# Inevitable Policy Response – Supply Chain Analysis (SCA)

Climate-related supply chain risk in the Food and Land-use sectors

October 2022

Updated February 2023

INEVITABLE POLICY RESPONSE

# Contents

# Executive summary

## Background

### Companies downstream of the supply chain for tropical soft commodities are at risk

Tropical soft commodities drive a disproportionate share of deforestation. As policy to regulate deforestation accelerates, and pressure for companies to disclose the environmental impacts of their supply chains increases, companies downstream these supply chains are expected to face greater risks due to the climate and policy transition.

### Risk value drivers can help assess risks associated with deforestation for downstream companies

The policy and climate transition poses new risks to companies with deforestation embedded in their products. Better articulation of different value drivers can help investors understand and assess different types of risks downstream companies face, such as market access, non-compliance and reputational risk.

## Approach

### New value drivers added to the 2021 IPR scenarios speak to downstream companies

A new set of supply chain-related value drivers have been produced to complement the existing IPR scenario value drivers, published in 2021. The IPR 2021 value drivers are especially useful for upstream companies (i.e., producers and processors), and the expanded framework in this work enables the application of risk value drivers to downstream companies (i.e., retailers and distributors).

### Value drivers on prices and production capture shifts in demand and supply

Value drivers related to production and prices of tropical soft commodities can help investors understand chronic demand shifts and changes in supply chains occurring due to the climate and policy transition, and how these affect the risk exposure of downstream companies operating with tropical soft commodities.

## Findings

### In-depth policy analysis supports the inevitability of policy response

An extensive analysis of 80+ policies regulating production and trade of tropical soft commodities demonstrate what an ‘inevitable policy response’ might look like, and that it could lead to the end of commodity-driven deforestation by 2035, although regions will move towards this achievement at different speeds.

### Piloting of the approach to assess the future of supply chains demonstrates that impacts can be material

Investors are provided with a toolkit to better understand climate scenarios and policy developments, and the impacts these have on the financial performance of companies downstream of the supply chain for tropical soft commodities. Piloting of this toolkit suggests that companies’ risk exposure can be material if left unaddressed.

# The policy response's impact on supply chains is currently poorly understood, creating a crucial gap in the analysis of transition risk for downstream sectors

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## Context

1. **IPR 2021 value drivers** include a section on land use: prices and production volumes of different agricultural commodities, NBS deployment, bioenergy, among others
2. In early 2022, UN-supported PRI and Vivid Economics organised a collective exercise for investors to **operationalize the IPR value drivers** in assessing the potential impact of transition risks on food companies' assets
3. One of the main conclusions of the study is that the existing value drivers are particularly useful for analysing upstream companies (i.e., producers and processors) but **difficult to apply to downstream companies** (i.e., retailers and distributors)

## Why this module?

1. **Tropical soft commodities** (e.g., beef, soybean, palm oil, timber, coffee, rubber, cocoa) **drive a disproportionate share of deforestation**, potentially creating transition risks for downstream companies
2. Supply chains of tropical soft commodities rely on international trade, so **upstream deforestation in a few jurisdictions drive direct and indirect risks to investors in downstream companies globally**
3. The 'inevitable policy response' would **tackle deforestation in most jurisdictions exacerbating risks for companies and investors**
4. There is increased **pressure for companies to disclose the environmental impacts of their supply chains and stress test their strategies** using scenario analysis
5. To date, there is no set of scenarios and **value drivers applicable to companies operating downstream** in the land-use sector

Note: the impact of deforestation on biodiversity is not covered in this report

# The Inevitable Policy Response (IPR) is commissioned by the Principles for Responsible Investment (PRI) and supported by world class research partners

**PRI commissioned** the Inevitable Policy Response in 2018 to advance the industry's knowledge of climate transition risk, and to support investors' efforts to incorporate climate risk into their portfolio assessments

**A research partnership** led by Energy Transition Advisors conducts the initiative's research with scenario modelling by Vivid Economics, and contributions from Kaya Advisory, the Grantham Research Institute, the London School of Economics and Political Science, the 2Dii, the Carbon Tracker Initiative, the Climate Bonds Initiative and Planet Tracker

The consortium was given the mandate to bring analytic tools and an independent perspective to assess the drivers of likely policy action and their implications on the market

# Financial institutions and philanthropic donors provide additional support for the IPR

**Financial institutions** have joined the IPR as Strategic Partners to provide more in-depth industry input and to further strengthen its relevance to the financial industry

**Core philanthropic support** has been received since IPR began in 2018. The IPR is funded in part by the Gordon and Betty Moore Foundation through The Finance Hub, which was created to advance sustainable finance, and the ClimateWorks Foundation, which strives to innovate and accelerate climate solutions at scale

# IPR has developed policy-based scenarios of forceful policy responses to climate change and implications for energy, agriculture and land use, across three scenarios

| Scenario | Policy Forecast Details | Open Access Database |
|---|---|---|
| **IPR 1.8°C Forecast Policy Scenario (FPS)**<br>• Models impact of forecasted policies on the real economy<br>• Global emissions fall by 80% by 2050, aligned with warming below 2C (1.8°C) | IPR 1.8°C FPS Policy Details<br>IPR 1.8°C FPS Energy and Land Use System Results Summary | IPR FPS 2021 Value Drivers |
| **IPR FPS + Nature**<br>• Explores the impact of forecast climate- and nature-related policies | IPR FPS_+ Nature | IPR FPS + Nature Value Drivers (2023) |
| **IPR 1.5°C Required Policy Scenario (RPS)**<br>• Required policies to align to a **1.5°C objective** building on the International Energy Association's Net Zero scenario and deepening analysis on policy, land use, emerging economies and value drivers | IPR 1.5°C RPS Energy and Land Use System Results including Policy Details | IPR RPS 2021 Value Drivers |

# This IPR supply chain analysis enables better climate risk analysis of tropical commodity supply chains by estimating value drivers and linking those to company exposure[1]

## Objectives

IPR Supply Chain Analysis aims to:

- Provide insights for investors to **understand the transition risks for downstream companies operating with tropical soft commodities**
- Support investors to do **more comprehensive and accurate valuations** of these risks, especially by **introducing metrics to assess transition risk**
- Support the **redeployment of capital into companies with deforestation-free supply chains**

## Outputs

**Policy mapping**

Provide investors with **information on the policy landscape regulating production and trade of tropical soft commodities** and its implications on downstream companies

**Production and price value drivers**

Provide investors with **production and price statistics of tropical soft commodities at the regional level** across **different scenarios**, to provide insights on the implications of policies and the climate transition[1]

**Risk exposure quantification method**

Provide investors with a **framework and metrics to understand and assess transition risk related to deforestation** driven by production of tropical soft commodities[2]

1. Results are derived from the Model of Agricultural Production and its Impact on the Environment (MAgPIE)
2. This analysis excludes physical risks and impacts of deforestation on biodiversity

# Investors in companies that operate downstream of tropical commodity supply chains need to understand the investment risks and associated negative climate and nature impacts

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## Why downstream companies and their investors have a responsibility to understand transition risk in supply chains

1. **Tropical soft commodities** (e.g., beef, soybean, palm oil, timber, coffee, rubber, cocoa) **drive a disproportionate share of deforestation,** driving significant scope 3 emissions and negative nature impacts, and creating financial risks for downstream companies

2. Supply chains of tropical soft commodities are reliant on international trade, meaning that **upstream deforestation in a few jurisdictions can drive direct and indirect risks to investors in downstream companies globally**

3. There is increased **asset owner and regulatory pressure for companies to disclose the environmental impacts of their supply chains and stress test their strategies for transition risk** using scenario analysis

4. An 'inevitable policy response' scenario includes **significant policy action to tackle deforestation in most jurisdictions – both exporting and importing – exacerbating risks for companies and investors**

5. Scenarios and value drivers applicable to companies operating downstream in the land-use sector are now available from the IPR initiative, **and conducting this analysis in now technically feasible**

# The module maps the policy landscape and estimates production and prices of tropical soft commodities that create value and risk in the supply chain …

| | Description | Detailed list of deliverables / indicators |
|---|---|---|
| **Policy mapping** | • The collection and analysis of 80+ country-level policies regulating deforestation tied to the production and trade of tropical soft commodities is used to estimate the 'inevitable policy response' that regulates levels of commodity-driven deforestation worldwide | • Estimated **year by when regions achieve fully regulated and deforestation-free production** by commodity<br>• Estimated **year by when regions achieve fully regulated and deforestation-free supply chains** by commodity |
| **Production and price value drivers** | • The policy mapping serves as a key input to **the land use model** which also take into consideration:<br>  • Carbon pricing<br>  • Diet shift<br>  • Bioenergy demand | • **Production volumes** (M tons DM year-1 or $Mm^3$ year-1) by region and by commodity over period 2020-2050 for IPR FPS and BAU scenarios<br>• **Global price index** by commodity over period 2020-2050 for IPR FPS and BAU scenarios |
| Risk analysis | | |

# … and develops a framework for quantifying risk exposure that can be applied to individual downstream companies

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Policy mapping

Production and price value drivers

**Risk analysis**[1]

## Description

- The risk analysis combines the policy mapping together with the production and price value drivers to **assess risks for downstream companies, and costs of mitigating those risks**
- The analysis provides a framework that distills risks into five categories:
  - **(Non) Compliance risk:** the risk of being fined or face credit restrictions
  - **Market access risk:** the risk of losing access to procurement channels
  - **Reputational risks:** the risk of loosing revenues due to an ESG event
  - **Chronic shift in demand** (assessed in previous modules)
  - **Carbon costs** (assessed in previous modules)
- The analysis quantifies the costs to avoid those risks by:
  - **Upgrading operations:** costs of upgrading operations and monitoring supply chains to fully avoid deforestation
  - Paying the **price premium for deforestation-free commodities**

## Detailed list of deliverables / indicators

1. **Market access risk** (low/medium/high) – by region over period 2020-2050
2. **(Non) Compliance risk** which is composed of fines and higher costs of accessing finance
3. **Reputational risk** (low/medium/high):
   - Reputational risk faced by downstream company given the commodity and region of procurement
   - Average reputational risk faced by downstream company given the economic sector and world region where the company is active

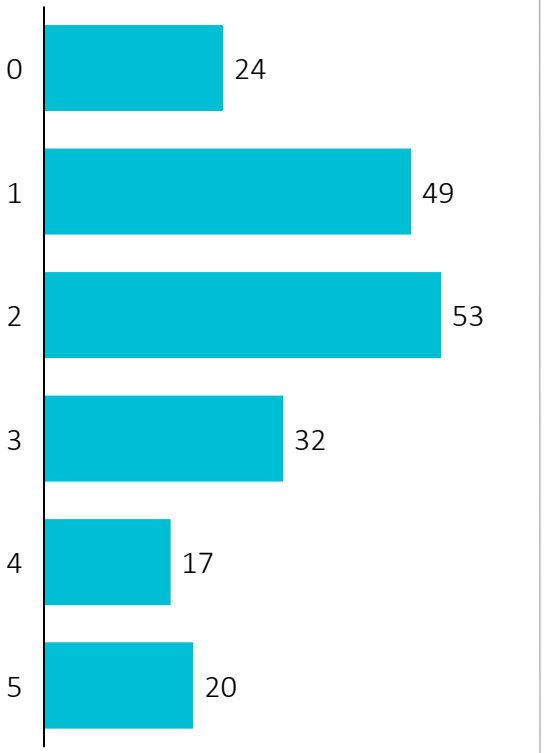
**Costs to avoid transition risk:**

4. **Average costs of upgrading operations** ($/year) to fully avoid deforestation over period 2020-2050 by company with different revenue ranges
5. **Global price premium** (% over global average market price) for deforestation-free commodities by commodity over period 2020-2050

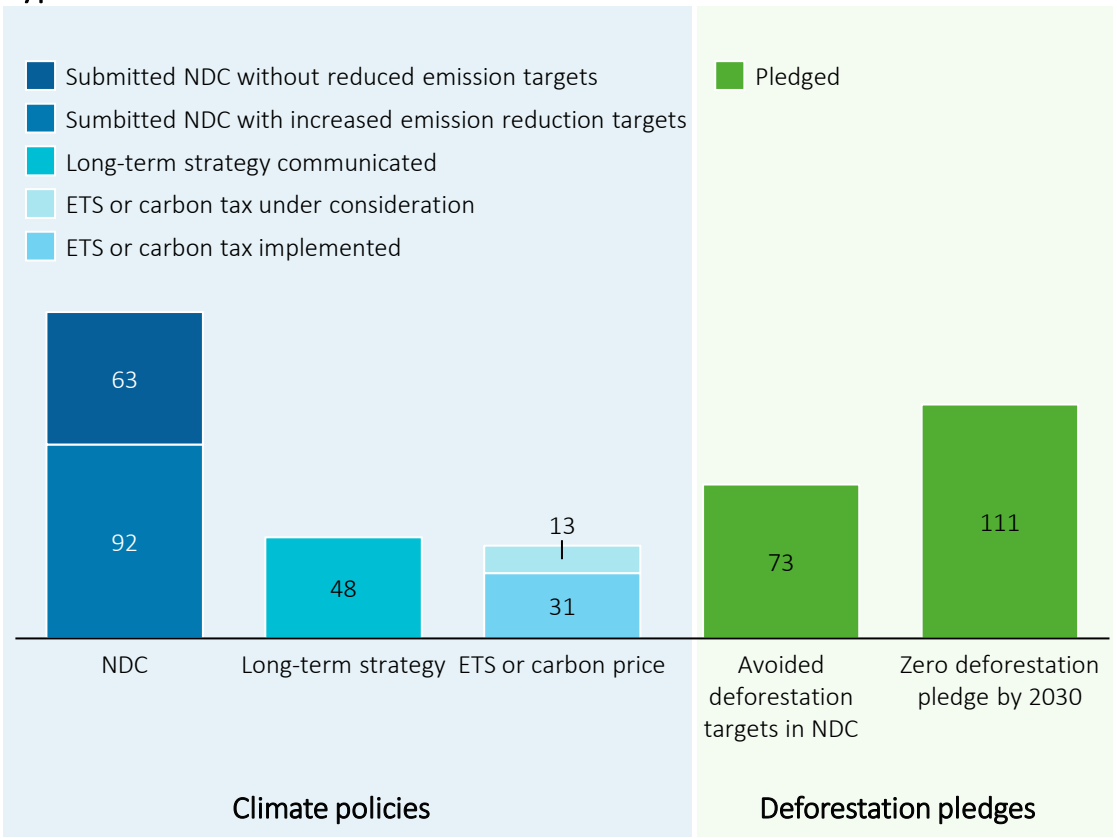
1. Risk value drivers are based on the IPR FPS scenario.

