



TRIPUTRA AGRO PERSADA

CLIMATE CHANGE RISK ASSESSMENT STUDY



CAFRM
Divission

PT TRIPUTRA AGRO PERSADA

2025

PREFACE

It is undeniable that Indonesia has proven to be the largest producer of plantation commodities in the world, including palm oil plantations which are growing very rapidly, so that every plantation worker and related parties are required to be committed to being responsible in maintaining and actively contributing to strengthen the sustainable governance of palm oil plantations and the environment.



Global warming and global climate change have become issues and concerns of the world community. This is because this phenomenon can cause many losses and can even threaten the sustainability of life on planet earth.

The issue of global climate change is one of the trending topics discussed by the global community in at least the last 20 years

The increase in the concentration of greenhouse gases (GHG) in the earth's atmosphere has increased the intensity of the greenhouse effect of the earth's atmosphere (IEA, 2019).

Triputra Agro Persada Group, recognizes the need to identify risks associated with climate change and to assess the vulnerability of the Company's governance to these risks.

OBJECTIVES

GENERAL OBJECTIVES

To evaluate and determine the level of risk of climate change impacts in each operational location of Triputra Agro Persada Group's palm oil plantations and mills.

SPECIFIC OBJECTIVE

- To identify and determine the level of risk of climate change impacts in each operational location of Triputra Agro Persada Group's palm oil plantations and mills production areas.
- To plan mitigation activities for climate change risk impacts.

SCOPE

TAPG'S ASSETS

Considered as part of this assessment fall under the following categories :

- 21 palm Oil Plantations
- 13 Palm Oil Mills
- 1 KCP + 1 Biogas
- 1 Rubber Plantations + 1 Smoked Rubber Processors



Risk assessment and analyses were developed for the following plantations and under the following parameters.

Entity Name	Regency	Location Coordinates		Distance to Beach (km)	Elevation (masl)
		Longitude	Latitude		
BRAHMA BINABAKTI	Muaro Jambi	103.3605889	-1.35966876	57.65	74
BRAHMA BINABAKTI	Batanghari	103.3513204	-1.54024162	75.92	23
GAWI BAHANDEP SAWIT MEKAR	Seruyan	112.3549059	-2.952380593	40.22	15
MEGA IKA KHANSA	Seruyan	112.3196741	-2.8408157	52.46	46
FIRST LAMANDAU TIMBER INT	Lamandau	111.4663119	-1.861952077	119.37	27
SUKSES KARYA MANDIRI	Sukamara	111.3420844	-2.196962167	78.9	39
TRIEKA AGRO NUSANTARA	Lamandau	111.1862783	-1.962883823	106.47	40
ETAM BERSAMA LESTARI	Kutai Timur	117.8828786	1.2168392	13.05	40
MUARATOYU SUBUR LESTARI	Paser	116.3289235	-1.3371543	26.85	86
KEDAP SAYAAQ DUA	Kutai Barat	115.9754752	-0.2578894	161.1	18
DWIWIRA LESTARI JAYA 1	Berau	118.0336022	1.5991660	10.87	80
DWIWIRA LESTARI JAYA 2	Berau	118.0007095	1.3696734	33.58	200
NATURA PASIFIC NUSANTARA	Berau	116.9843029	2.2462647	118.58	45
HAMPARAN PERKASA MANDIRI	Kutai Timur	116.6214676	0.8066485	117.14	87
SUBUR ABADI WANA AGUNG	Kutai Timur	116.4911949	0.7872645	130.53	114
KUTIM AGRO MANDIRI	Kutai Timur	116.7046258	0.6851175	104.37	48
PRADANA TELEN AGROMAS	Kutai Timur	116.8090738	0.7546660	95.35	31
YUDHA WAHANA ABADI	Berau	117.2097666	1.4403826	88.51	104
ANUGERAH AGUNG PRIMA ABADI	Berau	117.2079047	1.5531980	82.77	125

PHYSICAL CLIMATE RISKS ASSESSMENT



**Methodology,
Scenarios, and Results**

Data

Sources,



ASSESSMENT APPROACH

Physical Climate Risks

RISK ASSESSMENT

Risk assessment: in the risk assessment process, the factors to be analyzed are selected, such as: riverine floods, water availability (water scarcity), extreme heat, landslides, wind and cyclones

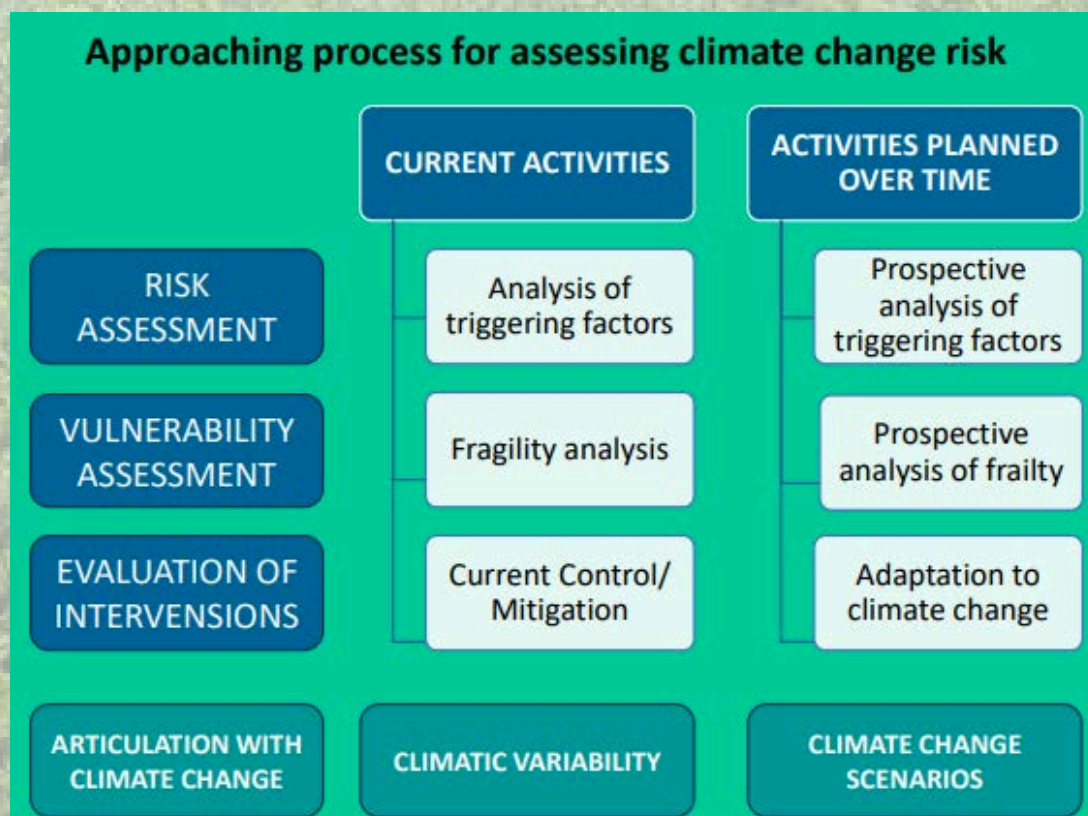
VULNERABILITY ASSESSMENT

The level of vulnerability of crops and plantations to the selected disaster risks.

