cumulative emission of each scenario in Pelalawan District



4.2.6 Gross Domestic Regional Product (GDRP)

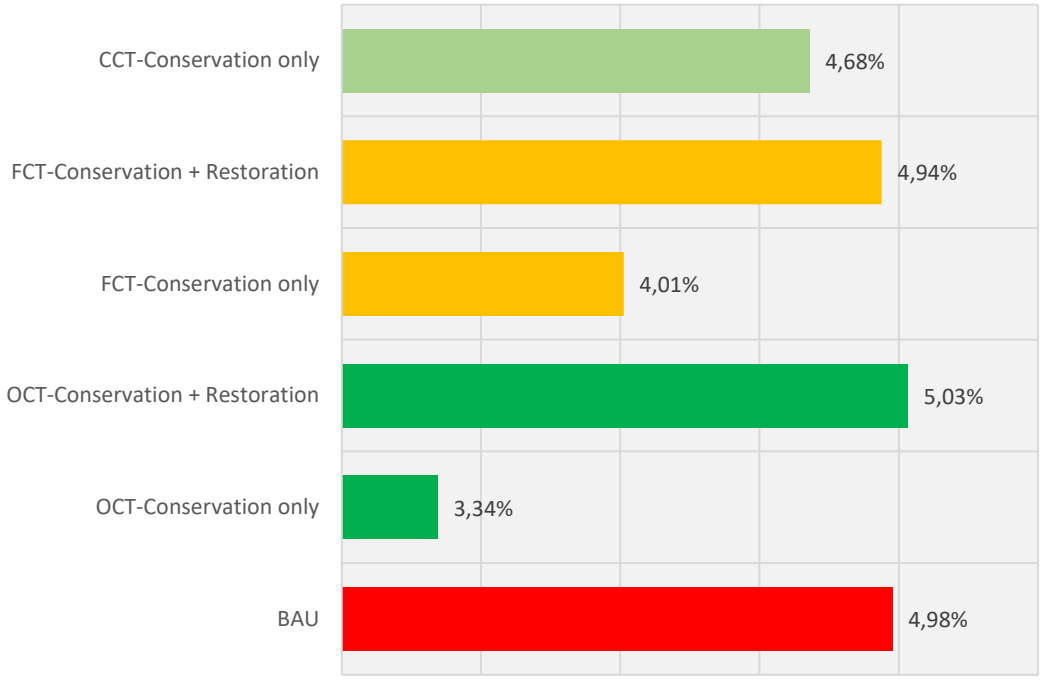
One of the most important SEM indicators agreed by the stakeholders in Pelalawan was economic growth. The proxy to growth in this case was the projected GDRP within the period where the land use plan would be enacted. The analysis used the "Input-Output Model" of Pelalawan in 2017 to estimate the future GDRP under different scenarios. Table 4.2 presents the result of I-O model simulation, while figure 4-15 shows the comparison of the average annual GDRP growth across different scenarios. Under BAU scenario, in 2039, GDP of Pelalawan had the potential to reach USD 11,557 million with an average annual growth of 4.98%/years. The OCT scenario had shown the potential to produce GDRP higher than BAU. The reason behind this was the restoration intervention, which transformed the degraded land with low to almost no economic value into various tree-based system with significant economic value. The OCT with only conservation intervention would produce GDRP of USD 7273 million in 2039, while the OCT with both conservation and restoration intervention would generate USD 11,279 million. The average growth of OCT with conservation and restoration intervention was 5.03%/years over the period of 2018-2039.

The FCT scenario had a significantly lower value compared to the OCT scenario. With both conservation and restoration intervention, the FCT would produce USD 11,042 million in 2039. The annual average growth under FCT scenario was 4.94%/years in the period of 2018-2039, which is 0.04% lower compared to BAU. The CCT scenario did not have restoration intervention as part of the proposed action. It produced the lowest GDRP compared to the other scenarios. In 2039, the CCT scenario produced USD 10,390 million with average growth of 4.68%/year.

Table 4.2. GDRP simulation results under various land use planning scenario of Pelalawan (value in million USD)

Scenario	2018	2024	2030	2033	2036	2039
BAU	3,025	4,067	5,341	6,931	8,867	11,158
OCT-Conservation only	3,025	2,826	3,710	4,817	5,797	7,273
OCT-Conservation + Restoration	3,025	4,229	5,472	6,998	8,921	11,279
FCT-Conservation only	3,025	3,432	4,506	5,849	7,039	8,832
FCT-Conservation + Restoration	3,025	4,180	5,410	6,922	8,800	11,042
CCT-Conservation only	3,025	4,037	5,301	6,881	8,281	10,390

Figure 4.15 Average annual growth rate of Pelalawan GDRP in 2018-2039



The GDRP result from land-based economic sector under various land use planning scenarios can also be observed in a spatially explicit land use profitability data (Figure. 4-16 until 4-20)