# As producing and importing countries commit to stopping deforestation, policies regulating deforestation are likely to become more stringent

Number of countries by climate and forestry commitment score[1] (0-5)




Number of countries with different climate and forestry commitment types



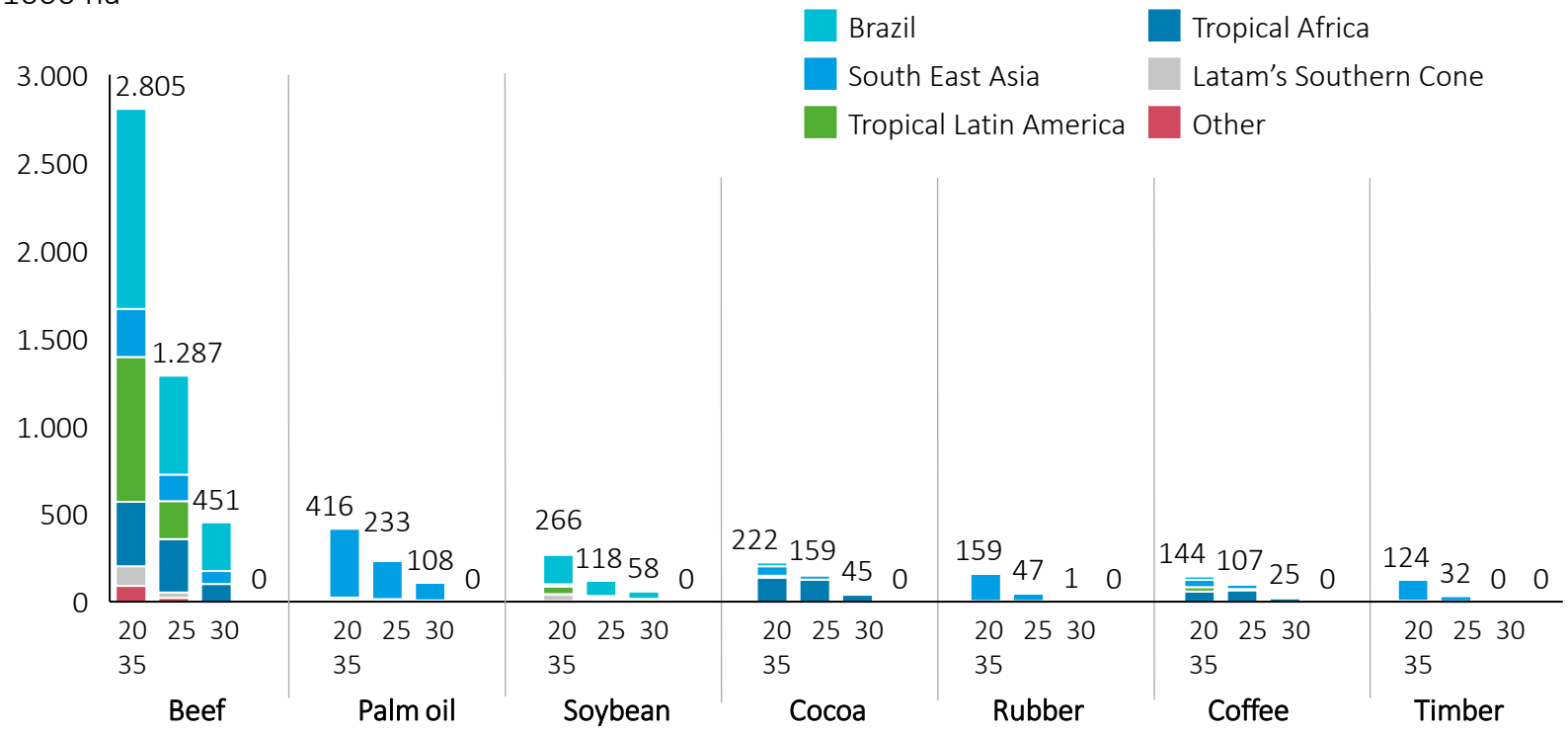

- **In IPR FPS, future policy stringency in exporting countries increases** as they increasingly commit to long-term strategies for GHG emission reduction or pledge to halt deforestation by 2030
- **88% of countries have made commitments either in climate or forestry, and 67% have committed to reduce or eliminate deforestation.** Most countries have made relatively few environmental pledges, with a climate and forestry commitment score of ≤2
- **Leading importing regions**, such as EU, UK, US and Canada, China, Japan and South Korea, Australia and New Zealand **have implemented or committed to climate- or deforestation-related policies**. This creates another source of risk, and also puts further pressure on policy in exporting countries

1. The climate and forestry commitment score is constructed using implemented climate policies and pledges to halt deforestation. Indicators used are: NDC submission (with or without updated emission reduction targets), country-level long-term strategy to abate emissions, implementation (effective or under progress) of carbon markets or carbon pricing (at the national or sub-national level), presence of avoided deforestation targets in NDC, pledges to achieve zero deforestation by 2030.
Score 0 occurs when none of the measures have been implemented (or pledged), while 5 means all measures have been undertaken. For more details on the scoring method see Annex I.

Source: Based on analysis by Vivid Economics drawing on data from UNFCCC and ClimateWatch

# In FPS, as deforestation is brought down by 2035, commodities linked to deforestation are likely to represent particularly big risks

**Deforestation likely driven by production of tropical soft commodities in period 2020-2035 by region[1]**
1000 ha




1. Deforestation likely driven by production of tropical soft commodities is estimated for year 2020 as the average value of deforestation linked to agriculture for years 2013-2015[2]. For future years, deforestation likely driven by production of tropical soft commodities is calculated applying both i) the regional policy stringency score for producing regions for each time step – as a factor imposing progressively lower deforestation – and ii) regional production levels of each commodity over time – adjusting the deforestation value to higher or lower push to the agricultural frontier
2. Source: WRI data. Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber." Technical Note. Washington, DC: World Resources Institute. Available online at: wri.org/publication/estimating-the-role-of-sevencommodities-in-agriculture-linked-deforestation., For more information see: https://research.wri.org/gfr/forest-extent-indicators/deforestation-agriculture
3. This projection is based on the future volumes of production of tropical soft commodities, produced by the MAgPIE Model. This model is calibrated to ensure the world population is fed. This means that the policy trajectory toward ending deforestation must remain compatible with all world regions being able to feed the population.

Source: Based on analysis by Vivid Economics drawing on WRI data on deforestation linked to agriculture, policy analysis and MAgPIE production data

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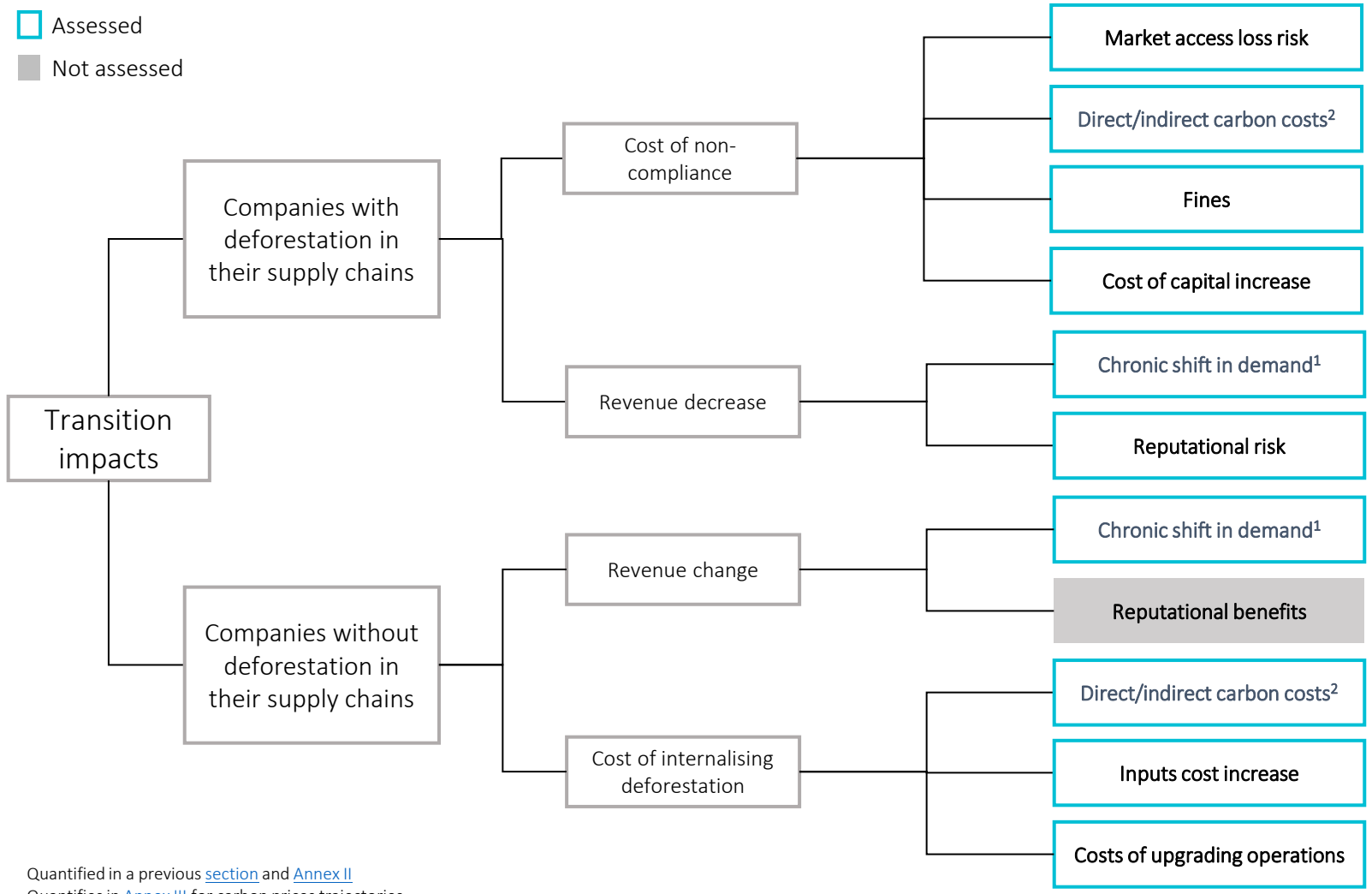
- **Under the IPR FPS, commodity-driven deforestation ends by 2035 across all world regions.** In Brazil, Tropical Latin America, Tropical Africa and Southeast Asia deforestation reaches zero in the early 2030s[3]
- **Commodities produced in regions with high levels of current or recent deforestation are likely to represent the greatest risks** to downstream companies during the rapid transition phase
- **Deforestation driven by beef, as well as cocoa and coffee, are more difficult to curtail** with stringent regulation due to the number of small producers
- **Deforestation driven by palm oil, timber and rubber shrinks to close to zero by 2030.** Policy stringency in producing countries increases at a faster rate than for other soft tropical commodities
- **These seven commodities** drive almost all deforestation and **represents a large source of scope 3 emissions** for downstream companies

# Risk exposure framework: Transition risk exposure for downstream companies is broken down into various categories



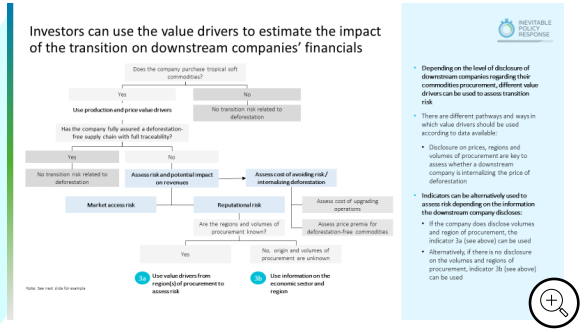

1. Quantified in a previous section and Annex II
2. Quantifies in Annex III for carbon prices trajectories
3. The framework covers only risks and costs, not benefits, as those related to Nature-based solutions are covered in the existing value drivers. Reputation benefits not accounted for in a prudential manner. Additionally, chronic changes in demand and carbon costs are already captured in the existing value drivers. All others are covered in following pages

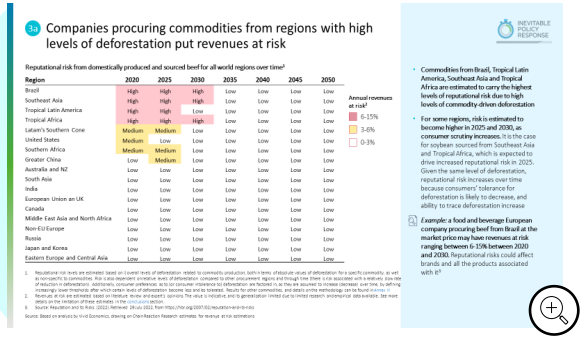
Source: Based on analysis by Vivid Economics

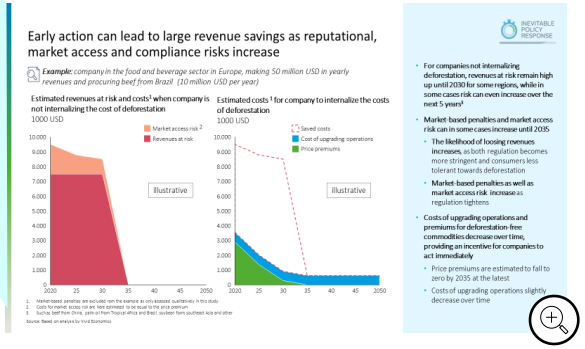
- The proposed framework supports investors to identify the key impacts associated with future transitions and deforestation and leverages existing research to assess the most relevant variables and indicators investors may consider[2]
- The transition risk framework conceptualizes the **impacts accruing to downstream companies through their supply chains. The framework covers impacts on companies internalizing and not internalizing the cost of deforestation** within their supply chains