EVALUATION OF INTERVENTIONS

Actions or strategies are identified for risk reduction and adaptation to climate change, based on climate variability and different climate change scenarios.

To carry out risk assessments on climate change, the following approach methods were developed:



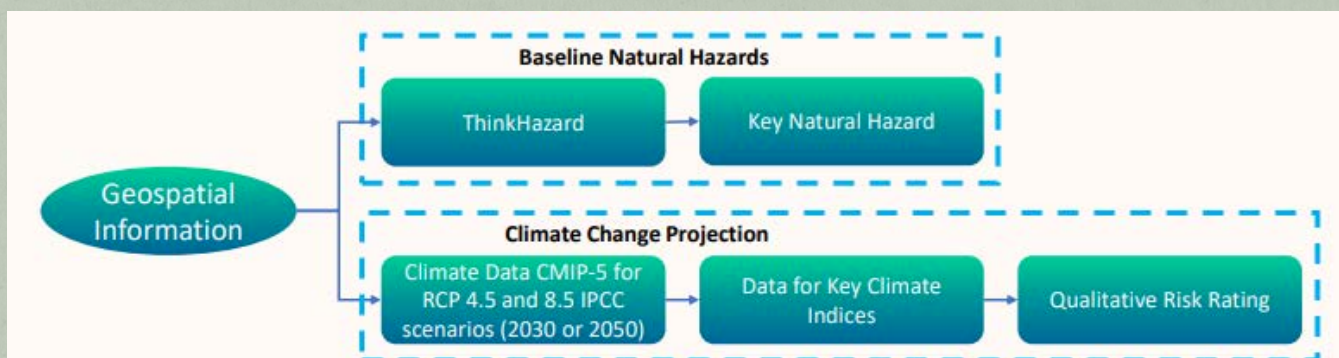
Assessment

Methodology

Screening-level physical climate risk assessment for Triputra Agro Persada Group (TAPG) operations in Indonesia. The assessment was conducted for baseline and climate change for:

- Two climate change scenarios (**RCP 4.5 and RCP 8.5**),
- Two timeframes - **2030** (mid-term) and **2050** (long-term), and
- **Five climate natural hazards** relevant to TAP's business and Indonesia: water availability, riverine flood, extreme heat, landslides and cyclones/winds

The physical climate risks analysis compared baseline data for climate-related natural hazards at assets' locations with future scenarios (RCP 4.5 and RCP 8.5 of IPCC) by 2030 and 2050.



SCENARIOS FOR PHYSICAL CLIMATE RISKS

Selection of scenarios for physical climate risks assessment

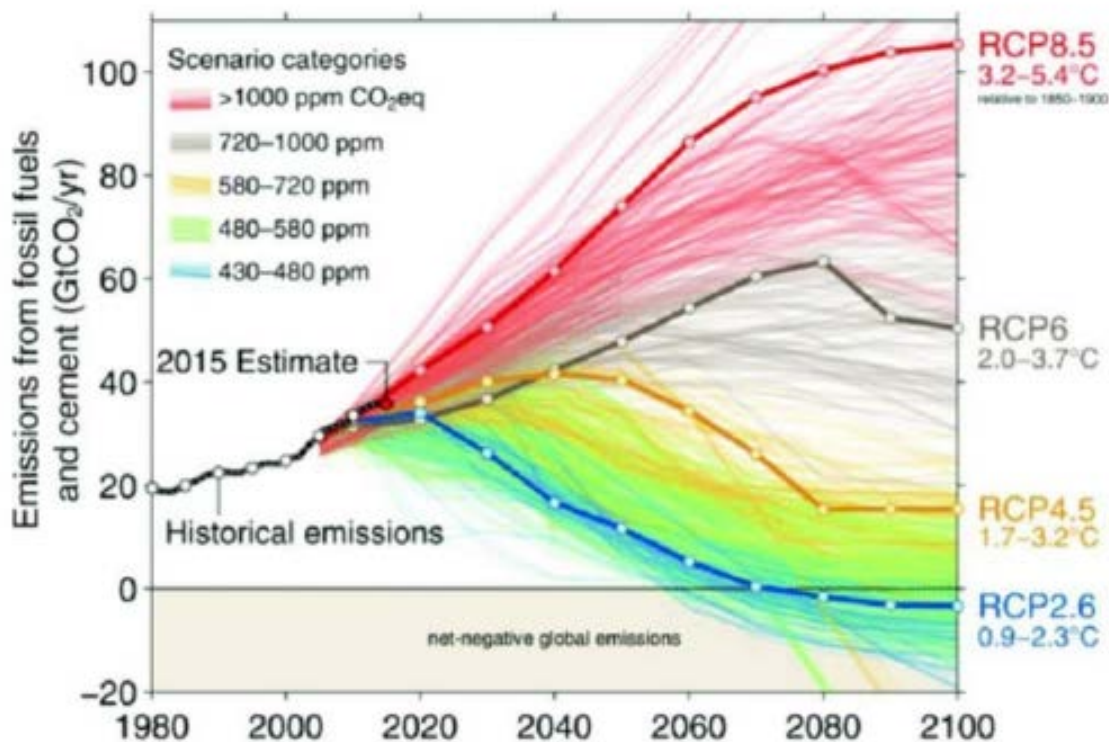


Image Source : Neil Craik, University of Waterloo

Two **Representative Concentration Pathway** (RCP) scenarios of the Intergovernmental Panel on Climate Change (IPCC) have been used for our physical climate risk assessment for Triputra Agro Persada Group, including:

RCP 8.5

Is a high emission scenario with no policy for emission reduction, hence the projections for RCP 8.5 in 2080 can be considered the 'worst case' physical risks scenario.

RCP 4.5

Considers the relatively ambitious GHG emissions reduction to keep global temperature increase within 2°C. At the same time, it envisages stronger changes in the climate system and hence higher physical impacts than the RCP 2.6 scenario (corresponding to the 1.5°C future), and thus has been prioritised for the TAP Group physical risk assessment.