Figure 4.16 Profitability of land uses system in Pelalawan District

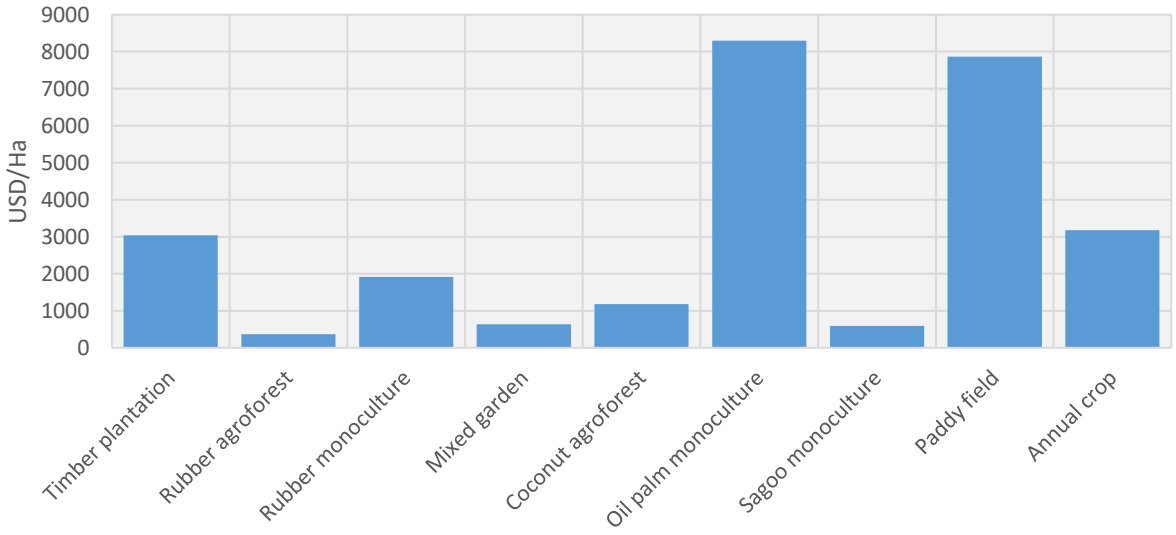


Figure 4.17 BAU scenario profitability maps of Pelalawan District

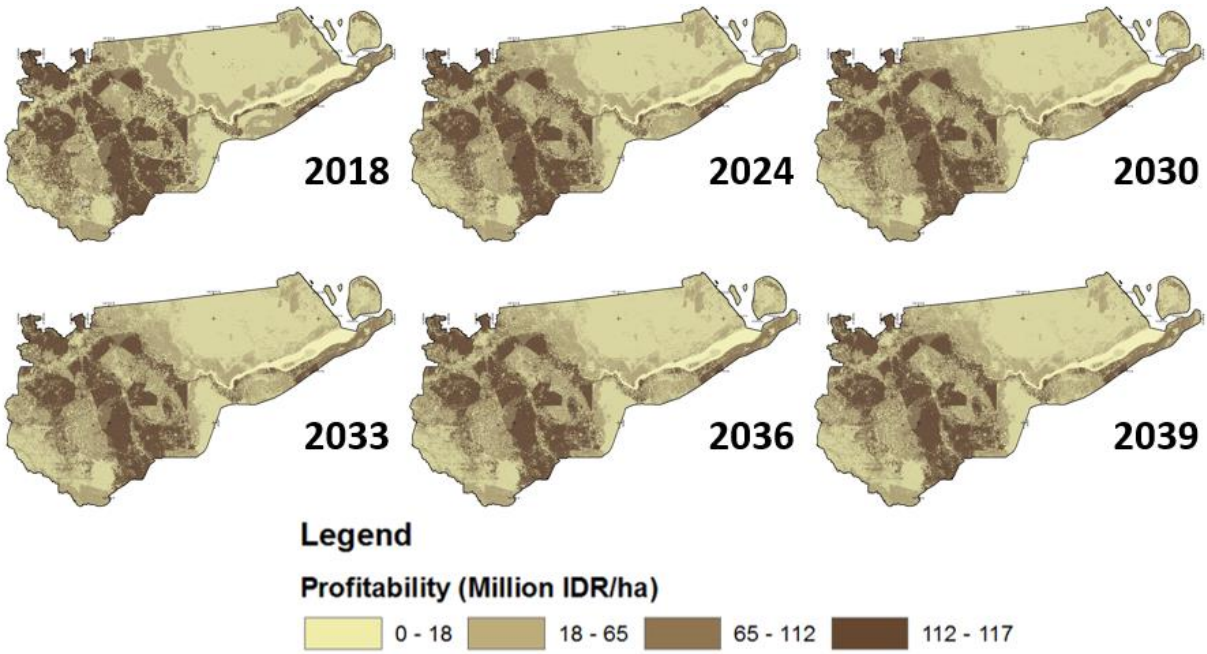


Figure 4.18 OCT scenario profitability maps of Pelalawan District

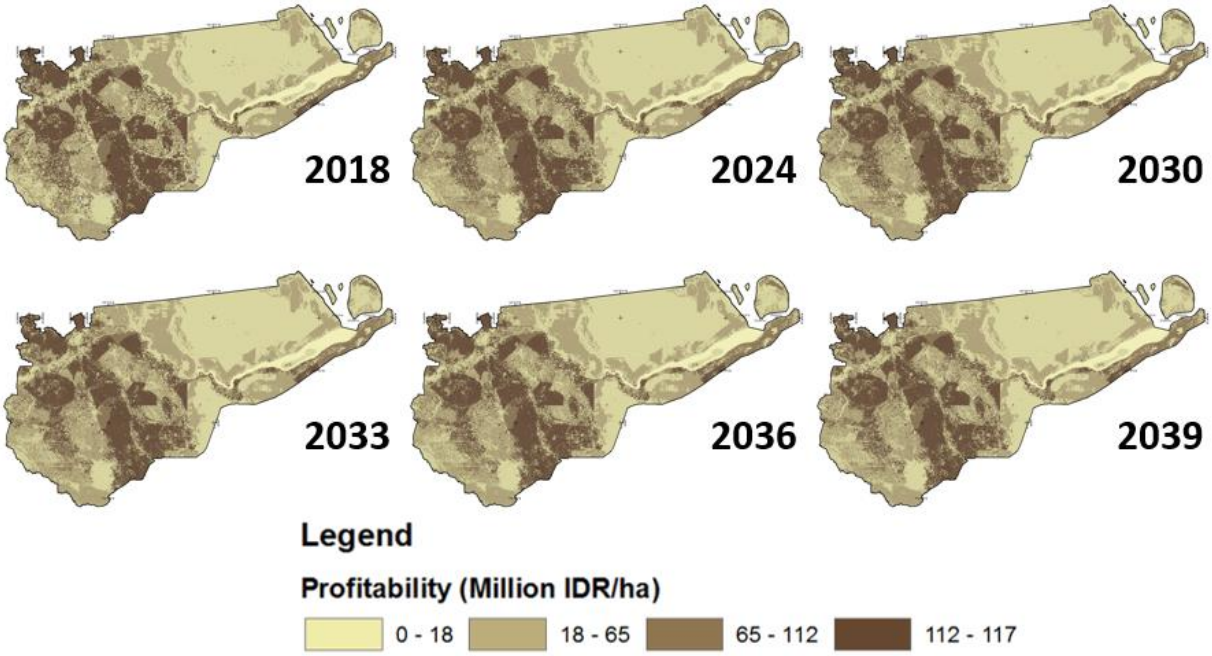


Figure 4.19 FCT scenario profitability maps of Pelalawan District

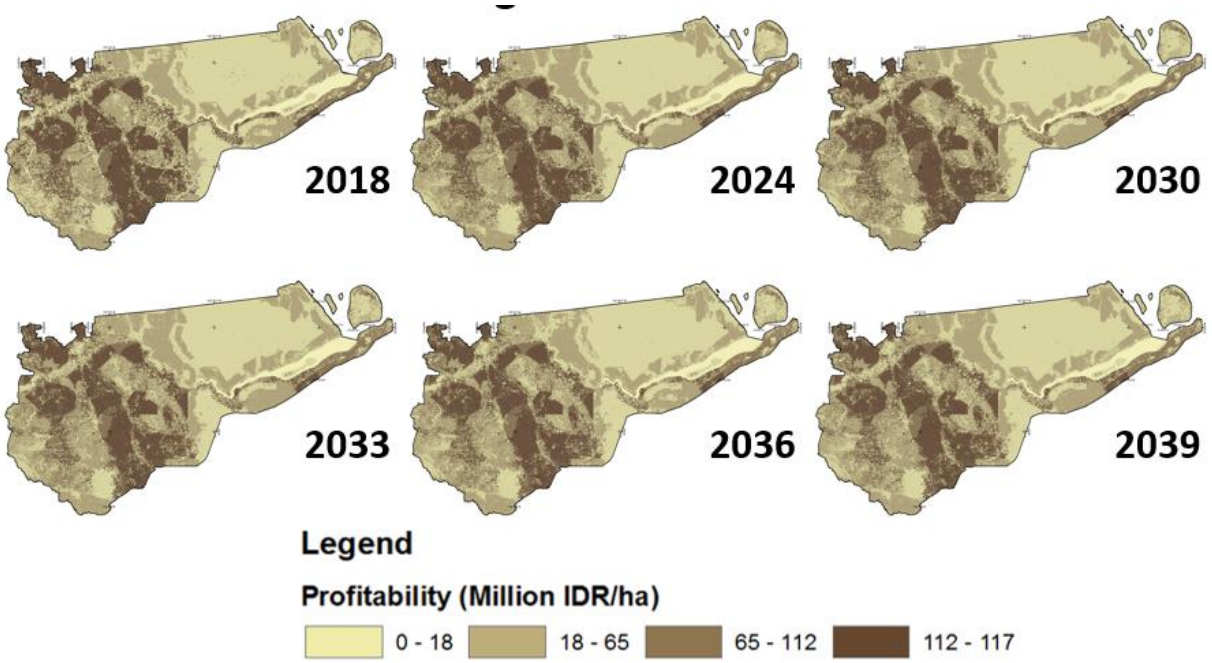
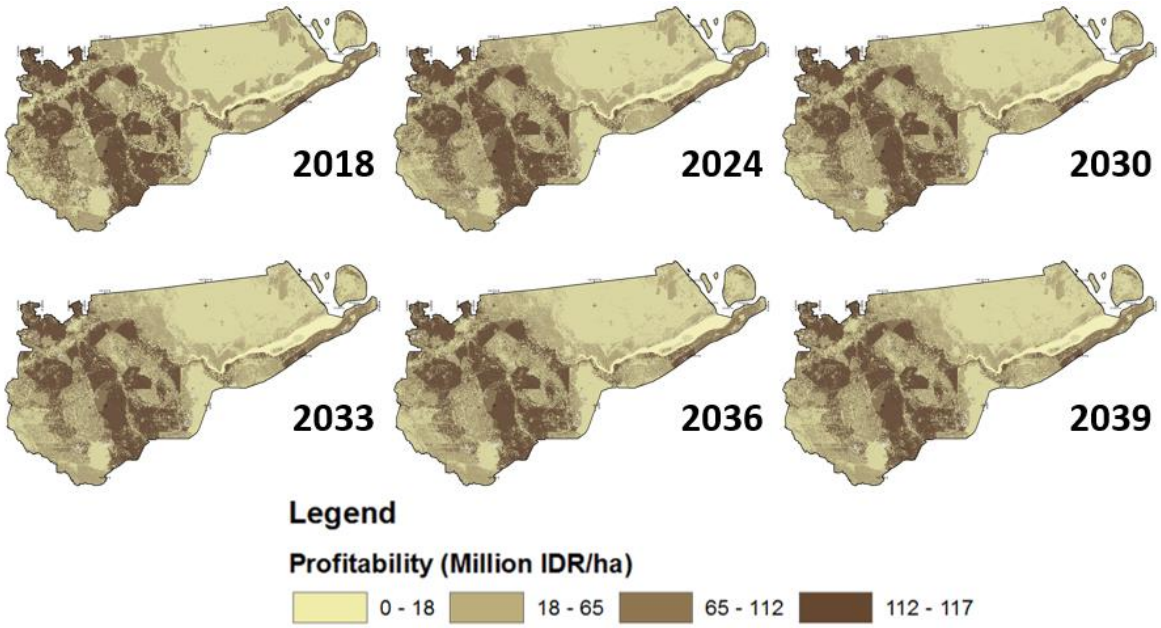


Figure 4.20 CCT scenario profitability maps of Pelalawan District



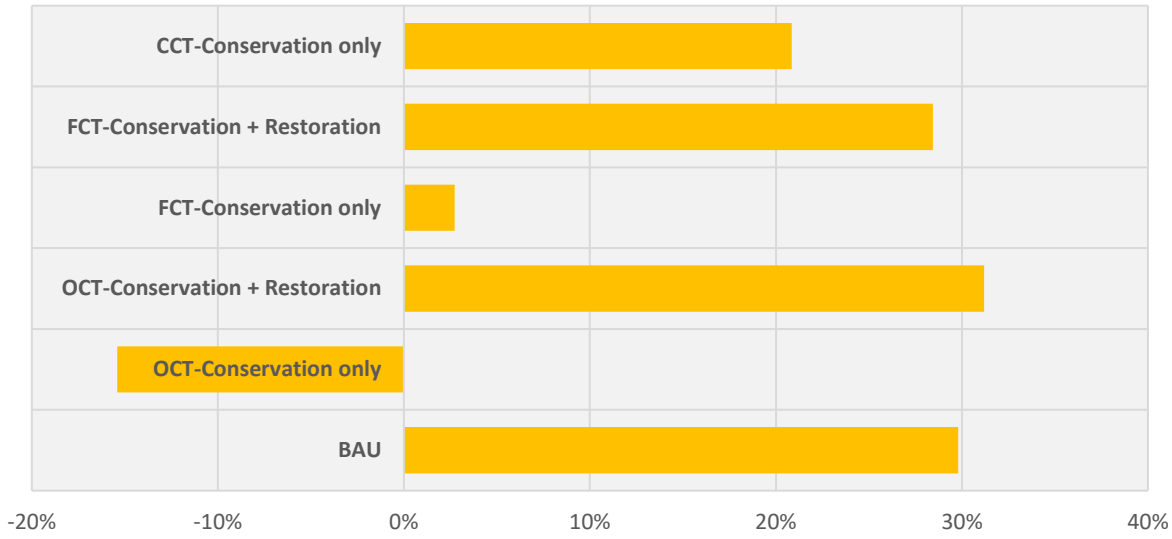
4.2.7 Income per Capita

The simulation results on income per capita in Pelalawan under various land use planning scenario are presented in Table 4.3. At the starting point of simulation in 2018, the income per capita of Pelalawan was USD 2,296/year. Under the BAU scenario, the simulated income per capita in 2039 had the potential to reach USD 2,980/year, which was a 30% increase compared to 2018. The OCT scenario without intervention on restoration produced the lowest income per capita at USD 1,942/year or -15% increase compared to the condition in 2018. However, with restoration intervention, the OCT scenario could produce USD 3,012/year or 31% increase compared to 2018. The FCT scenario with both intervention on conservation and restoration, produced USD 2,949/year which is a 28% increase compared to income per capita in 2018. The CCT scenario produced the lowest income per capita compared to OCT and FCT scenario.

Table 4.3 Income per capita simulation results under various land use planning scenario of Pelalawan (value in million USD)

Scenario	2018	2024	2030	2033	2036	2039
BAU	2,296	2,291	2,232	2,495	2,749	2,980
OCT-Conservation only	2,296	1,591	1,550	1,734	1,797	1,942
OCT-Conservation + Restoration	2,296	2,381	2,286	2,519	2,766	3,012
FCT-Conservation only	2,296	1,932	1,883	2,105	2,182	2,359
FCT-Conservation + Restoration	2,296	2,354	2,261	2,491	2,728	2,949
CCT-Conservation only	2,296	2,274	2,215	2,477	2,567	2,775