# **How can it be implemented?** Seven steps to risk assessment and insights

| Step | Action | Example output |
|---|---|---|
| 1 | **Identify company**<br>Identify company sector (e.g., food and beverage, retail) and region where activity and revenues occur, and where commodities are handled | |
| 2 | **Assess company: is it at risk?**<br>Assess whether the company internalizes or not the cost of deforestation by looking at how it purchases commodities and whether it monitors its supply chains | |
| 3 | **Assess company disclosure and identify value drivers**<br>Depending on whether the company discloses information on volumes and regions of procurement, investors can use different value drivers | |
| 4 | **Consult the risk value drivers to determine level of risk the company faces**<br>Use different value drivers depending on the commodities the company handles, and the regions and volumes of procurement | |
| 5 | **Calculate costs and revenues at risk deriving from deforestation**<br>Use the value drivers to assess the revenues potentially at risk from reputational risk | |
| 6 | **Calculate costs to avoid the risks**<br>Use value drivers to assess how much the company would have to pay to internalize the price of deforestation through a price premium and by upgrading operations | |
| 7 | **Use insights to engage**<br>Use the data to identify the risks and opportunities for companies downstream the supply chains of tropical soft commodities, and discuss its relevance to their transition plans and disclosure | |



# Initial supply chain analysis showed a potential 5-10% value loss across upstream and downstream sectors connected to tropical forest commodities, demonstrating materiality

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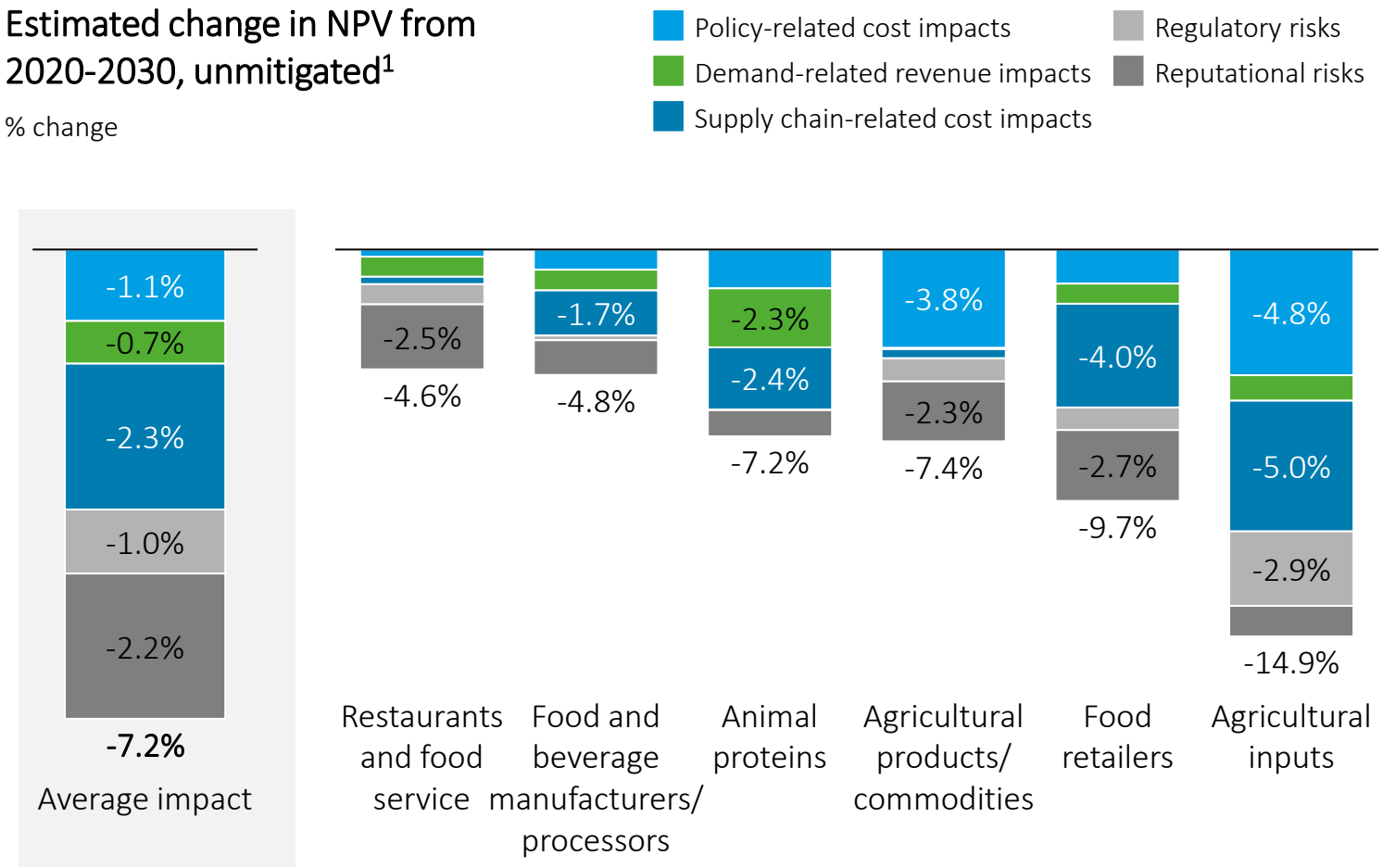
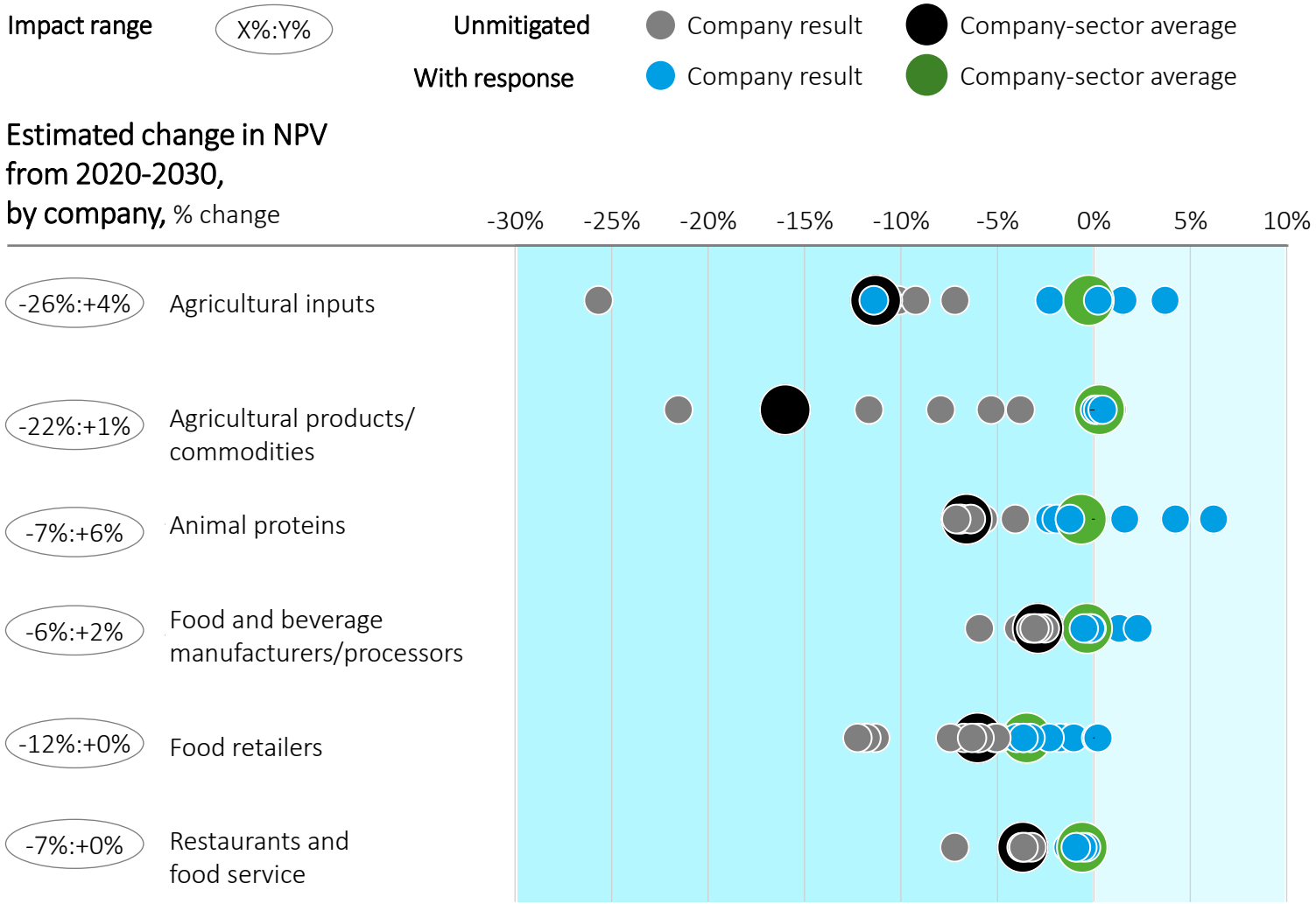



- **Upstream sectors, like agricultural inputs and commodities, are likely to experience substantial policy impacts** from carbon pricing and deforestation policy
- **Producers in the animal proteins sector are likely to begin to see demand destruction,** driven largely by dietary shifts in meat consumption, rather than carbon pricing, although carbon pricing could shift beef production across regions.
- **Downstream sectors, like food retail, tend to see impacts accrue through increased reputational risks** as consumers signal preferences for sustainable products through their purchasing decisions

1. NPV is net present value. The change is calculated as the cumulative impact from 2020 to 2030.

Source: UN Climate change high-Level Champions, 2022. Assessing the financial impact of the land use transition on the food and agriculture sector. Available at: https://climatechampions.unfccc.int/wp-content/uploads/2022/09/Assessing-the-financial-impact-of-the-land-use-transition-on-the-food-and-agriculture-sector.pdf

# Supply chain analysis can also enable investors to benchmark and better understand the risks of individual companies




NB: Company-sector averages differ from sector averages shown previously because companies often derive revenue from sources beyond their sector of classification.

Source: UN Climate change high-Level Champions, 2022. Assessing the financial impact of the land use transition on the food and agriculture sector. Available at: https://climatechampions.unfccc.int/wp-content/uploads/2022/09/Assessing-the-financial-impact-of-the-land-use-transition-on-the-food-and-agriculture-sector.pdf

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- **Upstream companies** have strong opportunities to protect value through altering operations and increasing efficiency to avoid increased policy-related costs. They may also be able to pass costs down the value chain

- **Downstream companies** have tight margins but could protect value by offering sustainable and certified products to safeguard their reputations. They also face the difficult choice of absorbing increases in costs or passing them on to consumers in a time of already high inflation

# Carbon prices and strong forest protection are a primary driver of upstream risk, while downstream firms are most exposed to costs passed on through the supply chain and additional regulatory and reputational risks

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The analysis reveals several factors that drive exposure to supply chain risks across firms:

1. **Policy impacts on upstream operations** - Companies that engage in upstream activities, like agricultural inputs and commodities, could be exposed to increasing costs due to policy, particularly around carbon pricing and enforcement of forest protection

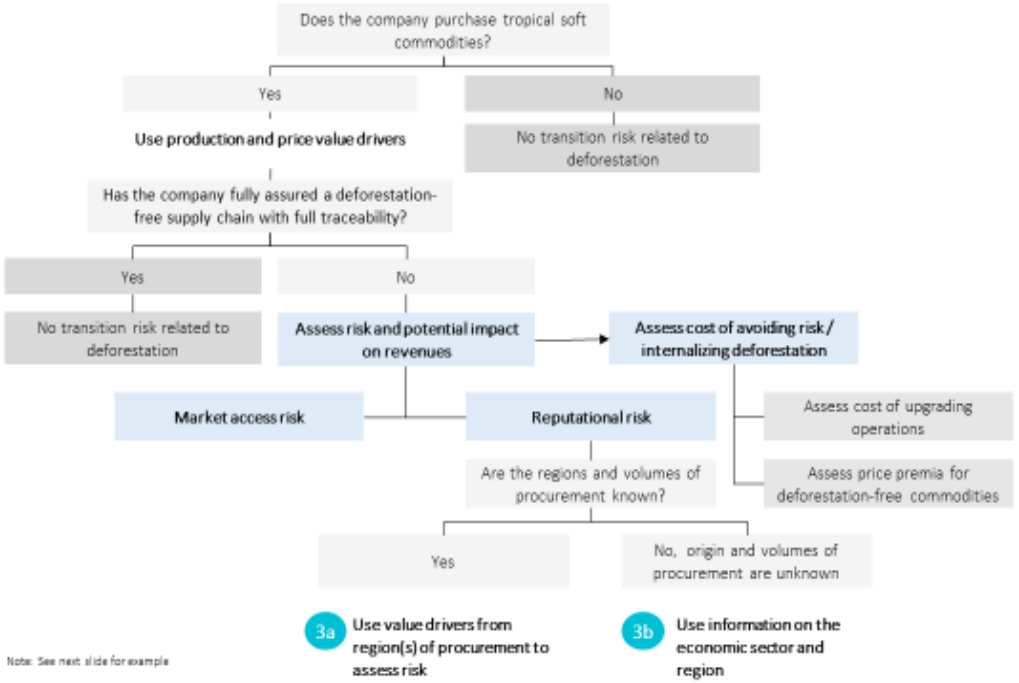
2. **Vulnerability to changing consumer preferences -** Producers and retailers in the animal proteins sector could begin to see demand destruction as consumers shift away from traditional meat consumption

3. **Supply chain costs -** Downstream sectors, like food manufacturing and retail, tend to see impacts accrue through costs passed through the supply chain

5. **Regulatory costs -** Downstream companies in key jurisdictions also face regulatory costs – particularly relevant for companies in the EU, where regulation on deforestation in supply chains is being introduced

6. **Reputational risk and supply chain transparency -** Reputational risks are more difficult to quantify but could be highly material to companies in sectors such as retail where public scrutiny is high and consumers demand more supply chain transparency

# Investors can use the value drivers to estimate the impact of the transition on downstream companies' financials




Note: See next slide for example

- **Depending on the level of disclosure of downstream companies regarding their commodities procurement, different value drivers can be used to assess transition risk**
- There are different pathways and ways in which value drivers should be used according to data available:
  - Disclosure on prices, regions and volumes of procurement are key to assess whether a downstream company is internalizing the price of deforestation
- **Indicators can be alternatively used to assess risk depending on the information the downstream company discloses:**
  - If the company does disclose volumes and region of procurement, the indicator 3a (see above) can be used
  - Alternatively, if there is no disclosure on the volumes and regions of procurement, indicator 3b (see above) can be used