BASELINE DATA SOURCES

Hazard and Description	Primary Data Source	Underlying Data Sources
Water Scarcity Hazard is classified using a Water Stress Index, which reflects the availability of water per person per year – a measure of water stress based on hydrological drought and water use.	Think Hazard (World Bank Group, 2017) https://thinkhazard.org/en/	Global Dataset of Water Crowding Index (WCI) (Veldkamp et al. 2015)
Riverine Floods River flood and urban flood hazards are classified using a threshold of area flooded to damaging intensity of 0.5 m. The area threshold is 1% of the Administrative (ADM) unit for river flood, and 4% of the ADM unit for urban flood	Think Hazard (World Bank Group, 2017) https://thinkhazard.org/en/	SSBN Ltd 90 m global flood hazard maps
Extreme Heat Extreme heat hazard classification is based on a daily maximum Wet Bulb Globe Temperature, provided as frequency-severity data in raster format.	Think Hazard (World Bank Group, 2017) https://thinkhazard.org/en/	Wet Bulb Globe Temperature (WBGT) extreme heat dataset developed by VITO
Landslides Landslide hazard classification is based on the annual frequency of landslides persquare kilometre.	Think Hazard (World Bank Group, 2017) https://thinkhazard.org/en/	
Cyclone Tropical cyclone is classified using wind speed, provided as frequency-severity data. The damaging intensity threshold is 80 km/h.	Think Hazard (World Bank Group, 2017) https://thinkhazard.org/en/	UNISDR Global Assessment Report 2015 (GAR15)
Baseline and Climate Change Projections Data (Precipitation, temperature)	ERM's in-house Climate Change Risk Assessment Tool	Couple Model Intercomparison Project (CMIP)

PHYSICAL CLIMATE RISK ASSESSMENT RESULTS

Relative hazard level in the baseline and future climate scenarios by 2030 and 2050 for TAPG operational & asset locations.

Region	Regency	Water Scarcity					Riverine Flood					Extreme Heat					Landslides					Wind and Cyclones				
		Baseline	RCP 4.5 2030	RCP 4.5 2050	RCP 8.5 2030	RCP 8.5 2050	Baseline	RCP 4.5 2030	RCP 4.5 2050	RCP 8.5 2030	RCP 8.5 2050	Baseline	RCP 4.5 2030	RCP 4.5 2050	RCP 8.5 2030	RCP 8.5 2050	Baseline	RCP 4.5 2030	RCP 4.5 2050	RCP 8.5 2030	RCP 8.5 2050	Baseline	RCP 4.5 2030	RCP 4.5 2050	RCP 8.5 2030	RCP 8.5 2050
Sumatra	Muaro Jambi	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	1	1	1	1	1	1	1	1
	Batanghari	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	1	1	1	1	1	1	1	1
Central Kalimantan	Seruyan	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	1	1	1	1	1	1	1	1
	Lamandau	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	1	1	1	1	1	1	1	1
East Kalimantan	Sukamara	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	1	1	1	1	1	1	1	1
	Kutai Timur	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	2	2	2	2	2	1	1	1	1	1
	Kutai Barat	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	1	1	1	1	1
	Berau	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	2	2	2	2	2	1	1	1	1	1
	Penajam Paser Utara	1	1	1	1	1	3	3	3	3	3	2	3	3	3	3	1	1	2	1	2	1	1	1	1	1

Legend :

No Hazard

Low Hazard

Medium Hazard

High Hazard

PHYSICAL CLIMATE RISK ASSESSMENT RESULTS

Although climate change projections indicate an increase in annual rainfall, water availability at the local level (e.g. at the Site) may be affected by rainfall intensity patterns, water use in and around the Site area. Therefore, a detailed water risk assessment may be required to evaluate water risks related to availability, infrastructure and governance.

Judging from the location of the assets, there is likely to be no significant change in cyclone hazard. However, it is worth noting that in recent years, more cyclones have been reported hitting several parts of Indonesia.

Under climate change scenarios, no significant changes in extreme rainfall are projected. However, any changes in land use patterns (e.g. replanting, clearing of forests, or large-scale logging for development) could exacerbate landslides in the future.

Under climate change scenarios, no significant changes in extreme rainfall are projected. However, increased rainfall may cause waterlogging and flooding in low-lying areas.

Climate change projections show higher maximum temperatures and longer duration of warm weather in the future. Heat and drought combined may reinforce each other's impacts, e.g., during an extreme heat episode, an industrial plant may require enhanced cooling, but a concurring drought might limit the availability of cooling water.