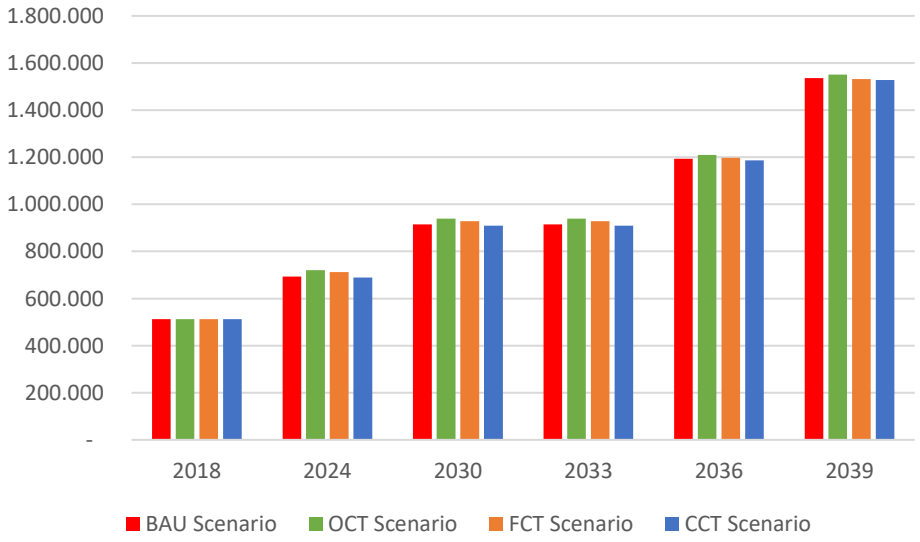
Figure 4.20 Comparison of Income per capita under different scenarios of land use planning



4.2.8 Labor absorption

Labor indicator of the four scenarios showed that there would be increasing labor absorption in the Pelalawan District in the future. Comparison between 4 scenarios indicating that OCT Scenario had the highest impact to labor absorption. This was because most of activity in the scenario contained restoration activity by integrating the agroforestry system with the valuable commodities.

Figure 4.21 Labor absorption in SEM scenarios compare to BAU

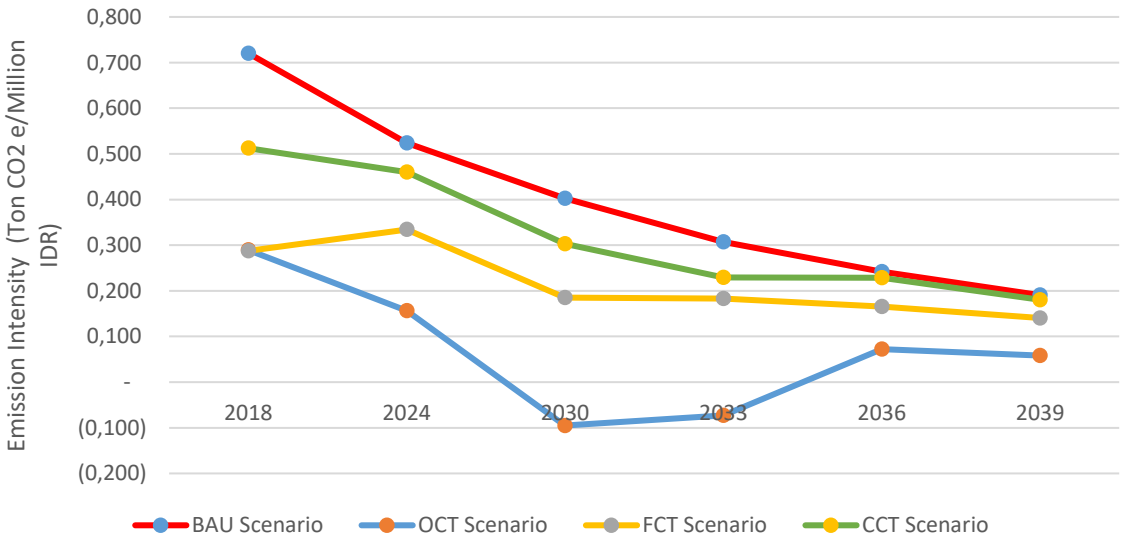


4.2.9 Emission intensity (ton CO2/Million IDR)

Emission intensity was calculated by dividing total projected GHG emissions with the projected GDP of Pelalawan. In order to reduce emission intensity, a region should be able to reduce their GHG emission and at the same time increase their GDP. Due to the comparative nature of the indicator, emission intensity is ideal to measure the performance of a region in implementing a low-emission development.

The OCT Scenario showed the highest impact in term of reducing the emission intensity, followed up by the FCT scenario and CCT scenario. Both OCT and FCT had been able to reduce the emission while also increasing the GDP of Pelalawan through restoration activities.

Figure 4.22 Emission intensity of Pelalawan District



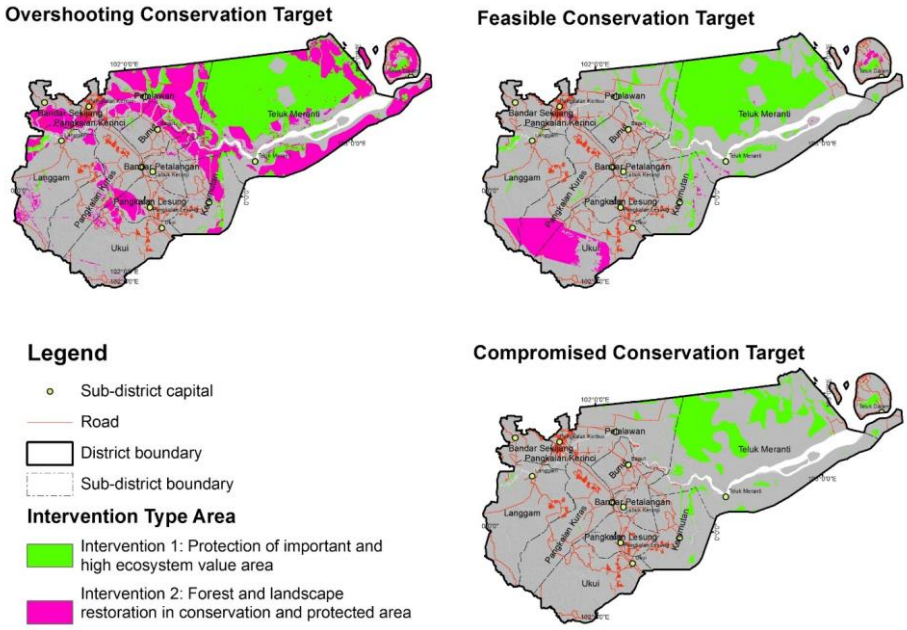
05

Policy Recommendations

5. Policy Recommendations

Based on the series of discussions with local stakeholders in Pelalawan District, the **Feasible Conservation Target** (FCT) scenario was selected as the most preferred choice. The main reason was the optimal trade-offs between adequate land allocation for economic development purposes (i.e. covering an area of 858,979 ha or 64.5% of the total area of the district), while keeping around 35% of the district area designated as conservation and protection area. The proposed FCT scenario therefore was selected to guide Pelalawan to achieve sustainable development.

Figure 5.1 SEM Scenarios of Pelalawan, the stakeholders choose the Feasible Conservation target (FCT) Scenario as the optimal one.



The protected/conservation area is under the jurisdiction of Riau Provincial Government and therefore the district government as a limited role; however due to the contiguity within the landscape, the coordination between district and provincial government in addressing and managing the areas area is crucial. The cultivation area, especially the plantation areas, are the main resources of the local government's income as well as livelihoods, of which the jurisdiction is under the district government and therefore land use planning of this area is a crucial tool for the district government in achieving green growth. Pelalawan District also plans to develop a Technopolitan area where cross-sectoral activities such as community forests, botanical gardens (conservation), education, industry and trade will be conducted in this strategic area. The proposed FCT scenario accommodated multiple needs and optimizes the development of sustainable areas.