# 3a Companies procuring commodities from regions with high levels of deforestation put revenues at risk

Reputational risk from domestically produced and sourced beef for all world regions over time[1]

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | High | High | High | Low | Low | Low | Low |
| Southeast Asia | High | High | High | Low | Low | Low | Low |
| Tropical Latin America | High | High | Low | Low | Low | Low | Low |
| Tropical Africa | High | High | High | Low | Low | Low | Low |
| Latam's Southern Cone | Medium | Medium | Low | Low | Low | Low | Low |
| United States | Medium | Low | Low | Low | Low | Low | Low |
| Southern Africa | Medium | Medium | Low | Low | Low | Low | Low |
| Greater China | Low | Medium | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union an UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Annual revenues at risk[2]
- 6-15%
- 3-6%
- 0-3%

1. Reputational risk levels are estimated based on i) overall levels of deforestation related to commodity production, both in terms of absolute values of deforestation for a specific commodity, as well as non-specific to commodities. Risk is also dependent on relative levels of deforestation compared to other procurement regions and through time (there is risk associated with a relatively slow rate of reduction in deforestation). Additionally, consumer preferences as to (or consumer intolerance to) deforestation are factored in, as they are assumed to increase (decrease) over time, by defining increasingly lower thresholds after which certain levels of deforestation become less and les tolerated. Results for other commodities, and details on the methodology can be found in Annex II
2. Revenues at risk are estimated based on literature review and expert's opinions. The value is indicative, and its generalization limited due to limited research and empirical data available. See more details on the limitation of these estimates in the conclusions section.
3. Source: Reputation and its Risks. (2022). Retrieved 29 July 2022, from https://hbr.org/2007/02/reputation-and-its-risks

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

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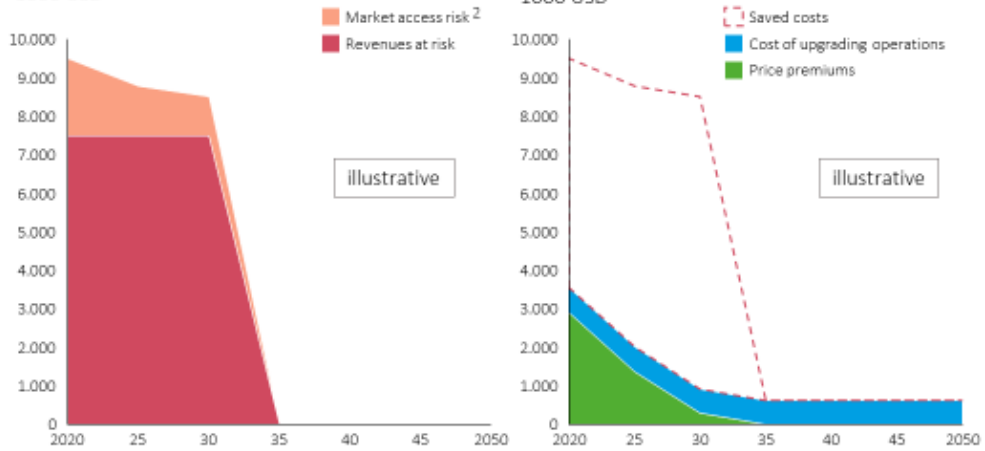
- Commodities from Brazil, Tropical Latin America, Southeast Asia and Tropical Africa are estimated to carry the highest levels of reputational risk due to high levels of commodity-driven deforestation
- For some regions, risk is estimated to become higher in 2025 and 2030, as consumer scrutiny increases. It is the case for soybean sourced from Southeast Asia and Tropical Africa, which is expected to drive increased reputational risk in 2025. Given the same level of deforestation, reputational risk increases over time because consumers' tolerance for deforestation is likely to decrease, and ability to trace deforestation increase

*Example:* a food and beverage European company procuring beef from Brazil at the market price may have revenues at risk ranging between 6-15% between 2020 and 2030. Reputational risks could affect brands and all the products associated with it[3]

# Early action can lead to large revenue savings as reputational, market access and compliance risks increase

*Example: company in the food and beverage sector in Europe, making 50 million USD in yearly revenues and procuring beef from Brazil (10 million USD per year)*

Estimated revenues at risk and costs[1] when company is not internalizing the cost of deforestation
1000 USD




Estimated costs [1] for company to internalize the costs of deforestation
1000 USD




1. Market-based penalties are excluded rom the example as only assessed qualitatively in this study
2. Costs for market access risk are here estimated to be equal to the price premium
3. Such as beef from China, palm oil from Tropical Africa and Brazil, soybean form southeast Asia and other

Source: Based on analysis by Vivid Economics

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- For companies not internalizing deforestation, revenues at risk remain high up until 2030 for some regions, while in some cases risk can even increase over the next 5 years[3]
- Market-based penalties and market access risk can in some cases increase until 2035
  - The likelihood of loosing revenues increases, as both regulation becomes more stringent and consumers less tolerant towards deforestation
  - Market-based penalties as well as market access risk increase as regulation tightens
- Costs of upgrading operations and premiums for deforestation-free commodities decrease over time, providing an incentive for companies to act immediately
  - Price premiums are estimated to fall to zero by 2035 at the latest
  - Costs of upgrading operations slightly decrease over time

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# The Inevitable Policy Response (IPR) is commissioned by the Principles for Responsible Investment (PRI) and supported by world class research partners

**PRI commissioned** the Inevitable Policy Response in 2018 to advance the industry's knowledge of climate transition risk, and to support investors' efforts to incorporate climate risk into their portfolio assessments

**A research partnership** led by Energy Transition Advisors conducts the initiative's research with scenario modelling by Vivid Economics, and contributions from Kaya Advisory, the Grantham Research Institute, the London School of Economics and Political Science, the 2Dii, the Carbon Tracker Initiative, the Climate Bonds Initiative and Planet Tracker

The consortium was given the mandate to bring analytic tools and an independent perspective to assess the drivers of likely policy action and their implications on the market

# Financial institutions and philanthropic donors provide additional support for the IPR

**Financial institutions** have joined the IPR as Strategic Partners to provide more in-depth industry input and to further strengthen its relevance to the financial industry

**Core philanthropic support** has been received since IPR began in 2018. The IPR is funded in part by the Gordon and Betty Moore Foundation through The Finance Hub, which was created to advance sustainable finance, and the ClimateWorks Foundation, which strives to innovate and accelerate climate solutions at scale

# The IPR helps the financial sector navigate the climate and nature transition by publishing policy forecasts, scenarios and value drivers

## Markets face an unprecedented climate and nature transition

Policies combined with new technologies and consumer preferences continue to affect established industries and economies

Increasing understanding of this unfolding environment can help financial institutions manage their assets effectively

**The IPR helps investors understand transition risks and opportunities by filling important gaps** in scenarios currently available to investors for portfolio analysis

## The IPR produces:

- **Policy projections** that account for emerging and forecast **policy action** to address climate change
- **Scenarios** that incorporate the energy sector and the **land use sector** in the context of the whole economy
- **Value drivers** that provide intelligence about the realistic **risks and opportunities** most critical to the financial sector

# The IPR's Forecast Policy Scenario (FPS) adds value for investors seeking to understand transition risk

**FPS is a forward-looking scenario** modelling the impact of **policies** up to 2050 and can be used to reveal insights on emerging sources of transition risk

## Inputs

**Based on a detailed policy-based forecast**, anchored in realistic policy, technology, and consumer preference expectations rather than hypothetical 'optimal' pathways

**Underpinned by transparency** around expected policy implementation and development of key technologies

**Includes global coverage** with policy forecasts available for regions

## Outputs

**Produced through a comprehensive modelling exercise** that includes macroeconomic, energy and land use models linking crucial aspects of policy change across the entire economy

**Applicable to reporting and regulatory stress testing** through frameworks like the **Task Force on Climate-related Financial Disclosures** (TCFD) and the Taskforce on Nature-related Financial Disclosures (TNFD)

**Includes global coverage** with value drivers available for regions

# Glossary

- $CH_4$ - Methane
- $CO_2$ - Carbon dioxide
- M- Million
- DM- Dry Matter
- ETS - Emission Trading Scheme
- FPS - Forecast Policy Scenario
- GHG - Greenhouse gas
- IPR - Inevitable Policy Response
- MAgPIE - Model of Agricultural Production and its Impact on the Environment
- $N_2O$ - Nitrous oxide
- NDC - Nationally determined contributions
- P1 - An IPCC 1.5°C scenario
- P2 - An IPCC 1.5°C scenario
- RPS - 1.5°C Required Policy Scenario
- SCA - Supply Chain Analysis
- TCFD - Task Force on Climate-related Financial Disclosures
- TNFD - Task Force on Nature-related Financial Disclosures
- WRI - World Resources Institute

# Contents

# The policy response's impact on supply chains is currently poorly understood, creating a crucial gap in the analysis of transition risk for downstream sectors

INEVITABLE POLICY RESPONSE

## Context

1. **IPR 2021 value drivers** include a section on land use: prices and production volumes of different agricultural commodities, NBS deployment, bioenergy, among others
2. In early 2022, UN-supported PRI and Vivid Economics organised a collective exercise for investors to **operationalize the IPR value drivers** in assessing the potential impact of transition risks on food companies' assets
3. One of the main conclusions of the study is that the existing value drivers are particularly useful for analysing upstream companies (i.e., producers and processors) but **difficult to apply to downstream companies** (i.e., retailers and distributors)

## Why this module?

1. **Tropical soft commodities** (e.g., beef, soybean, palm oil, timber, coffee, rubber, cocoa) **drive a disproportionate share of deforestation,** creating transition risks for downstream companies
2. Supply chains of tropical soft commodities rely on international trade, so **upstream deforestation in a few jurisdictions drive direct and indirect risks to investors in downstream companies globally**
3. The 'inevitable policy response' would **tackle deforestation in most jurisdictions exacerbating risks for companies and investors**
4. There is increased **pressure for companies to disclose the environmental impacts of their supply chains and stress tests their strategies** using scenario analysis
5. To date, there is no set of scenarios and **value drivers applicable to companies operating downstream** in the land-use sector

# This IPR supply chain analysis enables better climate risk analysis of tropical commodity supply chains by estimating value drivers and linking those to company exposure[1]

## Objectives

IPR Supply Chain Analysis aims to:

- Provide insights for investors to **understand the transition risks for downstream companies operating with tropical soft commodities**
- Support investors to do **more comprehensive and accurate valuations** of these risks, especially by **introducing metrics to assess transition risk**
- Support the **redeployment of capital into companies with deforestation-free supply chains**

## Outputs

**Policy mapping**

Provide investors with **information on the policy landscape regulating production and trade of tropical soft commodities** and its implications on downstream companies

**Production and price value drivers**

Provide investors with **production and price statistics of tropical soft commodities at the regional level** across **different scenarios**, to provide insights on the implications of policies and the climate transition[1]

**Risk exposure quantification method**

Provide investors with a **framework and metrics to understand and assess transition risk related to deforestation** driven by production of tropical soft commodities[2]

1. Results are derived from the Model of Agricultural Production and its Impact on the Environment (MAgPIE)
2. This analysis excludes physical risks and impacts of deforestation on biodiversity

# The module maps the policy landscape and estimates production and prices of tropical soft commodities that create value and risk in the supply chain …

| | Description | Detailed list of deliverables / indicators |
|---|---|---|
| **Policy mapping** | • The collection and analysis of 80+ country-level policies regulating deforestation tied to the production and trade of tropical soft commodities is used to estimate the 'inevitable policy response' that regulates levels of commodity-driven deforestation worldwide | • Estimated **year by when regions achieve fully regulated and deforestation-free production** by commodity<br>• Estimated **year by when regions achieve fully regulated and deforestation-free supply chains** by commodity |
| **Production and price value drivers** | • The policy mapping serves as a key input to **the land use model** which also take into consideration:<br>  • Carbon pricing<br>  • Diet shift<br>  • Bioenergy demand | • **Production volumes** (M tons DM year-1 or $Mm^3$ year-1) by region and by commodity over period 2020-2050 for IPR FPS and BAU scenarios<br>• **Global price index** by commodity over period 2020-2050 for IPR FPS and BAU scenarios |
| Risk analysis | | |

# … and develops a framework for quantifying risk exposure that can be applied to individual downstream companies

INEVITABLE POLICY RESPONSE

Policy mapping

Production and price value drivers

**Risk analysis**[1]

## Description

- The risk analysis combines the policy mapping together with the production and price value drivers to **assess risks for downstream companies, and costs of mitigating those risks**
- The analysis provides a framework that distills risks into five categories:
  - **(Non) Compliance risk:** the risk of being fined or face credit restrictions
  - **Market access risk:** the risk of losing access to procurement channels
  - **Reputational risks:** the risk of loosing revenues due to an ESG event
  - **Chronic shift in demand** (assessed in previous modules)
  - **Carbon costs** (assessed in previous modules)
- The analysis quantifies the costs to avoid those risks by:
  - **Upgrading operations:** costs of upgrading operations and monitoring supply chains to fully avoid deforestation
  - Paying the **price premium for deforestation-free commodities**

## Detailed list of deliverables / indicators

1. **Market access risk** (low/medium/high) – by region over period 2020-2050
2. **(Non) Compliance risk** which is composed of fines and higher costs of accessing finance
3. **Reputational risk** (low/medium/high):
   - Reputational risk faced by downstream company given the commodity and region of procurement
   - Average reputational risk faced by downstream company given the economic sector and world region where the company is active

**Costs to avoid transition risk:**

4. **Average costs of upgrading operations** ($/year) to fully avoid deforestation over period 2020-2050 by company with different revenue ranges
5. **Global price premium** (% over global average market price) for deforestation-free commodities by commodity over period 2020-2050