PHYSICAL CLIMATE RISKS ASSESSMENT RESULT

Palm Oil Plantation in Muaro Jambi Regency

Water Scarcity Hazard Level : Very Low



Riverflood Hazard Level : High



Riverflood Extreme Heat : Medium



Land Slides Hazard Level : Low



Cyclone Hazard Level : Very Low



Palm Oil Plantation in Batang Hari Regency



Water Scarcity Hazard Level : Very Low



Riverflood Hazard Level : High



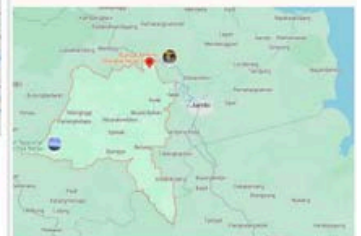
Riverflood Extreme Heat : Medium



Land Slides Hazard Level : Low

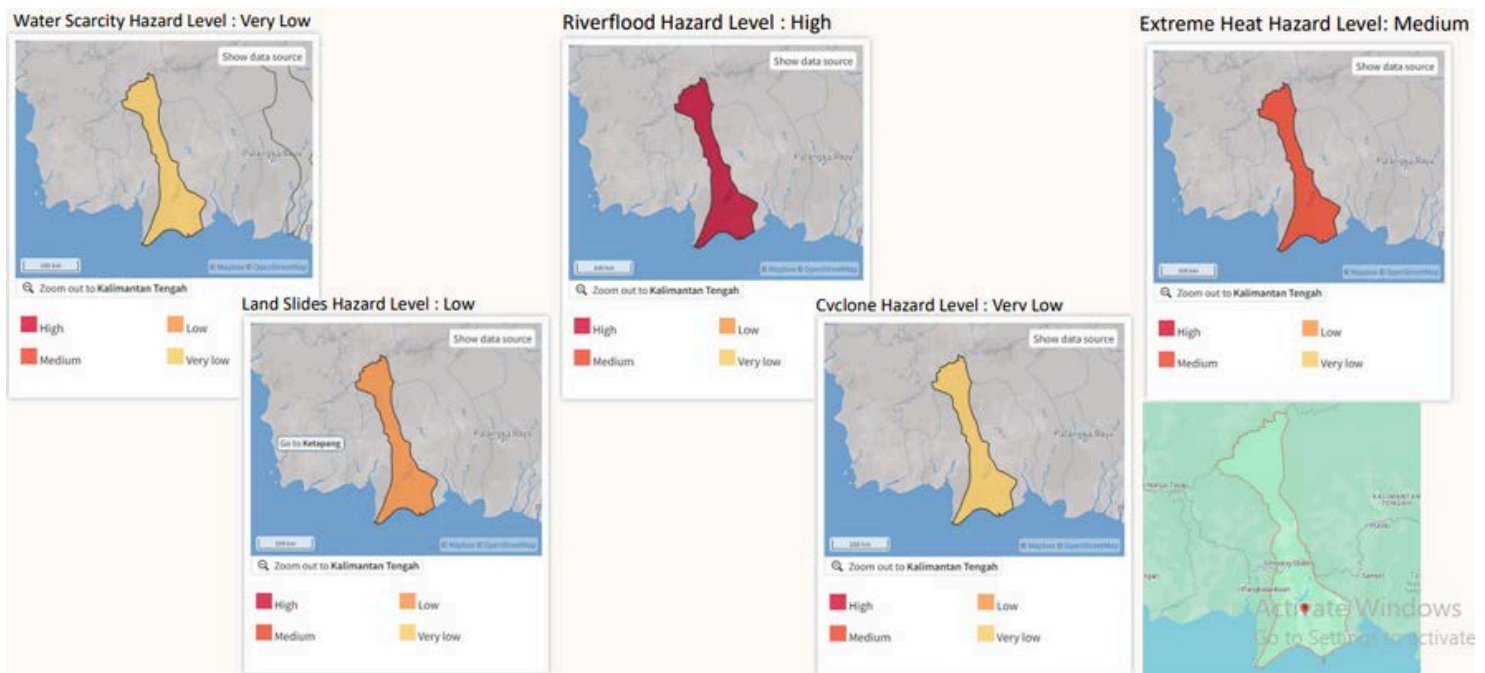


Cyclone Hazard Level : Very Low

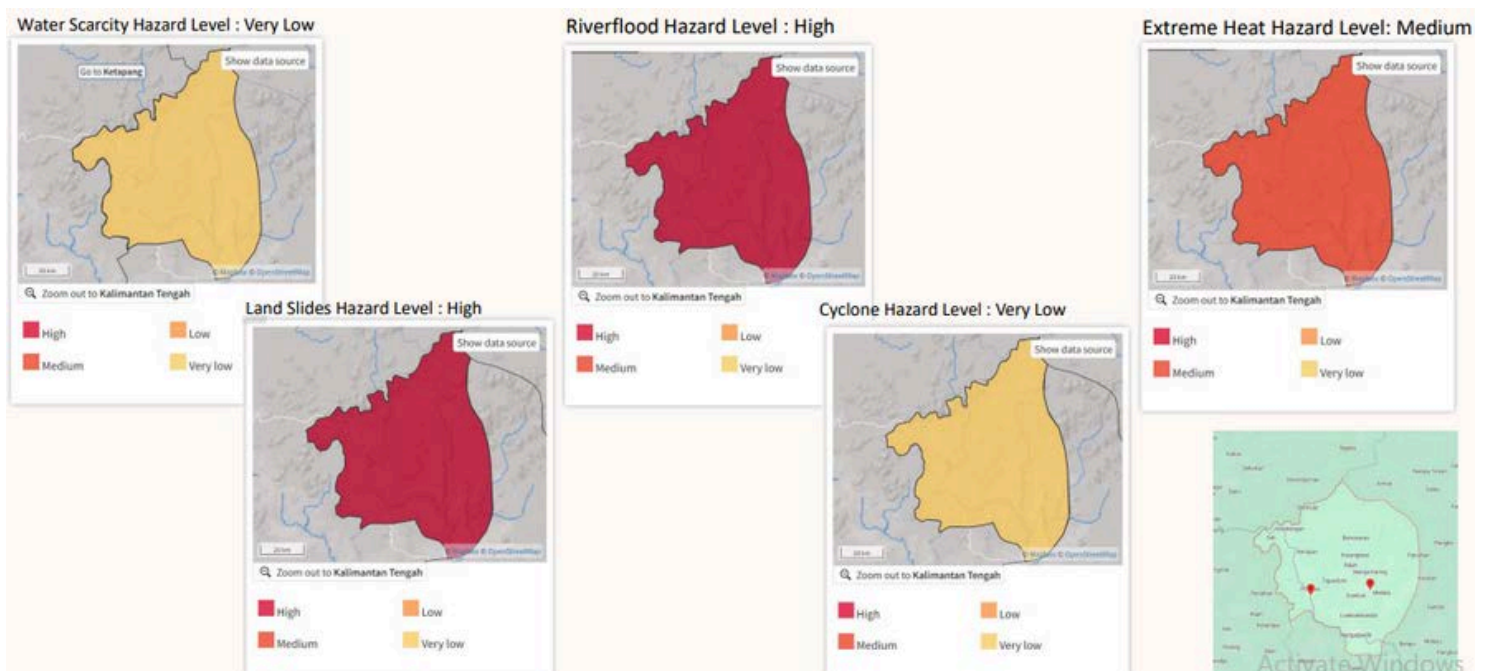


PHYSICAL CLIMATE RISKS ASSESSMENT RESULT

Palm Oil Plantation in Seruyan Regency

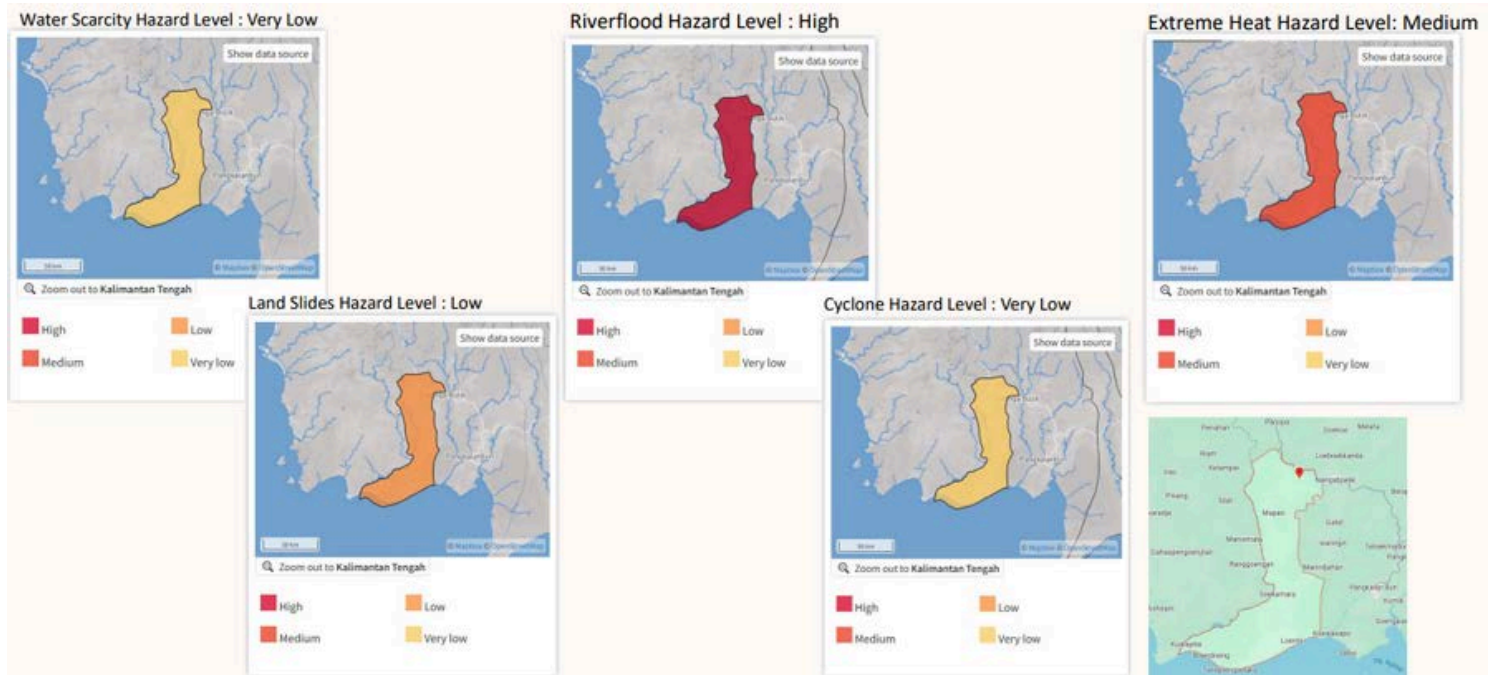


Palm Oil Plantation in Lamandau Regency

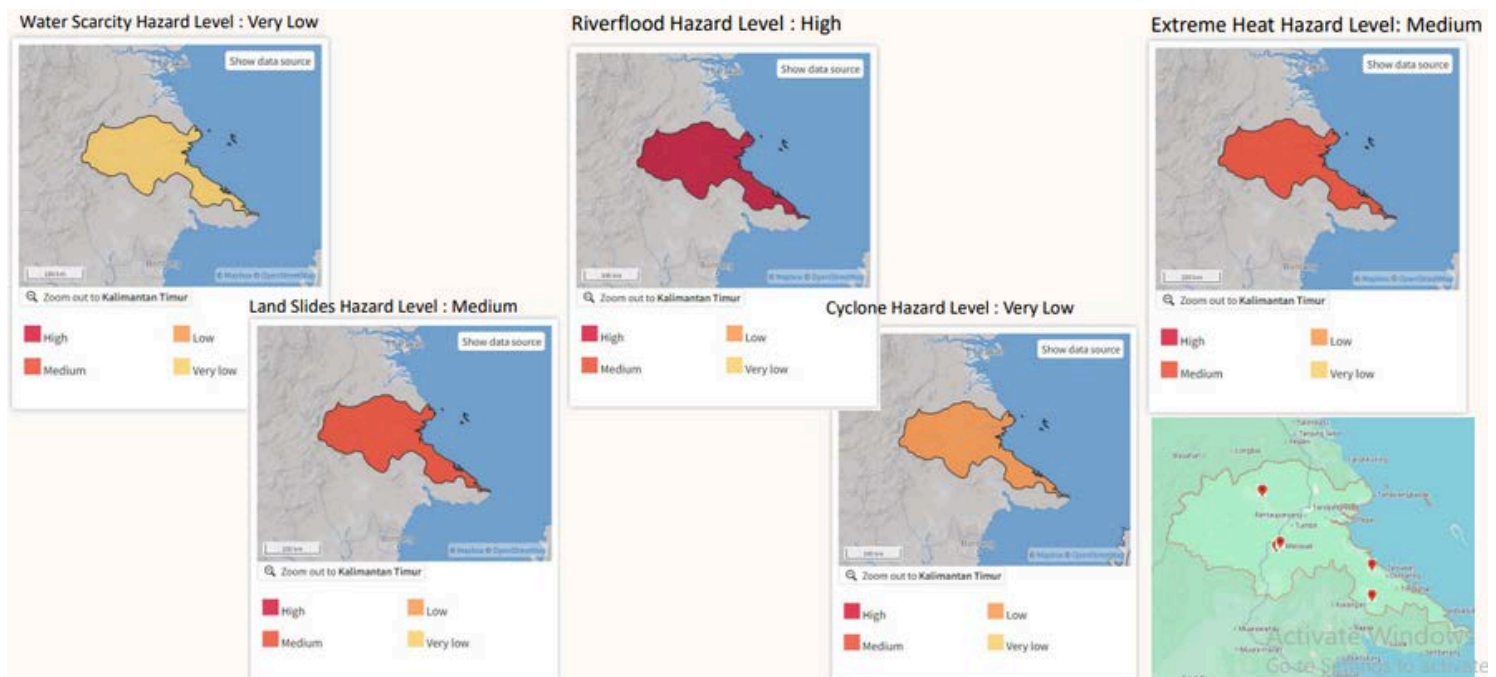


PHYSICAL CLIMATE RISKS ASSESSMENT RESULT

Palm Oil Plantation in Muaro Sukamara Regency

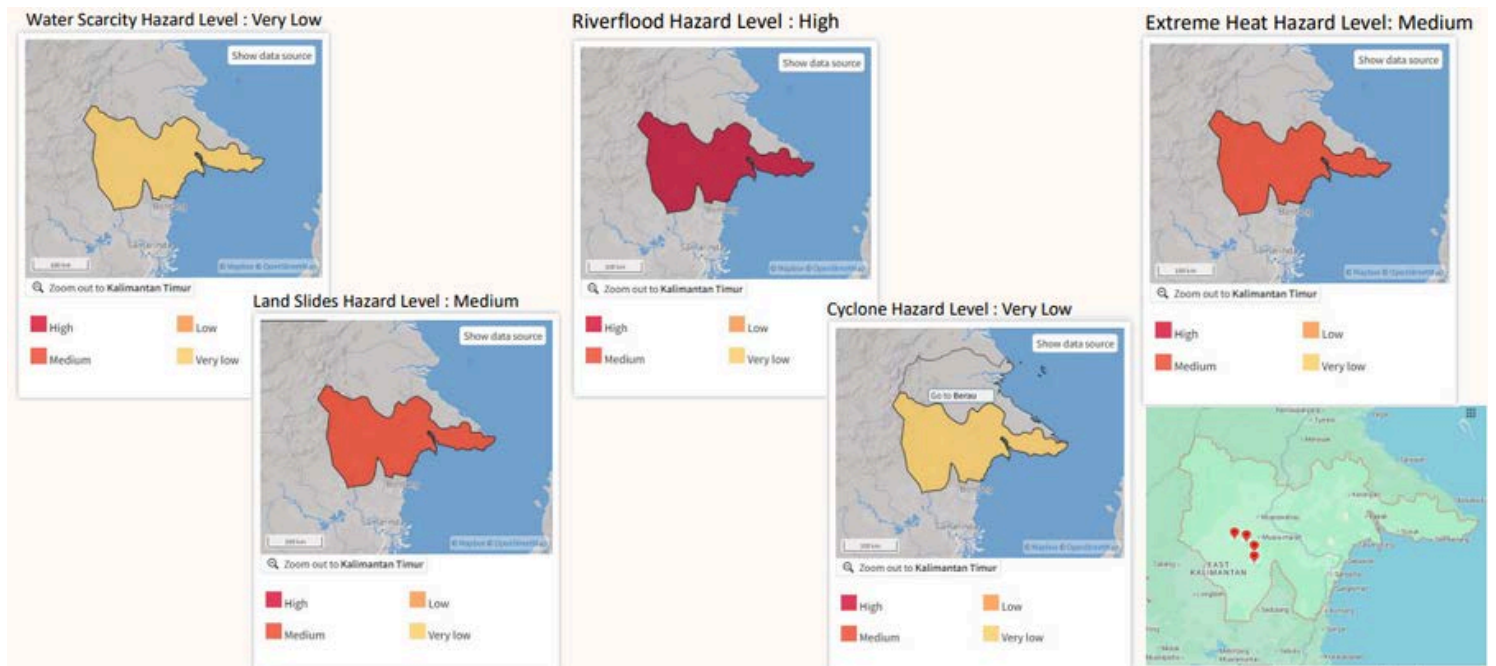


Palm Oil Plantation in Berau Regency

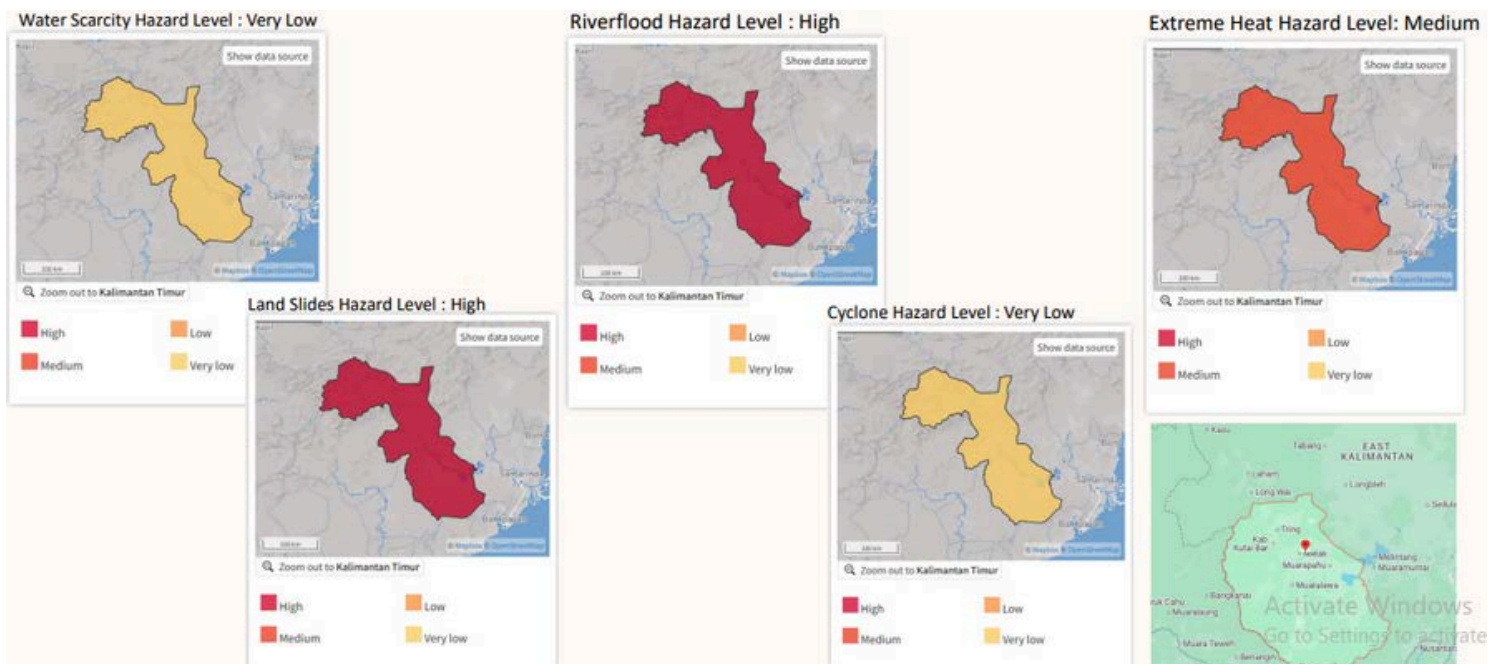


PHYSICAL CLIMATE RISKS ASSESSMENT RESULT

Palm Oil Plantation in Kutai Timur Regency

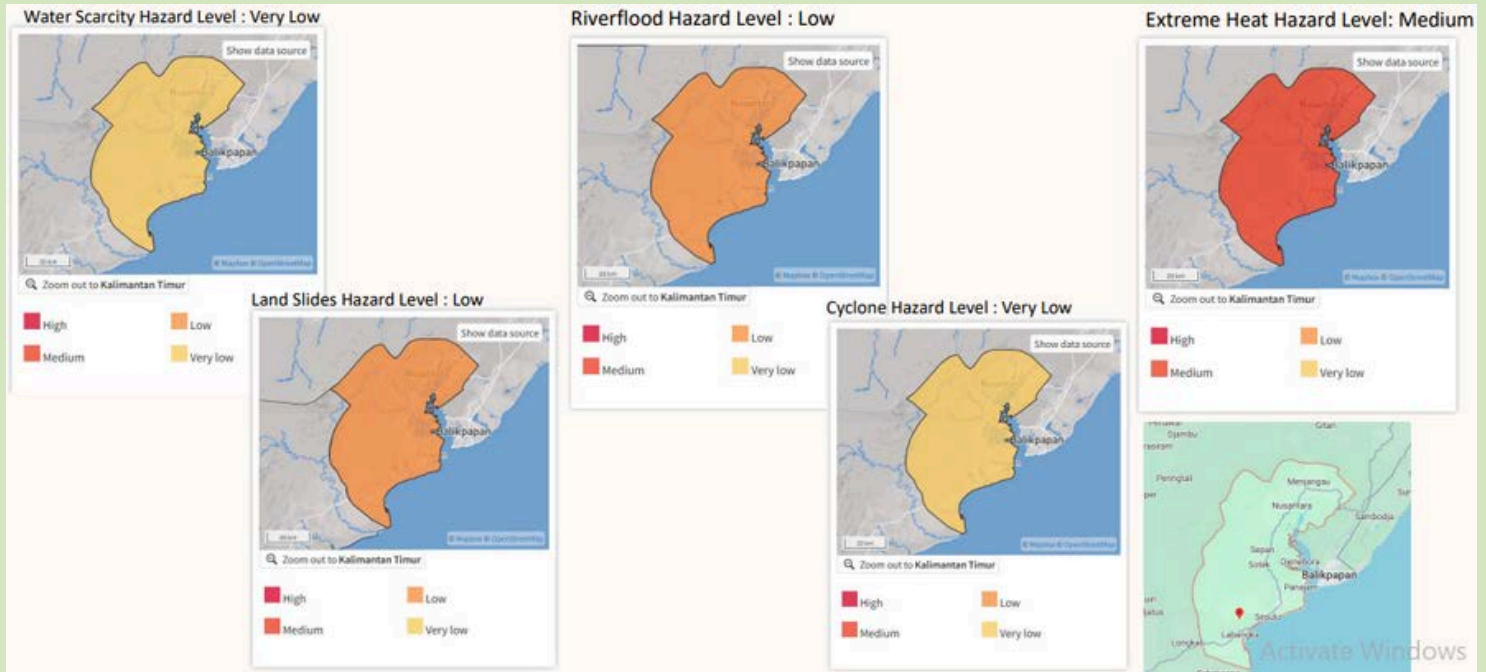


Palm Oil Plantation in Kutai Barat Regency



PHYSICAL CLIMATE RISKS ASSESSMENT RESULT

Palm Oil Plantation in Penajam Paser Utara Regency



CLIMATE CHANGE IMPLICATIONS & RISK MANAGEMENT

Hazard Type	Key Implications	Risk Management Techniques Considered