The simulations and projections of several economic and environmental indicators of the BAU scenario and SEM scenarios are showed in Figure 5.1; the results conveyed major differences in the ex-ante impacts among the scenarios. The ex-ante impacts of OCT and FCT scenarios hugely differed from those of CCT and BAU scenario. Whilst the OCT scenario restricted communities' access to lands for their land-based livelihood activities, the FCT scenario offered a more balanced view and was selected by stakeholders as the most preferred scenario for the land utilization in Pelalawan.

The FCT scenario would lead to an additional 212,472 ha of conservation areas, which would be restricted from intensive uses based on its high conservation values. However, the implementation will be challenging, considering the various threats that exist in the field. The current regulation also does not fully support the existence of this area. According to the current Spatial Plan of Riau Province (Regional Regulation No. 10/2018 on the Spatial Plan of Riau Province for 2018-2038), the additional conservation areas proposed in the FCT scenario mostly fall under production forest areas, limited production forests and conversion production forests – are all areas designated for cultivation. The various economic activities allowed to take place in this area will lead to potentially huge environmental impacts.

Mainstreaming the FCT scenario into the formal policy processes will bind the commitment of the stakeholders. The most prospective opportunity is the government's plan to finish the revision of its spatial planning document, of which peatland protection should be more pronounced.[1] In this 20-years-long planning document, once the FCT scenario has been mainstreamed into, the district's commitment to ensure sustainable development will be formalized. Nevertheless, considering the lack of synergy and integration processes across government levels, there may be some difficulties in converting the district spatial plan against the provincial spatial plan. Therefore, peat protection recommended in the FCT scenario would be proposed to be incorporated into the district's spatial plan revision through several options below:

1. Developing a detailed spatial plan (RDTR – see Minister of Agrarian and Spatial Planning Regulation No. 16/2018) where the area will be regulated with reference to the FCT scenario.

   The detailed spatial plan is an elaboration of the district spatial plan, which is equipped with a zoning regulation. It is a translation from the district's spatial plan to become a reference for controlling spatial utilization, releasing permits and developing management and environmental plan (RTBL). In terms of planning stages, the RDTR is a product of operational action plan, area development plan, and design guidelines.

2. Developing and complementing the draft Pelalawan's spatial plan through the general provision of zoning regulation (KUPZ – see Minister of Agrarian and Spatial Planning Regulation No. 1/2018).

   The general provision of zoning regulation is a directive for the zoning regulation in the detailed spatial plan. In the spatial planning document, KUPZ is a part of the direction for controlling the utilization of space. As a direction, the detailed spatial plan and zoning regulation must refer to the KUPZ. However, the KUPZ description is rather general than the zoning regulation. Mainstreaming the FCT scenario in KUPZ should consider several aspects such as (i) detailing the terms related to space utilization in the explanatory article to avoid misinterpretation, (ii) conducting background studies in the "Facts and Analysis" document, and (iii) providing relevant comparison maps.

[1] Currently, peat protection is not recognized by the spatial plan. This will be the first ever attempt to integrate peat protection into a spatial plan.

Table 5.1 Comparison of Indicator Performance of BAU and SEM Scenarios

No	SEM Indicator	Scenarios	2018	2024	2030	2033	2036	2039
1	Deforestation (ha/yr)	BAU		4,967	1,425	1,092	739	707
		OCT		317	104	71	66	59
		FCT		299	106	57	52	42
		CCT		4,950	1,435	1,092	739	707
2	Tree cover (%)	BAU	60.81%	59.96%	58.48%	57.92%	57.43%	56.96%
		OCT	60.81%	62.94%	62.31%	61.96%	61.64%	61.33%
		FCT	60.81%	64.93%	64.14%	63.75%	61.47%	63.05%
		CCT	60.81%	61.60%	60.32%	59.84%	59.43%	59.04%
3	Agroforest (%)	BAU	4.39%	4.90%	5.29%	5.41%	5.54%	5.62%
		OCT	4.39%	5.90%	5.79%	5.73%	5.68%	5.65%
		FCT	4.39%	5.99%	5.94%	5.89%	5.89%	5.87%
		CCT	4.39%	6.10%	6.42%	6.50%	6.60%	6.66%
4	Habitat integration	BAU	0.152	0.146	0.143	0.142	0.141	0.139
		OCT	0.152	12.012	12.068	16.394	16.384	16.361
		FCT	0.152	21.449	23.621	27.85	27.87	27.821
		CCT	0.152	21.779	24.868	41.521	41.493	41.472
5	GHG emission (Mton)	BAU		31,601,441	30,883,025	31,193,191	30,872,276	31,112,997
		OCT		12,691,081	9,592,858	(7,542,149)	(7,394,346)	9,346,217
		FCT		12,600,488	20,255,449	14,514,131	18,391,502	21,137,607
		CCT		22,475,530	26,916,181	23,295,046	22,869,722	27,488,622
6	GDP (Million IDR)	BAU	43,864,834	58,978,077	77,443,517	100,498,132	128,572,065	161,796,959
		OCT	43,864,834	61,319,812	79,340,838	101,476,985	129,361,040	163,547,435
		FCT	43,864,834	60,613,047	78,448,231	100,365,335	127,606,258	160,107,461
		CCT	43,864,834	58,540,472	76,860,244	99,777,192	120,077,488	150,661,121
7		BAU	2296	2291	2232	2495	2749	2980

	Income per capita	OCT	2296	2381	2286	2519	2766	3012
		FCT	2296	2354	2261	2491	2728	2949
		CCT	2296	2274	2215	2477	2567	2775
8	Labour (Number of Labour)	BAU	512,731	692,858	914,685	914,685	1,193,848	1,535,846
		OCT	512,731	720,363	939,225	939,225	1,209,834	1,551,413
		FCT	512,731	712,568	928,988	928,988	1,197,318	1,531,872
		CCT	512,731	688,919	909,353	909,353	1,187,202	1,527,787
9	Emission intensity] (ton CO2/Million IDR)	BAU	0.720	0.524	0.403	0.307	0.242	0.191
		OCT	0.289	0.156	(0.095)	(0.073)	0.072	0.058
		FCT	0.287	0.334	0.185	0.183	0.166	0.141
		CCT	0.512	0.460	0.303	0.229	0.229	0.181

Table 5.2 Strengths and Weakness between the Two Policy Options

	Detailed Spatial Plan (RDTR)	General Provision of the Zoning Regulation (KUPZ)
Strength	• May create a detail regulation for peatlands in the zones (zoning regulation) and each management guideline on the planning map of 1:5000. • The function and utilization of the peatlands can be managed based on the parcels of lands. • May include a more detailed sanction which will results in a more robust law enforcement.	• Included in the spatial planning document, which is referred by the development plan and the detailed spatial plan • In accordance with the project's time frame which is currently underway • Will become a general direction for the detailed spatial plan and the zoning regulation. • Flexibility to be included in the utilization of spatial pattern in terms of article by article.
Weakness	• The process will take more time because the government hasn't started the development of the detailed spatial plan yet. • The detailed spatial plan must refer to the spatial planning document. If the spatial planning document hasn't included peatlands, the inclusion of the peatland in the RDTR may be questioned during the review process.	• May not change/add specific peatland spatial pattern in the established spatial pattern.