1. Risk value drivers are based on the IPR FPS scenario.

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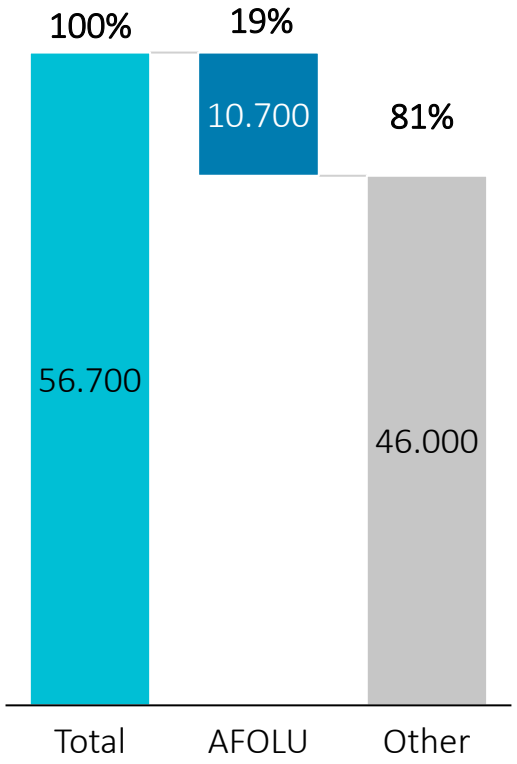
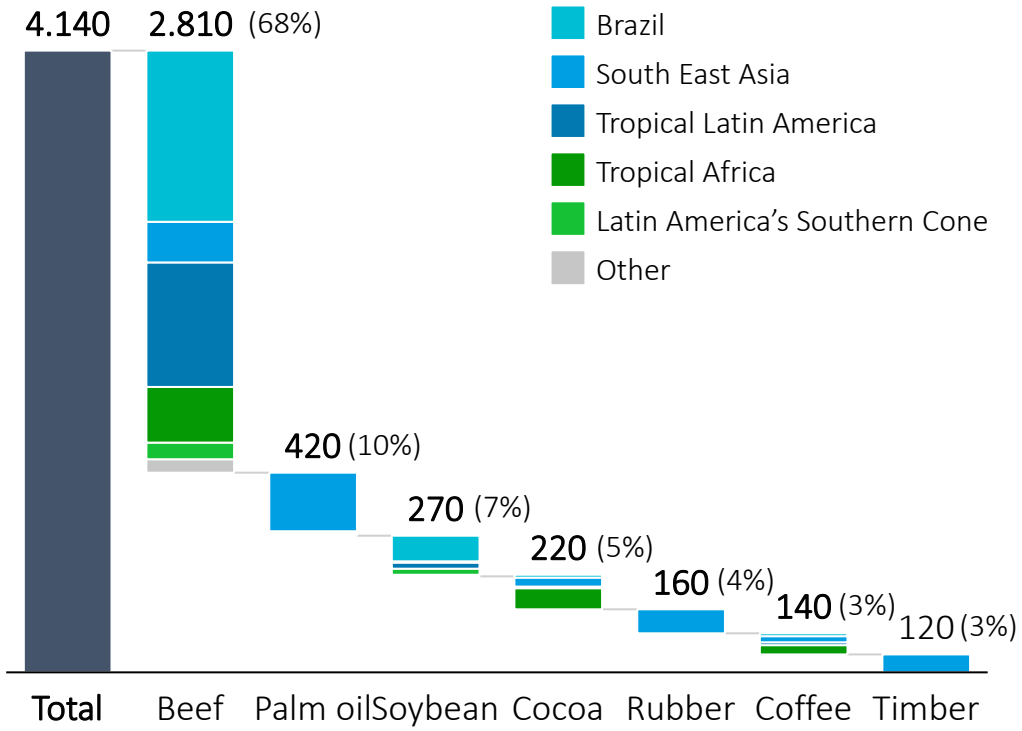
# Deforestation is one of the main drivers of climate change and is primarily driven by seven tropical soft commodities

2019 Global GHG emissions by sectors[1]
Mt $CO_{2e}$




Global deforestation by commodity, calculated as yearly average over years 2013-2015[2]
1000 hectares (% over Total)

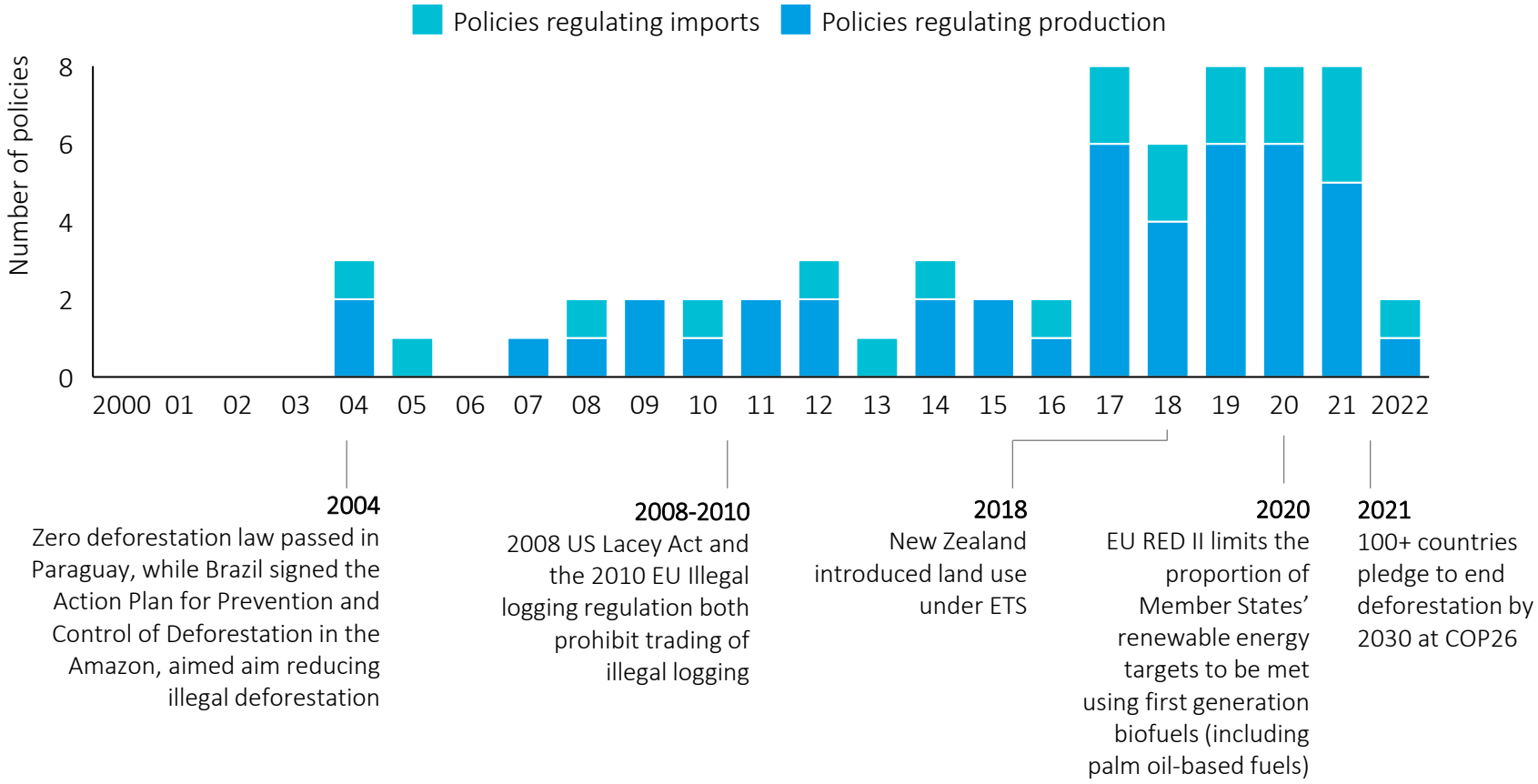



- In 2019, **agriculture, land-use change, and the forestry sector** contributed to **19% of global GHG emissions**, with deforestation being a key driver
- In the period 2013-2015, more than **4 million hectares of forest cover were lost** due to production of tropical soft commodities
- **Beef production is the greatest driver of deforestation**. Beef production causes approximately 7 times more deforestation than palm oil and 10 times more than soybean
- **98% of deforestation** linked to the production of tropical soft commodities in 2015 occurred in **five regions**: Brazil, Tropical Latin America, Southeast Asia, Tropical Africa and Latin America's Southern Cone

1. 'AFOLU' includes Agriculture, Land-use change and Forestry. 'Other' includes Bunker fuels, Energy, Industrial processes, Waste sectors. Source: FAO. (2021). *The share of agri-food systems in total greenhouse gas emissions. Global, regional and country trends 1990–2019*. Retrieved from https://www.fao.org/3/cb7514en/cb7514en.pdf
2. Source: WRI data. Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber." Technical Note. Washington, DC: World Resources Institute. Available online at: wri.org/publication/estimating-the-role-of-sevencommodities-in-agriculture-linked-deforestation., For more information see: https://research.wri.org/gfr/forest-extent-indicators/deforestation-agriculture

# Policies regulating imports and production of tropical soft commodities have been increasing in number over the last decade

## Number of policies regulating imports and production of tropical soft commodities by year



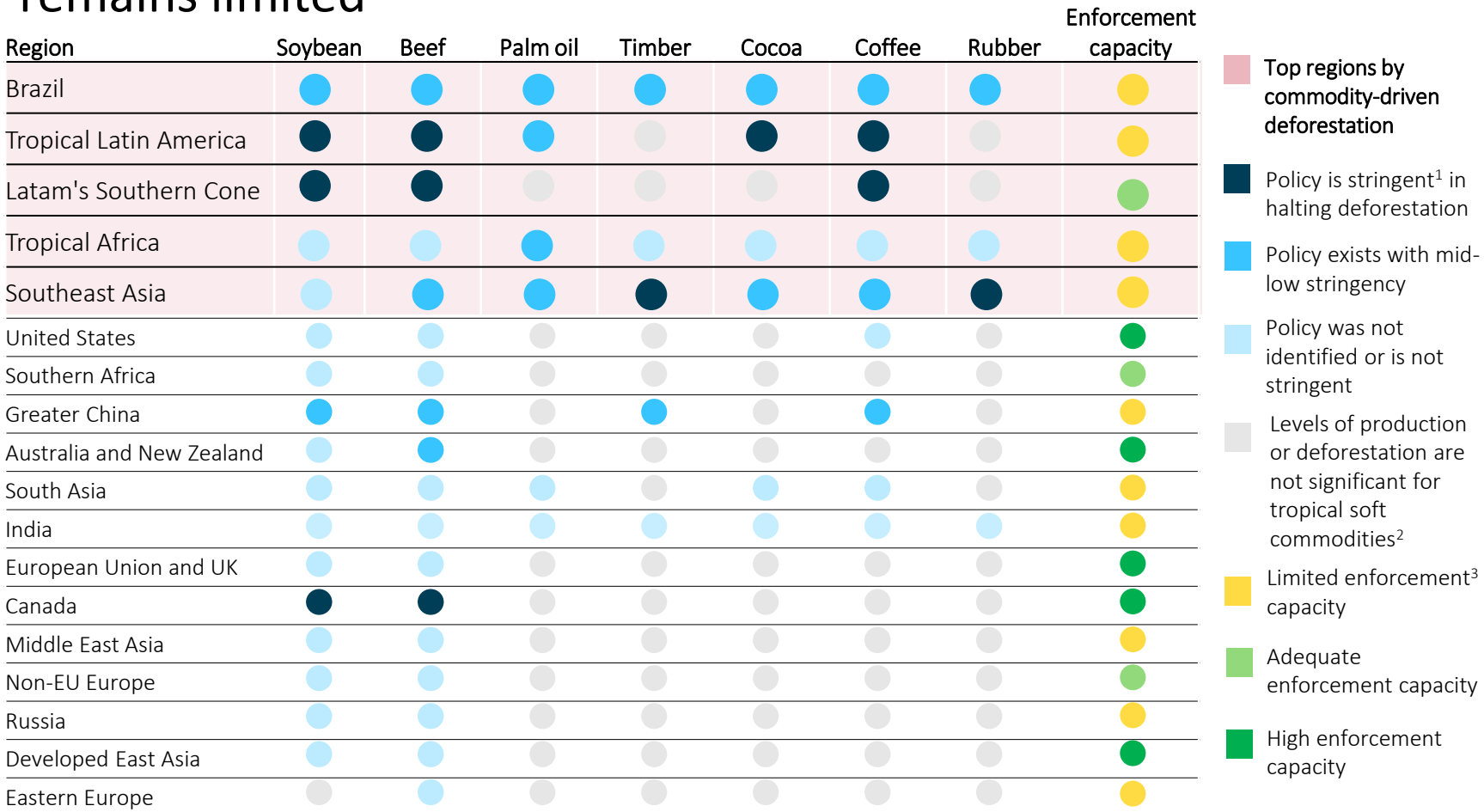

Note: The graph captures only the policies analysed, and therefore is not meant to exhaustively capture all regulation in this area. Additionally, the timeline is limited to the period 2000-2022, therefore it does not include regulation implemented before 2000, which includes especially regulation on forests and nature conservation dating pre-2000 for many countries. For more information on the methodology of the policy analysis exercise, as well as the sources used, please see Annex I.

Source: Based on analysis by Vivid Economics

INEVITABLE POLICY RESPONSE

- **Over the last two decades, governments across the world have increasingly implemented policies aimed at regulating production and trade of tropical soft commodities**
- Policies regulating both production and imports of tropical soft commodities linked to deforestation have been accelerating especially in the last 5-7 years
- The acceleration of policy in this area signals the possibility that policy will accelerate further in the future, driven in part by commitments in climate and forestry

# Governments made efforts to curb the expansion of the agricultural frontier, but policy stringency and enforcement remains limited




1. 80+ policies were analysed for countries producing tropical soft commodities. Key sources of policies are listed in Annex I. Policies are assessed based on their stringency level. Policy stringency measures the extent to which the set of policies is binding in halting deforestation and based on whether laws are mandates and on the severity of their penalties. Policies assessed include national forestry policies, NDCs, laws on specific commodities. Policy list was validated by experts. Enforcement capacity is estimated through the World Bank Governance indicator for each country and aggregated at the regional level based on commodity-driven deforestation. For more information on the methodology see Annex I.
2. Deforestation levels based on WRI data (Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber.")
3. Enforcement capacity is estimated through the World Bank Governance indicator for each country and aggregated at the regional level based on commodity-driven deforestation. For more information on the methodology see Annex I.