Water Availability	- Impact on operations - Water stress may impact growth of plants - Vulnerability to the impacts of land fires - Impact on water availability for irrigation - Impact on domestic water requirement - Reputational risk during water stressed periods	- Conduct water risk assessment - Explore opportunities for rainwater harvesting at site and catchment level - Adopt water efficiency/saving technology to reduce water usage - Explore opportunities to reuse or recycle wastewater within the plant or from nearby communities - Construction of water embankments and water reservoirs in the field - Developing strategic water reservoirs for summer/dry seasons - Strategic excellence in plantation water management
Flooding	- Safety of employees - Damage to infrastructure, tools and equipment - Temporary access disruption and degradation of soil quality due to waterlogging on access roads and planting areas - Erosion of top soil - Nutrient deficiency and death of immature plants - Increased insurance costs - Impact on operations - Impact on staff, local communities, and biodiversity	- Flood risk assessment may be conducted to identify areas prone to flooding for all key assets - Consider flood hazards in the emergency response plan & business continuity plan (BCP) - Prepare an emergency response that takes into account the safety of TAPG Employees - Design and implement suitable mitigation measures, such as increasing the capacity of storm water drainage or pumping system, construction of flood barrier, etc. - Periodic normalization of river and ditch sedimentation - Evaluate existing spill management plans/storm water management plans - Provide security equipment to mitigate impacts of flooding - Strategic excellence in plantation water management
Extreme Heat	- Increased irrigation water demand due to high evapotranspiration - Impact on crop yield (an increase of 1-4°C may result in 10-40% decline in yield). - Potential discomfort due to heat stress and reduced working efficiency of employees. - Vulnerability to the impacts of land fires - Overheating, reduced efficiency and breakdown of equipment	- Water mitigation (creating and maintaining ditches, long beds, silt pits, drip irrigation, and optimizing natural ditches in the plantation) - Consider extreme heat conditions in the emergency response plan & business continuity plan (BCP) - Provide training to employees to identify symptoms of heat stress and provide first aid - Evaluate existing operational temperature ranges of tools and equipment against projected extreme temperatures
Landslides	- Damage to infrastructure, tools and equipment - Temporary disruption of access along roads - Safety of employees - Increased cost for replacement or repair of damaged assets - Potential risk of damage to plantations located at foothills	- Identify areas prone to landslides - Avoid deep/steep cuttings - Implement landslide mitigation measures as appropriate