Of the two options (Table 5.2), the second alternative can be pursued more efficiently in this current condition while the first alternative requires more comprehensive efforts, additional uptakes and adequate time. The first alternative can be done in parallel with the Pelalawan District Spatial Planning process, which is currently underway. Furthermore, the implementation of the general provision of the zoning regulation will be discussed in the Deliverable 3, which will be prepared in conjunction to the management guideline. The management guideline will outline the do's and don'ts activities by taking into account the spatial arrangements, which had been developed at the provincial level, as well as the socio-economic conditions in the region.

As a final recommendation, the implementation of spatial plan, which facilitates protection activities for peatlands in the Pelalawan District, is conducted through the general provision of the zoning regulation, including:

- Activities to control the land use compliance according to existing government regulations: national zoning regulation, regulations on provincial system zoning, and district government regulation on district / city zoning; and
- Permit issuance is adjusted to the designation of zoning systems, procedures, and statutory provisions.

Towards a successful implementation of the general provision of the zoning regulation, the following several aspects need to be addressed:

1. Legal factors: the granting of land use permits in protected peat areas that are incompatible with the national spatial plan (RTRWN). In this context, the government officers are preparing / forming / drafting local level regulations, SOPs for spatial planning, financing / budgeting to develop ideal facilities that may support the spatial planning performance at the district level.
2. Law enforcement factors: the extent of the BKPRD and other institutions in regulating their implementation. At present, there is no special structural / non-structural institution whose task is to control and supervise the use of the area. For this reason, it is necessary to establish a special institution with the task to control land utilization that is in accordance with the task of the district's planning team (TKPRD).
3. Cultural factors: the current condition shows that not all stakeholders care about peat management in the Pelalawan District; and there is no monitoring and evaluation of activities up to the site level. For this reason, efforts are needed to increase community participation through the establishment of community groups to participate in the spatial planning at the village and sub-district levels.
4. Facility factors: lack of supporting facilities in the management of protected peat areas can affect peatland management. The district planning team is not facilitated with regular implementation of activities related to peat management. For this reason, there is a need to to increase the number of adequate supervisory personnel in Pelalawan District.
5. Sanctions: currently the sanctions are not clearly stated in the regulation. For this reason, the imposition and implementation of sanctions can be carried out by the Regent, assisted by the competent authority/agencies.

References

Dewi, S., van Noordwjik, M., Ekadinata, A., Pfund, J.-L. . 2013. Protected areas within multifunctional landscapes : squeezing out intermediate land use intensities in the tropics?. Land Use Policy, 30 (1) : 38–56. http://dx.doi.org/10.1016/j.landusepol.2012.02.006

Hanski I. (2011). Habitat loss, the dynamics of biodiversity, and a perspective on conservation. Ambio, 40(3), 248–255. doi:10.1007/s13280-011-0147-3

IPCC 2008, 2006 IPCC Guidelines for National Greenhouse Gas Inventories – A primer, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Miwa K., Srivastava N. and Tanabe K. (eds). Published: IGES, Japan.

Klaus, Hubacek & Sun, Laixiang. (2001). A scenario analysis of China's land use and land cover change: Incorporating biophysical information into input-output modeling. 10.1016/S0954-349X(01)00029-7.

06

Annexes

Annex 1. Tree Biodiversity and Carbon Stock

A. Biodiversity

1. Pelalawan's land cover distribution.

No	Land use type	Location	Additional Information
1	Paddy field	• Kuala Kampar	Kuala Kampar used to be the biggest producer for Pelalawan. However, in the last 5 years, most of the paddy fields are abandoned due to the abrasion. The sea water goes through the paddy fields and create an unsuitable environment.
2	Rubber plantation	• Bunut • Pangkalan Kuras • Kerumutan • Teluk Meranti	Most of the rubber plantation is owned by the local community.
3	Coconut plantation	• Kuala Kampar sub-district • Teluk Meranti.	
4	Small holder palm oil	• All areas of Pelalawan district.	There are also palm oil areas owned by plantation companies (HGU)
5	Mangosteen garden	• Langgam sub-district	
6	Durian and Rambutan garden	• Ukui district • Bandar Seikijang • Bunut	
7	Petai and Jengkol	• Ukui district • Bandar Sikijang • Bunut	Planted on the local community land.
8	Sago	• Kuala Kampar	Aside from the natural sago, in 2002 there was sago planting by DAK DR. Sago from Kuala Kampar district is sold to Meranti island district. There is a sago processing factory and industrial timber estate (HTI) owned by PT Nasional Sagu Timber at this area.
9	Mangrove	• Kuala Kampar (damaged due to exploitation for charcoal making)	A study states that Kuala Kampar experiences 30 cm abrasion from the coastal line per year. Mangrove replanting was unsuccessful due to waves. The local people stated that mangrove rehabilitation in this area is nearly impossible and therefore the DAK filings for DR is rejected.
10	Acacia		Acacia plants grow wild on community lands. The local community is not interested in cultivating wood-producing plants such as acacia and Sengon due to transport permit. The sale of the wood must have a Certificate of Origin issued by the village Headman. In practice, many of the responsible key persons are unaware of this information and therefore the issuance of COO is transferred to the Forestry Office. Consequently, the local community prefer to sell the product illegally. Therefore, seasonal cultivation was chosen as an alternative. For other wood type such as Mahogany, the community harvest and sell them as finished products, such as doors, frames or furniture so they cannot be detected as a wood log.

2. Mangosteen, Lime, Lemon, and Chili Agroforest Demo Plot

The agroforestry based on Mangosteen plantation was conducted at Langgam Village. The 99 hectares of land bordering the oil palm plantation and RAPP gardens are managed by the community which consists of 9 farmer groups and is incorporated in Harapan Jaya working group.

This land was originally logged-over forest, however timber with a diameter of 50 cm can still be found. The land status is unknown but is recognized as someone from Riau Malays' land. People who came from Java and Medan paid for land compensation at a price of IDR 1 million per hectare in 2002. However, the land still left unmanaged. In 2007 there was a government program for the development of Mangosteen centers in this location. This program funds land clearing and provision of agricultural facilities (fertilizers, Mangosteen seedlings and land preparation costs including land clearing).

The stage budget fund (APBN) is given through development program of Mangosteen center from 2007 to 2012 for 80 ha while the local government budget (APBD) at district level was given for another 10 ha and the APBD at province level was given for 9 ha. The planting was conducted in 2009. Initially, the government did not issue a land clearing permit and suggested the Mangosteen to be planted among the forest stands. However, this environment does not support the plant's growth as they competed with shrubs. The local community then cleared out the shrubs and planted the Mangosteen in 10m x 10m distance. Mangosteen can only be harvested after 7 years and will reach its optimal production at the age of 12 years, which leads the farmer working group leader to advice to develop an agroforest between Mangosteen of lime/lemon with 3m x 4m distance or about 600 stems in 2 ha. Lime and lemon were chosen because they can be harvested within 3 months with 150 – 200 kg yield per week with a price of IDR 4,000 per kg.

Since 2012 there has been no financial assistance from the government. However, the farmers have begun to run the plantation independently. Currently, the local farmers have other crops planted: Jengkol, Jackfruit, Durian and Betel Nut as a barrier to the garden. Chilli is planted between the Mangosteen crop stands. The first Mangosteen harvest came in early 2019. Even though productivity is not yet optimal, it inspires other farmer groups. The lime, lemon and chilli products are distributed from farmers to the farmer groups with farmer group leaders as the main collector.