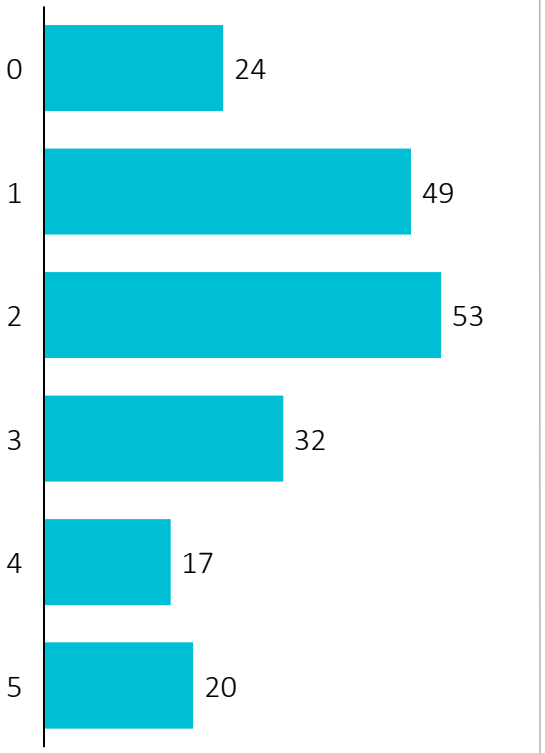
Source: Based on analysis by Vivid Economics drawing on data from different sources, listed in Annex I

INEVITABLE POLICY RESPONSE

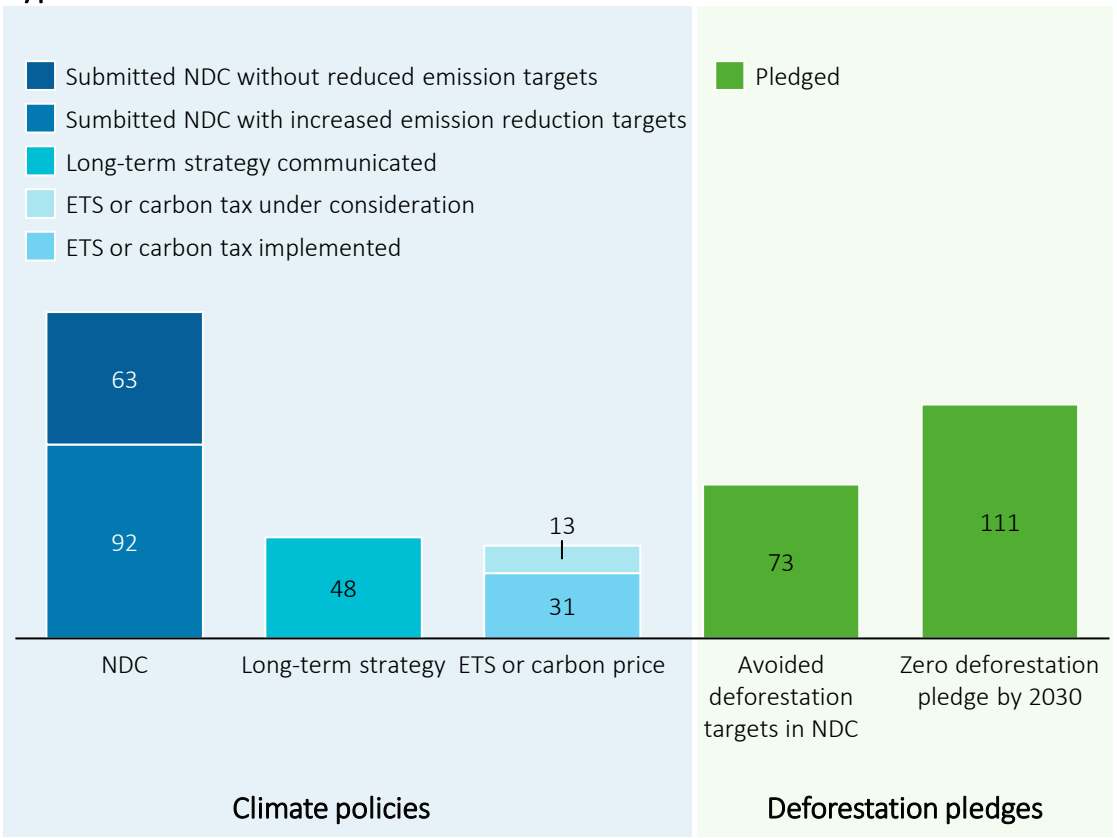
- Countries producing tropical soft commodities have implemented several policies to halt deforestation, although with **different levels of stringency**
- **However, policy stringency is often undermined by low enforcement capacity, ineffective regulatory systems and corruption**
- For example, although Tropical Latin America, Brazil and Southeast Asia all have implemented several policies to halt deforestation and regulate expansion of agricultural frontiers (e.g., Land moratoria in Indonesia, Brazil's Forest Code, and several policies in Latin American countries), law enforcement remains limited

# As producing and importing countries commit to stopping deforestation, policies regulating deforestation are likely to become more stringent

Number of countries by climate and forestry commitment score[1] (0-5)




Number of countries with different climate and forestry commitment types



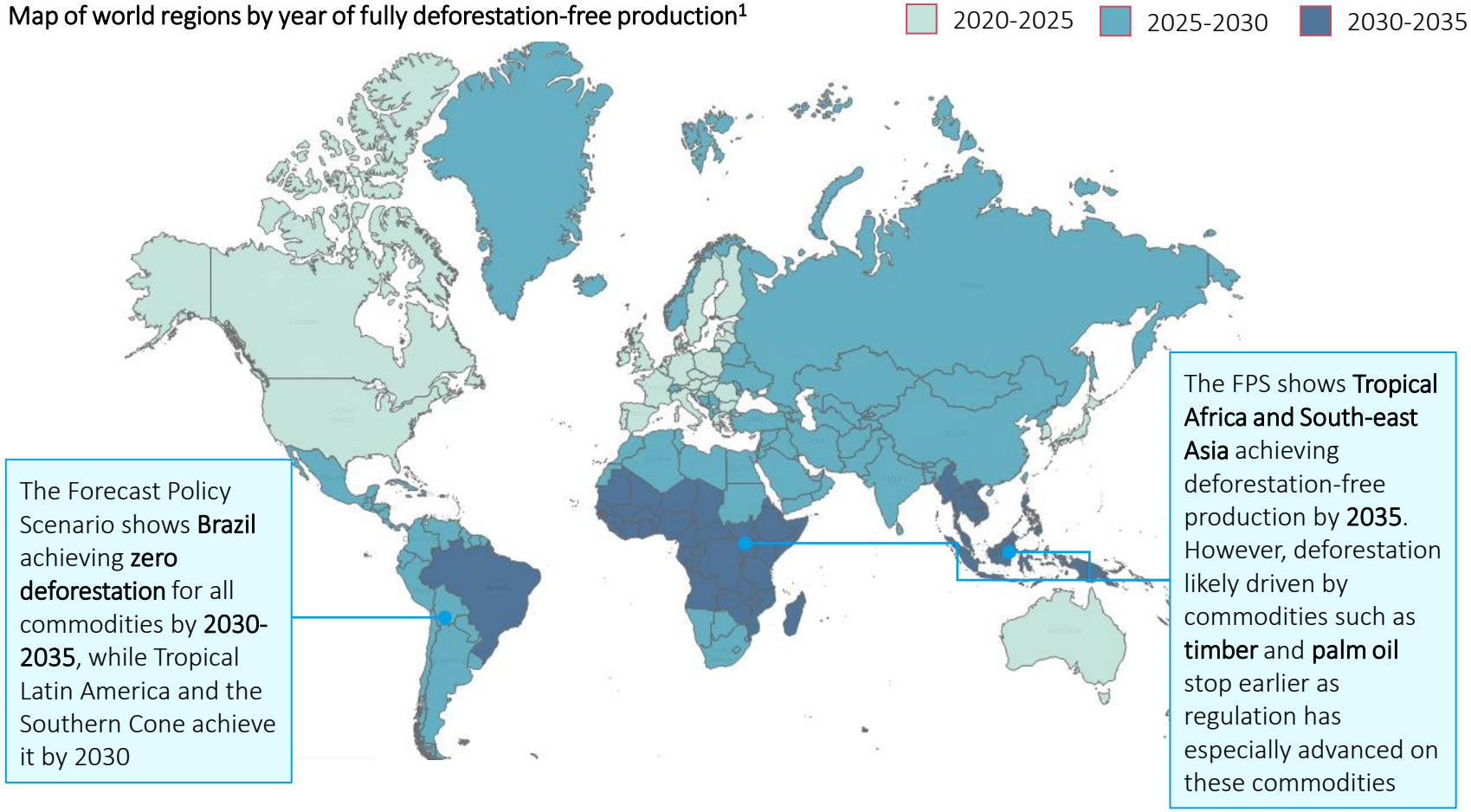

- In FPS, future policy stringency in exporting countries is expected to **increase** as they increasingly commit to long-term strategies for GHG emission reduction or pledge to halt deforestation by 2030
- **88% of countries have made commitments either in climate or forestry, and 67% have committed to reduce or eliminate deforestation.** Most countries have made relatively few environmental pledges, with a climate and forestry commitment score of ≤2
- **Leading importing regions**, such as EU, UK, US and Canada, China, Japan and South Korea, Australia and New Zealand **have implemented or committed to climate- or deforestation-related policies**. This creates another source of risk, and also puts further pressure on policy in exporting countries

1. The climate and forestry commitment score is constructed using implemented climate policies and pledges to halt deforestation. Indicators used are: NDC submission (with or without updated emission reduction targets), country-level long-term strategy to abate emissions, implementation (effective or under progress) of carbon markets or carbon pricing (at the national or sub-national level), presence of avoided deforestation targets in NDC, pledges to achieve zero deforestation by 2030.
Score 0 occurs when none of the measures have been implemented (or pledged), while 5 means all measures have been undertaken. For more details on the scoring method see Annex I.

Source: Based on analysis by Vivid Economics, drawing on data from UNFCCC and ClimateWatch.

# The FPS analysis shows different regions could reach zero deforestation depending on the current levels of deforestation, enforcement capacity and environmental commitments

Map of world regions by year of fully deforestation-free production[1]



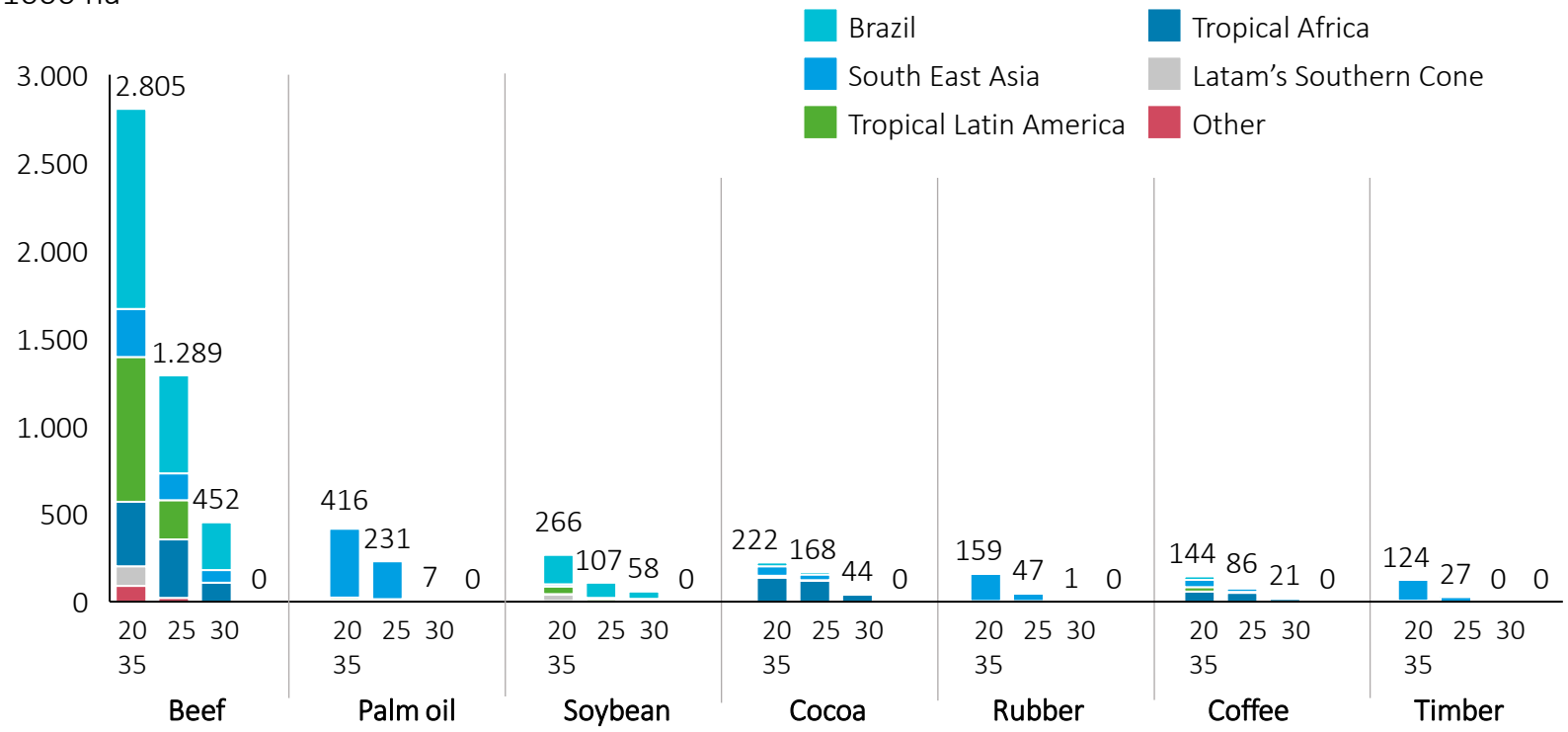

- **In the FPS, most regions with high deforestation in 2020 end deforestation between 2030 and 2035 (core FPS assumption).**[2] Most governments in these regions have not or only partly published long-term climate strategies, implemented carbon pricing or committed to end deforestation
- **Among the regions with higher levels of commodity-driven deforestation, Tropical Latin America and Latin America's Southern Cone end deforestation by 2030,** largely driven by commitments to halt deforestation and advancement in climate policy in Chile, Colombia, Paraguay and Peru
- **USA, EU, Canada, Australia and New Zealand achieve zero-deforestation production by as early as 2025,** as these regions have largely implemented long-term climate policies and committed to end deforestation, and all have high regulation enforcement capacity

1. Results shown are a result of a scenario analysis: the year by when each region is expected to achieve zero-deforestation is assessed by commodity, based on the policies in place, on the governments' engagement capacity, on climate and forestry commitment as well as on current levels of commodity-driven deforestation. The map shows the time period by when each region is expected to achieve zero-deforestation over the production of *the majority* of the produced commodities. For more details on both the methodology and the results see Annex I
2. For more information on assumptions and methodology see Annex I

Source: Based on analysis by Vivid Economics

# As deforestation is brought down by 2035, commodities linked to deforestation are likely to represent particularly big risks

**Deforestation likely driven by production of tropical soft commodities in period 2020-2035 by region[1]**
1000 ha




1. Deforestation likely driven by production of tropical soft commodities is estimated for year 2020 as the average value of deforestation linked to agriculture for years 2013-2015[2]. For future years, deforestation likely driven by production of tropical soft commodities is calculated applying both i) the regional policy stringency score for producing regions for each time step – as a factor imposing progressively lower deforestation – and ii) regional production levels of each commodity over time – adjusting the deforestation value to higher or lower push to the agricultural frontier
2. Source: WRI data. Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber." Technical Note. Washington, DC: World Resources Institute. Available online at: wri.org/publication/estimating-the-role-of-sevencommodities-in-agriculture-linked-deforestation., For more information see: https://research.wri.org/gfr/forest-extent-indicators/deforestation-agriculture
3. This projection is based on the future volumes of production of tropical soft commodities, produced by the MAgPIE Model. This model is calibrated to ensure the world population is fed. This means that the policy trajectory toward ending deforestation must remain compatible with all world regions being able to feed the population.