Wind and Cyclone	- Damage to buildings and infrastructure - Safety of employees - Loss of revenue due to disruption of operations - Cost of replacement and repair of damaged infrastructure - Increased insurance costs	- Comply with national or international best practices for wind load for design and construction of all structures - Implement/follow monitoring mechanisms with the national or regional meteorological agencies for the early warning system - Develop a response mechanism to plan operations and take preventive steps (e.g. planned shut down before cyclone) to reduce impacts Include cyclone and wind as one of the hazards in site level emergency response plans

TRANSITION RISKS AND OPPORTUNITIES



**Methodology,
Scenarios, and Results**

Data

Sources,



ASSESSMENT APPROACH

Transition Risks & Opportunities

CLIMATE CHANGE SCENARIO

- Level of vulnerability of crops and plantations to selected disaster risks.
- Two time horizons - medium term (2030) and long term (2050).
- Twelve transition drivers representing policy and regulatory, market, technology, and reputation risks, in line with TCFD.

RISK ASSESSMENT

Qualitative climate transition risk and opportunity assessment for TAPG operations in Indonesia and along the company's value chain.

CLIMATE CHANGE SCENARIO

TAPG's strategic business units under consideration palm oil.

Identify relevant transition drivers and assess their potential impact on TAPG's strategic business units.