Next steps for the demo plot are: (1) developing access roads to replace the existing footpaths and (2) building warehouse for fruits storing and packing.

3. Rubber, Mangosteen and Agarwood (Gaharu) Demo Plot

There is an area of 10 Ha demo plot of rubber, mangosteen, agarwood and matoa owned by one of the farmer group leaders in Segati. It was established in 2006 from logged-over forest, which was planted by rubber the next year. The local farmers prefer rubber to oil palm since elephants may disrupt and consume oil palm. The rubber trees are planted in 3m x 4m distance, the agarwood stands are 5 years old and the mangosteen stands are 10 years old.

In 2009 the government held a development program and provided mangosteen seeds to local farmers. The seeds are then planted between rubber plants in 10 m x 10 m distance. In 2013, gaharu trees were planted between the mangosteen plants. In 2019, mangosteen stands have been successfully harvested 2 times in 1 year as much as 1 ton per 10 Ha in each harvest time. Rubber plants are tapped every day, but productivity is not optimal. Therefore, the owner plans to cut down some of the rubber stands and optimized the mangosteen instead.

Mangosteen seedlings need to grow in a shady area and need more sunlight at the age of 8-10 years. With rubber plants, the mangosteen plants have to compete for sunlight and soil nutrients. Clearance of weeds and the provision of fertilizers for garden maintenance are carried out once in 3 months.

4. Palm Oil Demo Plot

A demo plot of oil palm plantation – a mix of Socfin and Marihat varieties with a density of approximately 130 - 135 trees per hectare of 11 years old trees - is owned by the relatives of the

farmer group leaders in Segati. It is reported by the local communities that soil fertility on oil palm land is better than rubber. Oil palm farmers make profits if they own a 5-hectare land that they manage personally and at least 10 hectares if they have 1 worker.

5. **Rubber Monoculture Demo Plot**
   The observed monoculture rubber plantation is owned by the local community. Rubber planting was carried out in 2007 using local seeds taken from Asian Agri plantation. The plantation is not intensively cleaned out and only get herbicide sprayed once a year. Seedling, saplings and trees are found in this area.

6. **Old Rubber Monoculture**
   The old rubber monoculture area observed were planted in 1989 with seeds from the SER-DP government program distribution. This area is cleaned out regularly every three months. Because of its low price (IDR 8,000 per kg), rubber plants will be cut down and replaced with oil palm.

7. **Oil Palm Monoculture**
   The observed oil palm plantation is 15 years old with seeds from Medan. The average yield of the plantation is 1 ton in each harvest time at a price of IDR 1,000,000 with a wage of IDR 150,000.

8. **Old Rubber plantation**
   The old rubber plantation observed were planted in 1985 on land cleared from peat forest with a density of 4 m x 3 m. Currently, it is unproductive because of the low price of rubber. It is now covered with pioneer species such as ficus and ferns. The thickness of peat in this rubber plantation is 604 cm depth with a groundwater level at measurement time is 90 cm. The peat maturity level is sapric at the first 50 cm and the rest is hemic. The width of the canal is about 1 m and is located at about 10 m from the plantation area.

9. **Rubber and Coconut Agroforest**
   The agroforest of rubber and coconut is 8 years old for the rubber and 28 years old for the coconut. The rubber plantation is next to the canal which has begun to close and is not deepened anymore. It is located on peatland with a thickness of 373 cm with a water level of 95 cm. The maturity level of the first 50 cm peat is sapric and subsequently hemic and fibric.

10. **Secondary Forest**
    i. **Lubuk Balai**
       A secondary forest in Lubuk Balai is located on the edge of the Nilo River. According to local guide sources and local species identifiers, the forest was opened by the local community in the 1960s to cultivate rice and rubber. It was then made into production forest area by INHUTANI IV and oil drilling was carried out by PT. Stanvac. The drilling stopped because the oil produced was considered raw. In 1994, t RAPP company came to the area to collect wood logs until 2004. This are had been rich with Jelutong trees. the trees and the jelutong market, however, no longer exist due to RAPP's activities to establish HTI.

    ii. **Near Jungle Track close to Flying Squat**
       This secondary forest behind the flying squat camp is a logged-over forest of HPH. According to the TNTN forest rangers, this forest area has been cleared by several HPHs until 2004. The origin of this forest area is the same as in Lubuk Balai, a production forest of INHUTANI IV. Although timber in this area has been taken by several HPHs, this forest has never been opened and burned.

    iii. **Around WWF Restoration Camp**

This forest area is a natural forest and has experienced illegal logging by the community on several types of commercial timber such as Meranti, Seminai, Balam, Kulim and several other types of commercial timber. However, HPHs never felled timber at this location.

11. Coconut Plantation

i. Old Coconut Plantation

The coconut plantation is around 40 years old on peatlands with a thickness of 523 cm with a groundwater level of 73 cm and density of 8 m x 8 m. The peat maturity is sapric at the first 50 cm, hemic at the second 50 cm and the rest is still at the fibric maturity level. It is located in an area next to a 1-m wide canal.

ii. Young Coconot Plantation

The young coconut plantation area was 10 years old which was a rejuvenation from a previous plant that was 40 years old. Coconut is planted on peat with a thickness of 403 cm. Groundwater level at the time of observation is 60 cm. The maturity level of the peat at the first 50 cm is sapric and subsequently fibric.

iii. Coconut and Betel Nut Agroforest

Sampling was conducted in the Mangrove Bay Village. The garden is dominated by coconut and areca nut and a mixture of jengkol, rambai, banana and cempedak. Coconut was planted in 1987 and betel nut was planted in 2013. The owner of the plantation came to this location in 1985. The owner created a 2-m wide trench manually using hoes and remove wood logs from the forest by using the trenches to move the logs. At the same time, farmers began to plant coconut. There is a sago plantation around this area which is a daily food source for farmers. The depth of peat in this place is 33 cm. Based on observations of coconut tree roots that are seen, the peat subsidence that occurs in this region is estimated at 50-80 cm in 28 years.

12. Sagoo Forest

Sampling was carried out in Teluk Village. Sago groves are located on peatland with a thickness of 200 cm, groundwater level 50 cm and maturity level of hemic and fibric peat.

13. Mangrove

A sampling of mangroves was carried out in Teluk Beringin Village. The mangrove is dominated by Avicennia. There are other species such as Rhizhophora, Sonneratia and Bruguiera. In this area a crab cultivation program is also being developed in collaboration with the Pelalawan Regency Joint Plantation and Livestock Service Office, a local farmer group.

B. Types and Existing Land Use Distribution

1. Langgam Sub-district

Langgam sub-district is one of the sub-districts approved in Pelalawan Regency and is a cross-district route to Kampar district. The land cover area in Langgam District was approved by the cover of monoculture oil palm land both owned by private companies and community plantations. The oil palm cropping system carried out by companies such as PT Pusaka Megah Bumi Nusantara and PT RGMS is more regular in the planting pattern of the management of stagnant ditches compared to those managed by the community. Some of the oil palms inundated in some locations have died due to the air condition. The cover of oil palm land that was continuously flooded turned into a swamp. In addition, on the south side of the Kampar River there are several oil palm plantation concessions owned by PT Mitra Unggul Pusaka, PT Agrita Sari Prima, and part of PT Peputra Supra Jaya.