Source: Based on analysis by Vivid Economics, drawing on WRI data on deforestation linked to agriculture and policy analysis and MAgPIE production data

INEVITABLE POLICY RESPONSE

- **The FPS estimates that commodity-driven deforestation is going to end by 2035 across all world regions.** In Brazil, Tropical Latin America, tropical Africa and Southeast Asia deforestation reaches zero in the early 2030s[3]
- **Commodities produced in countries with high levels of current or recent deforestation are likely to represent the greatest risks** to downstream companies during the rapid transition phase
- **Deforestation driven by beef, as well as cocoa and coffee, are more difficult to curtail** with stringent regulation due to the number of small producers
- **Deforestation driven by palm oil, timber and rubber shrinks to close to zero by 2030.** Policy stringency in producing countries increases at a faster rate than for other soft tropical commodities
- **These seven commodities** drive almost all deforestation and **represents a large source of scope 3 emissions** for downstream companies

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# In the FPS, production of tropical soft commodities changes as regulation become more stringent, diets shift away from ruminant meat and bioenergy demand increases

INEVITABLE POLICY RESPONSE

## Key policy, behavioral and technological shifts related to land use

### Regulation:

- Supply chain policies, including commodity-specific laws, trade policies and public procurement policies lead to lower levels of deforestation, reducing net $CO_2$ emissions
- Carbon prices increase the cost of high emitting products and incentivize Nature-based Solutions (NBS)
- Government forestry policy, including creation and enforcement of controls on deforestation and directed re/afforestation programs lead to a growth in forest land
- Deforestation likely driven from commodity production declines over time, and drops to zero in all world regions by 2035

### Shifts in food production:

- Government regulation increases the cost of animal protein and encourages the production of alternative meat
- Consumer preferences shift away from beef and towards alternative meat due to concerns over sustainability and health
- Technology development reduces the cost and improve the taste of alternative meat

### Bioenergy demand:

- Global demand for bioenergy increases globally, with regulation implemented to ensure the sustainability of bioenergy and reduce competition with food for land use

Source: Based on analysis by Vivid Economics

# These changes are captured in our value drivers for upstream sectors, which can help downstream companies assess chronic changes in demand and supply

**Demand and production of tropical soft commodities is expected to be affected by the climate and policy transition**

Downstream companies are in turn affected by changes in and supply

Value drivers are relevant to downstream companies and investors to assess i) chronic demand shifts and ii) changes in supply

**Downstream companies can use value drivers to assess their positioning in future markets[2]**

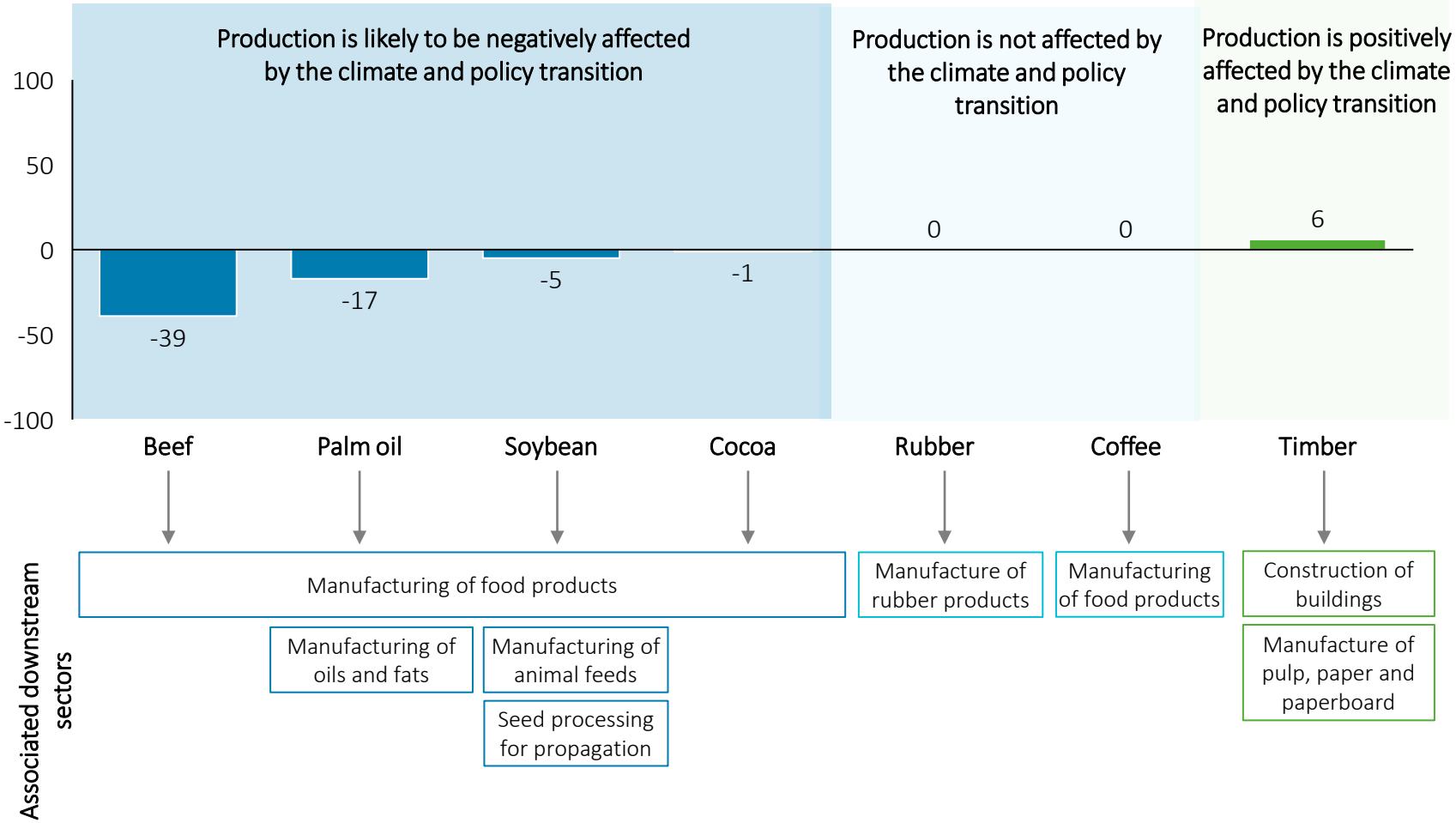
| What is delivered | Use case for downstream companies |
|---|---|
| **Production value drivers**<br><br>Production volumes (M tons DM $year^{-1}$ or $Mm^3$ $year^{-1}$) by region and by commodity over period 2020-2050 in IPR FPS and BAU scenarios | *Will companies downstream the supply chains of tropical soft commodities be at risk of facing chronic changes in demand?* |
| **Price value drivers**<br><br>Global price index by commodity over period 2020-2050 for IPR FPS and BAU scenarios | *To what extent and in which directions will commodity prices increase? Will companies downstream have to pay higher prices to procure commodities?* |

1. Assumptions are explained in the following slide.
2. Note: This module does not provide an analytical framework for downstream companies to use value drivers

# In FPS, the policy response slows the production growth of some tropical soft commodities, a risk for the food industry

## Percentage difference between 2050 production volumes in FPS and BAU scenario by commodity

% difference




Source: Based on analysis by Vivid Economics analysis using MAgPIE (Model of Agricultural Production and its Impact on the Environment)
Note: No probability or sensitivity estimations should be inferred from the analysis.

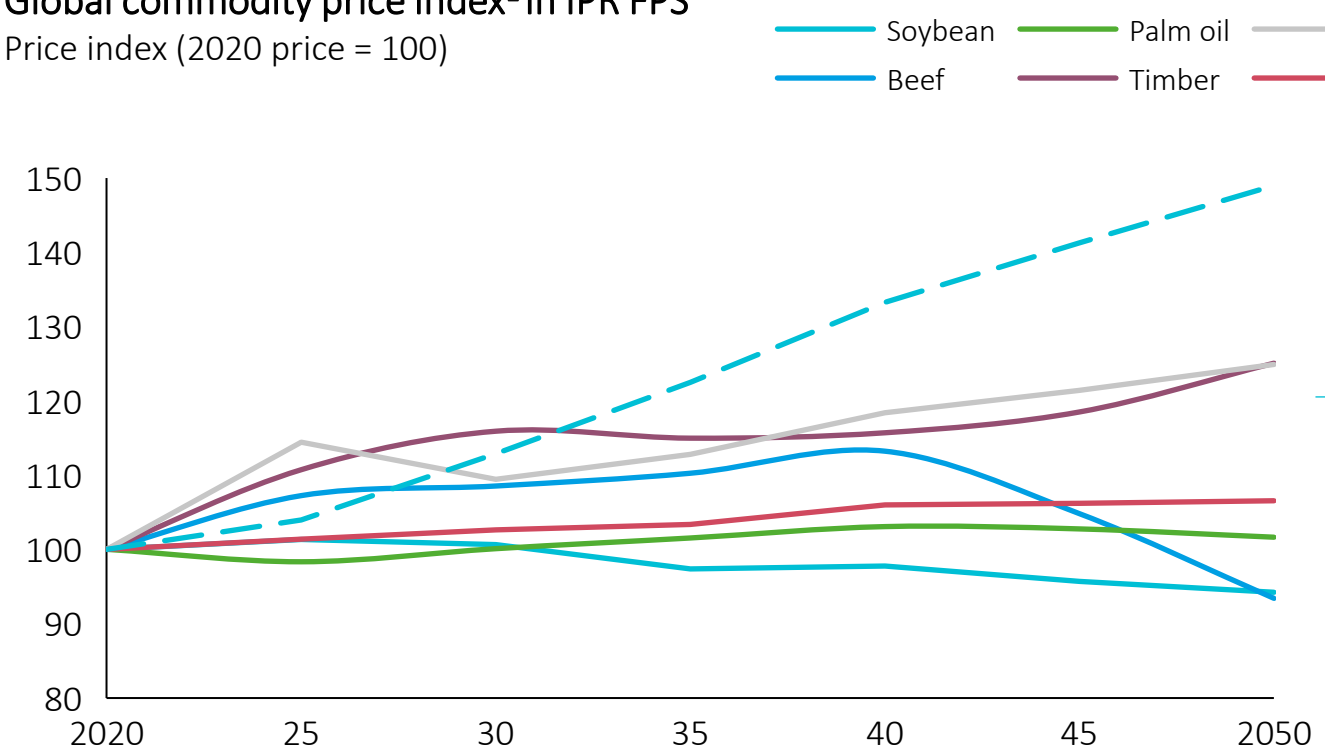
INEVITABLE POLICY RESPONSE

- **Downstream companies in sectors associated with beef, palm oil and soybean are likely to see chronic decline in demand,** as production of beef, palm oil and soybean are likely to be negatively affected by the climate transition, with 2050 values in FPS largely lower than the BAU values for the same year
  - Both beef and soybean production could decrease compared to a business-as-usual scenario, as diets **gradually shift away from beef**
  - Soybean production is lower in FPS compared to BAU, although the negative effect of diet shifts is mitigated by increased soybean demand for alterative protein production
  - **Palm oil production** is lower in IPR FPS compared to BAU due to increased regulation and due to fade out of first-generation biofuels
- **Companies in sectors associated with timber – such as construction and manufacturing of pulp and paper – could see a substantial increase in demand,** as the use of timber to replace other less sustainable construction materials leads to an increase demand under FPS

# Downstream companies may experience input price increases for timber, rubber and cocoa

## Global commodity price index[1] in IPR FPS

Price index (2020 price = 100)




**Downstream companies** may experience large input price increases in sectors requiring timber, rubber and cocoa use. Other sectors may not experience large input price increases thanks to yield increases

**The analysis does not attempt to capture shorter-run fluctuations, such as those caused by the war in Ukraine.** Being the output of a global land use model operating on long timescales and with reduced time granularity, the global commodity price index is intended to capture long-term trends in commodity price variation.

1. The global price index represents the global market price for each commodity over time, price that is assumed not to incorporate deforestation costs as externality.