Step 1

Scenario analysis and (qualitative) assessment of future transition risks and opportunities for TAPG's strategic business units

Step 2

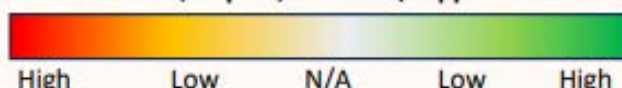
Identification of potential risk mitigation actions and recommendations for business strategy

Step 3

SUMMARY OF KEY DRIVERS AND THEIR IMPACT

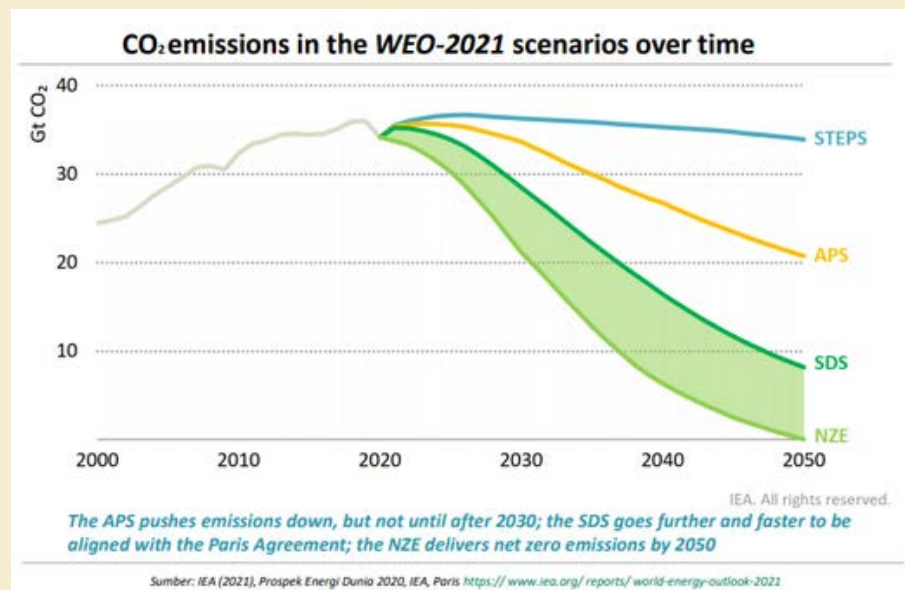
Key Drivers	Risk/ Loose Event Scenario Indicator	Palm Oil		Financial Drivers
		Weight	Rationales	
Government Policies and Regulations	Land use restriction		This risk scenario is already happening and is likely to increase in the future as more countries need to adapt	CAPEX, OPEX
	Carbon Tax		Significantly increase OPEX. Cost benefit analysis is needed to find a balance between increasing sustainability and managing carbon prices.	CAPEX, OPEX, Revenue
	Foreign trade restrictions		Already happening and reducing market coverage, Increasing certification standards may mitigate some of this risk	Revenue
	Mandatory biofuel utilization		Already happening and fuel demand is expected to increase over time	Revenue
	International standards		Increase OPEX and CAPEX to meet standards. However, the product may reach new markets at a better value	OPEX, Revenue
Market & Technology	Customer Sustainability Concerns		This scenario is already happening and is likely to increase in the future as more countries need to adapt	Revenue
	Niche Market		Efforts to become more sustainable can help capture niche markets	Revenue
	Sustainability-Linked & Green Loans		Complying with regulations and diversifying businesses, as TAPG is currently doing.	CAPEX
	More Efficient Technologies		Opportunity to meet yield targets when land restrictions for oil palm plantations are	Revenue
	Renewable and Methane Capture Costs		Increasing demand for renewable energy generation, and the adoption of methane capture technology	CAPEX
Reputational	Shareholders' Sentiments		Already happening and the risks have a significant impact on investment. Many investors are increasingly concerned about the sustainability of oil palm companies.	CAPEX
	NGOs' and Other Stakeholders' Role		Most likely to happen, with increasing CAPEX and OPEX to meet stakeholder expectations	CAPEX, OPEX

- likelihood, impact, and risks/ Opportunities +



Low carbon scenario: A pathway towards reducing global CO₂ emissions and achieving other, non-climate, sustainable development goals. Global demand for fossil fuels declines in this scenario, and the world embraces clean technology as an alternative. Consumers make informed choices about their carbon footprints, such as impacting frequency of travel. Implied climate warming is 1.65°C to 'just above' 2°C.

Base case scenario: A pathway that takes account of announced climate-related policies (such as the current Paris Agreement 'Nationally Determined Contributions'), however does not forcefully pursue decarbonisation. The implied global climate warming associated with the base case scenario is between 2.5°C and 3.3°C.



SCENARIOS FOR TRANSITION RISKS AND OPPORTUNITIES

APS

Announced Pledges Scenario: Enhanced STEPS with net zero pledges from more than 50 countries which just recently announced in the run-up to COP26.

NZE

Net Zero Emissions by 2050 Scenario: A narrow but achievable roadmap to 1.5°C stabilisation in rising global temperatures and the achievement of other energy-related SDGs

TRANSITION RISKS RESPONSE MEASURES / STRATEGIC PRIORITIES

	Climate Drivers	Implication for TAPG Business	Risk Mitigation Techniques Considered
Policy & Regulation	Carbon Tax	Increasing CPO production cost	Calculating internal carbon pricing based on regulations in Indonesia and other target market countries
	Foreign trade restriction	- Limiting international market for TAPG - Need to make greater efforts to improve product sustainability level to escape import ban	- Establishing a clear climate strategy to address these issues - Mapping market expansion and assessing the requirements
Technology & Market	Technology Advancement	Increase yield and efficiency for each strategic business unit	Detailed assessment of technologies and how they will fit into TAPG's current and future operations
	Renewable Energy & Methane Capture	Market will be more concerned about reducing green technology cost	Finding investments for green technologies to be used by TAPG.
Reputational	Shareholder and Stakeholder Sentiment	Reputation on shares that can affect TAPG's position in the market and access to funding	Expressing TAPG's sustainability journey through a credible framework such as TCFD

TRANSITION RISKS & OPPORTUNITIES FOR TAPG

Heatmap

Risk Score Colour Key

High Opp.

Mod Opp.

Low Opp.

Neutral

Low Risk

Mod. Risk

high Risk

Identified Transition Risk & Opportunity	Heatmap of Potential Transition Risks and Opportunities for TAPG	
	Palm Oil	
	2030	2050
Policy & Legal		
Land-use Restrictions	High Opp.	High Risk
Carbon tax	High Opp.	High Risk
Foreign trade restrictions	High Opp.	High Risk
Mandatory biofuel utilization	Mod Opp.	Mod Opp.
International Standards	High Opp.	Mod Opp.
Market		
Sustainability-related customer concerns	High Opp.	Mod Opp.
Niche market	Mod Opp.	Mod Opp.
Sustainability-linked & green loans	Mod Opp.	Mod Opp.
Technology		
Increased technology efficiency	Mod Opp.	High Risk
Renewable and methane capture cost	Mod Opp.	High Risk
Reputation		
Shareholders' concerns	High Opp.	Mod Opp.
Role of NGOs and other stakeholders	High Opp.	Mod Opp.