Figure Annex 1.1. (a) A Powerhouse (GAS Plan Langgam), (b) Condition of oil palm cover that has become a swamp

The Langgam village is located on the edge of the Kampar river as the main center of the residential area. This area is dominated by mixed fruit gardens around the community-owned settlements such as coconut, durian, rambutan and banana.

In addition to oil palm, around Langgam settlements there is monoculture rubber with a variety of plant patterns lined up and mixed with monoculture palm oil. In addition, there are also acacia concessions owned by Nusa Wana Raya and RAPP companies adjacent to Segati Village.

There is a center for mangosteen gardens as a center for mixed gardens in Segati Village which enters Langgam District. This location is within the location of the oil palm stand with closed access and is not easily known by other communities other than the village itself. There is 99 ha of fruit plant area with a system of planting variations between monocultures and agroforest systems that are planted around the forest location.

2. Pangkalan Kuras Sub-district

Pangkalan Kuras Subdistrict is an eastern crossroad. The area around this road is experiencing rapid development. Kemang Village is a residential center with land cover conditions dominated by the cover of monoculture oil palm land. There are oil palm companies PT Adei plantations and PT Langgam Inti Hibrida around Kemang Village.

Figure Annex 1.2. Oil Palm Plantation

Aside from oil palm, there is also a rubber monoculture plantation system and mixed gardens planted with coconut, rambutan, mango, and other plants around the settlement area.

(a)

(b)

Figure Annex 1.3. (a) Rubber plantation, (b) Mixed garden around settlement

In Palas Village, a combination of agroforest rubber land cover and mixed gardens are distributed in several locations. The village also have settlement land cover, monoculture rubber, open land, and mixed gardens. In addition, Sorek village land cover is the most extensive location of residential land cover and is the busiest economic center in the base sub-district of Kuras. The Batang Kulim Village is dominated by monoculture oil palm land, both smallholder palm oil and palm oil companies, such as PT Musim Mas subsidiary in the south of the village and PT Surya Bratasena plantation in the northern region. Kesuma village land cover is oil palm plantation, partial settlement of mixed fruit trees and swamp bushes in residential areas close to the river.

Figure Annex 1.4. Pangkalan Kuras

Trans villages are usually covered by oil palm vegetation such as in Sidomukti Village, Suryaindah, Beringin Indah, sialang Indah, Jaya Harapan and Meranti Village.

Figure Annex 1.5. Trans settlement dominated by oil palm

3. Pangkalan Lesung Subdistrict

There is a more diverse combination in Pangkalan Lesung subdistrict, for example in Pangkalan Lesung village where a mixed plantation stands among the community settlements. There are also small areas planted by perennial plants such as chilli, tomatoes, and corn. The main land cover is dominated with oil palm vegetation from the shaft road to the boundary of PT Musim Mas plantation (the company entrance access).

(a)  (b) 

Figure Annex 1.6. (a) PT SLS Oil Palm plantation, (b) PT SLS conservation forest

There are several large companies owned by Astra in this area, one of them is PT Sawit Lembah Subur (SLS). Some areas are conservation areas in the form of swamp forest that stands in several SKT locations owned by the company.

4. Ukui Subdistrict

Land cover in the Ukui subdistrict is dominated by secondary forests in the National Park area. Some of the other areas are concession area dominated by Acacia stands from RAPP, Rimba Lazuardi, and the other area has cultivation right title of oil palm plantations. There is also horticultural agriculture area smaller than those found in Bukit Gajah village.

Figure Annex 1.7. Horticulture area in Ukui subdistrict

Vegetation cover in several villages in Ukui sub-district such as Bukit Jaya, Trimuljaya, Air Emas and Air Hitam are enclosed around the company's oil palm plantation area. Meanwhile, in Lubuk Kembang Bunga village there are few mixed gardens and rubber stands around the settlements.

(a)  (b) 

Figure Annex 1.8. (a) A mixed garden around settlement area, (b) Rubber stands

The study area at the National Park is an ex-timber company area located in the park with a decree from the Ministry of Environment and Forestry on Tesso Nilo National Park protection. In addition, some parts of the National Park have no primary forest stands due to the logging threat. Some areas are shrubs, and some others are oil palm stands.

(a)  (b) 

Figure Annex 1.9. (a) Shrubs in TNTN area, (b) Secondary forest landscape in Camp Squad TNTN

5. Kerumutan Subdistrict

Kerumutan sub-district is one of the sub-districts that still has oil resources which is characterized by the presence of refineries and Pertamina drill wells in Kerumputan District. The land cover is dominated by oil palm stands, owned by both companies and communities, such as PT SLS, PT Gandaerah Hendana, and PT Mekar Sari Alam Lestari. There are also peat swamp forests located on the border of Pelalawan and the Indahiri sub-district upstream.

Figure annex 1.10. Swamp forest

In several villages such as Bukit Lembah Subuh village, Pematang Tinggi, Banjar Panjang and Beringin Makmur, the village has a variety of land cover in the form of palm stands. Some areas are still planted with rubber agroforest mixed with other plants and some others are monocultures.

6. Bandar Petalangan Subdistrict

At the study location (Merbau Village) there are Acacia and Eucaliptus forest stands.

7. Bunut Subdistrict

Bunut Subdistrict has a hilly topography with palm oil stands owned by companies and the industrial timber Arara Abadi. There are also coconut palm agroforest stands and other fruit plants. The coconut agroforest is located behind a settlement that is directly adjacent to mixed gardens, coconut agroforests and oil palm.

8. Teluk Meranti Subdistrict

Teluk Meranti has a tourist spot called Ombak Bono on the Kampar river. The settlement of Teluk Meranti centered on the edge of the Kampar river and surrounded by old rubber stands mixed with several other stands. Besides rubber and mixed gardens, there are also oil palm plantations and conservation forest areas around the settlements. There is also Acacia stands owned by PT Arara Abadi and the log pond port in the Kampar river for timber transportation.

The meranti bay area is dominated by coconut monoculture and the other areas are dominated by coconut agroforest with other plants such as areca palm, oil palm, and fruit trees. There is also rubber agroforest with coconut distributed in Teluk Meranti area to the Mas river area. Teluk Meranti was once used as a corn farming area and in 2015 when land burning is forbidden, the local communities planted corn on other areas. The coconut area was then abandoned.

Figure Annex 1.11. Burned shrubs area (left) and coconut-oil palm-areca nut agroforest (right)

9. Kuala Kampar Subdistrict

Kuala Kampar sub-district has a unique land cover known as "penyalai" where only sago and rice fields are found. This area is the largest rice producer in Pelalawan since 2010 and the rice field has been expanding until 2019. There is also sago monoculture and mangrove forests

Figure Annex 1.12. Forest stands (dominated by Maang) (top left), sago monoculture (top right), rice fields (bottom left), and secondary forest, mangrove (bottom right)

10. Pelalawan Subdistrict

Pelalawan sub-district is dominated by acacia belonging to the RAP company and some of them are oil palm land owned by companies such as Asian Agri. Rubber stands found in the middle of oil palm plantations owned by the company and the local community.

11. Bandar Sekijang Subdistrict

About 90% of the Bandar Sekijang area is dominated by oil palm. There are also mixed gardens such as fruit and vegetables around the areas.