Source: Based on analysis by Vivid Economics analysis using MAgPIE (Model of Agricultural Production and its Impact on the Environment)

INEVITABLE POLICY RESPONSE

- **Global prices of rubber, cocoa and timber increase over the 2020-50 period.** Measures to halt deforestation may drive up land prices, particularly in regions already experiencing high land competition (e.g., Southeast Asia, which is a key producer of rubber).
- **Cocoa and timber global prices increase in FPS** as global demand steadily increases over the period.
- **Global price of beef increases until 2040 and decreases thereafter.** Although demand declines globally, largely due to dietary shifts rather than carbon prices, beef prices are estimated to increase in regions that are likely to quickly increase regulation, such as the EU, Australia and New Zealand, China and Developed East Asia. This mitigates price decline in regions, such as Brazil and Tropical Latin America.
- The global price of **soybean** is estimated to decrease steadily over the period 2025-2050, driven by a relative decrease in demand in IPR FPS compared to BAU.
- **Coffee and palm oil** prices are estimated to slightly increase as demand and production expand, especially in Tropical Africa and Southeast Asia

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# Value drivers can help understand and assess the materiality and extent of risks downstream companies face when deforestation is embedded in supply chains

### Risks are shifting

With regulation likely to increase across world regions, companies operating downstream of supply chains of tropical soft commodities face new risks, including reputational risk, compliance risk and market access risk

### Risks are material for downstream companies

Downstream companies operating on the supply chains of tropical soft commodities are substantially at risk, since profits largely depend on these commodities

### Companies have a choice

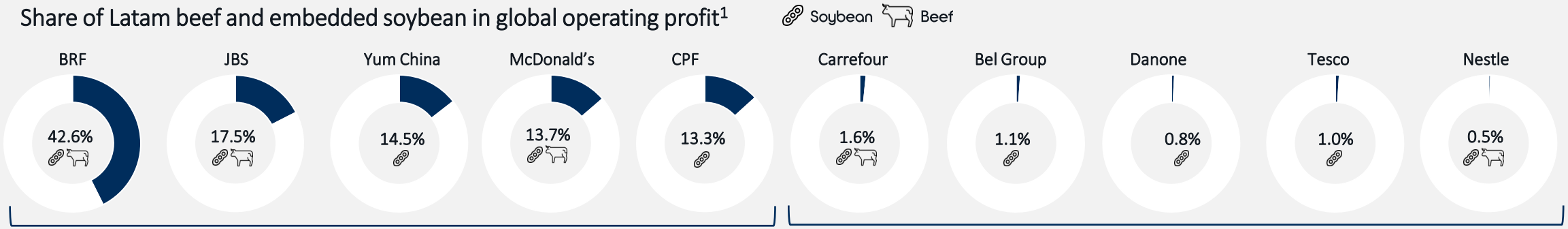
Companies with deforestation in their supply chains can mitigate these risks by

- Procuring deforestation-free commodities at a premium price
- Upgrading operations and monitoring supply chains

### Value drivers can support investors understand and assess transition risks

There is a lack of metrics that investors can use to assess transition risk. The framework proposed can help investors understand and assess transition risks. The value drivers can be used to ensure risk is accounted for in companies' valuations

## Share of Latam beef and embedded soybean in global operating profit[1]

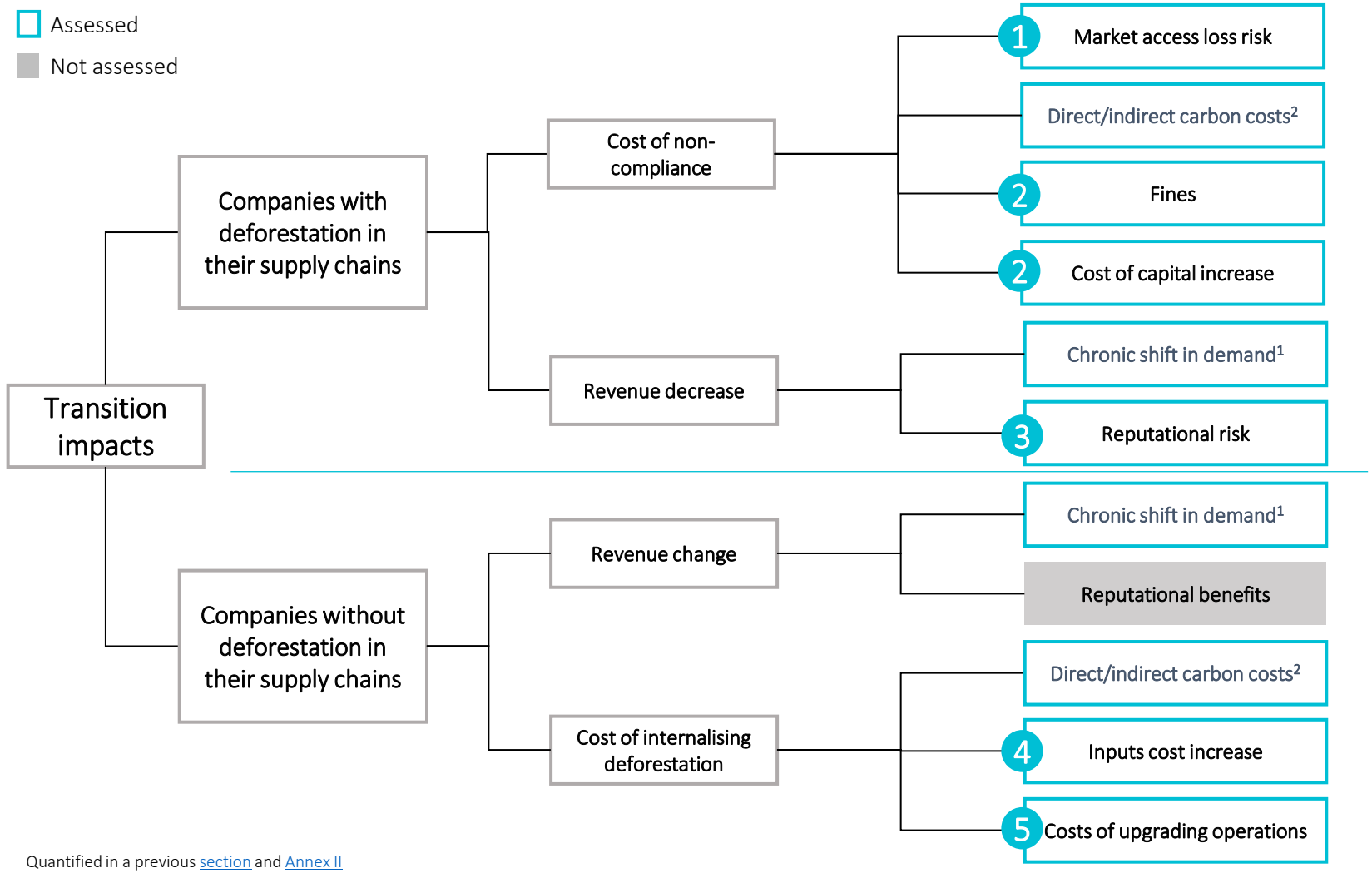



Low product diversification puts businesses at higher risk since companies' profits depend more heavily on tropical soft commodities, like beef and soy

Companies with higher product diversification - e.g. food retailers – are less exposed to transition risks as profits are less reliant on tropical soft commodities

1. Source: Profundo analysis.

# The framework demonstrates for investors the downstream supply chain risks driven by the transition




1. Quantified in a previous section and Annex II
2. Quantifies in Annex III for carbon prices trajectories
3. The framework covers only risks and costs, not benefits, as those related to Nature-based solutions are covered in the existing value drivers. Reputation benefits not accounted for in a prudential manner. Additionally, chronic changes in demand and carbon costs are already captured in the existing value drivers. All others are covered in following pages

INEVITABLE POLICY RESPONSE

- **The proposed framework aims at supporting investors identify the key impacts associated with future transitions and deforestation and leverages existing research to assess the most relevant variables and indicators investors may consider[3]**
- The transition risk framework conceptualizes the **impacts accruing to downstream companies through their supply chains,** and **covers impacts on companies internalizing and not internalizing the cost of deforestation** over their supply chains
- Risks occur on both the **demand side, as reputational risk disrupts demand, and on the cost side**, as a result of non-compliance or as companies must undergo additional costs to avoid transition risk
- The framework covers only risks and costs, not benefits, as those related to Nature-based solutions are covered in the existing value drivers. Reputation benefits not accounted for in a prudential manner. Additionally, chronic changes in demand and carbon costs are already captured in the existing value drivers. All others are covered in following pages

# 1 Market access risk emerges as regulation develops at different speeds across regions, generating disparity in production and import standards

INEVITABLE POLICY RESPONSE

## Drivers

### Policies and commitments

In FPS, policies to halt deforestation increase across world regions and become more stringent, creating different standards as to production and trade of tropical soft commodities

## Risk

### Market access risk

- **Market access** risk emerges when downstream companies' **supply chain is disrupted by regulation** that **limits imports** from jurisdictions that do not regulate deforestation stringently enough
- **Market access risk** translates into limited access to procurement and increased monitoring duties for the importers
- Downstream companies are expected to suffer from market access risk, based on the policy stringency at the **region of procurement relative to the stringency in the importing region**
- Market access risk exists **regardless of the levels of commodity-driven deforestation**
- When commodities are purchased at a price that does incorporate deforestation, there is no market access risk

## Impact

### Higher costs

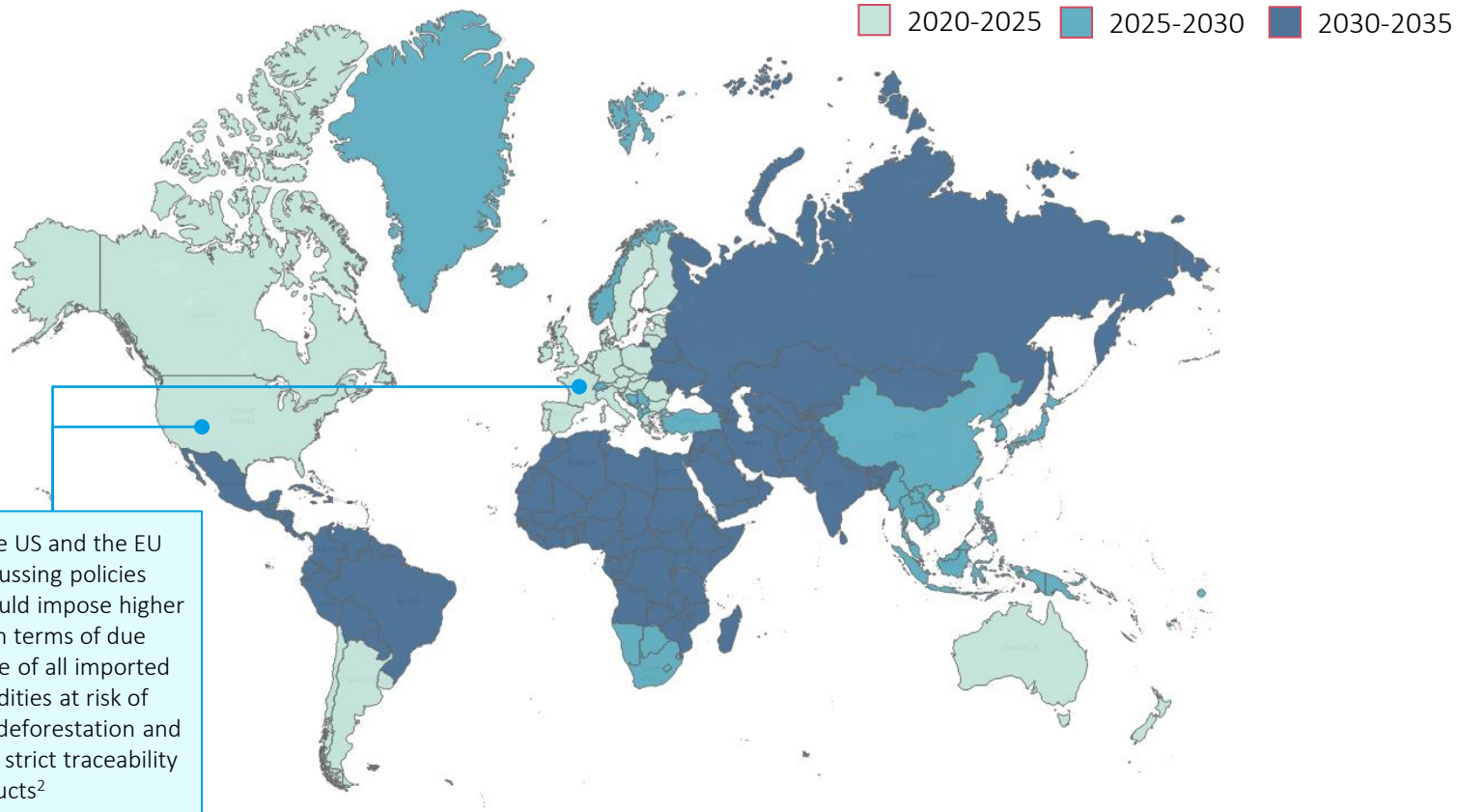
Market access risk impacts downstream companies through increased costs. When market access risk manifests in limited access to procurement due to legislation, downstream companies must pay higher price to comply. Expected costs include:

- **Cost of upgrading operations.** Companies must ensure supply chain monitoring and due diligence is carried out
- **Costs to switch to new suppliers.** Changing supplier implies additional costs in terms of due diligence and product quality assurance, as well as administrative costs[1]
- **Higher input costs.** Due to limited access and changes to procurement channels, downstream companies may have to pay higher prices for commodities, as these are purchased at a price that incorporates higher compliance over production and trade

1. Additionally, companies may suffer from supply disruption and associated costs – which are here not included in the scope of analysis

# 1 In FPS, regulation on imports is expected to increase, and major importing regions could achieve deforestation-free imports by as early as 2025

Map of world regions by year of fully deforestation-free imports[1]




Both the US and the EU are discussing policies that would impose higher duties in terms of due diligence of all imported commodities at risk of driving deforestation and enforce strict traceability of products[2]

- **Regulation on deforestation-free imports could increase across world regions, limiting trade of commodities where production drives deforestation (unless certified)**
- **EU, USA, Canada and Australia and New Zealand achieve deforestation-free supply chains by 2025 or earlier.** A strong signal that these regions are likely to soon implement laws to improve supply chain monitoring and achieve zero-deforestation imports is provided by high climate and forestry commitment in these regions and recent policy announcements regarding upcoming import regulations on import of commodities at risk of causing deforestation
- Latam's Southern Cone, South Africa, China and South, and Southeast Asia are estimated to achieve deforestation-free imports by 2025-2030

1. Results shown are a result of a scenario analysis: the year by when each region could achieve fully regulated and deforestation-free imports is assessed by commodity, based on the policies in place, on the governments' policy enforcement capacity and on climate and forestry commitment. The map shows the time period by when each region is expected to achieve zero-deforestation imports of *the majority* of the produced commodities. For more details on the results see Annex I
2. The European Commission proposed a 'Regulation on deforestation-free products' to minimise EU-driven deforestation and forest degradation, while the FOREST Act is a draft bill authored by Senator Brian Schatz and currently under discussion, which would prohibit agricultural commodities produced with illegal deforestation to enter the US market

# 1 In FPS, market access risk emerges for commodities imported from regions with lower stringency in regulation

Potential market-access risk[1] accruing to Brazil's beef exports over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Southeast Asia | Low | Low | Low | Low | Low | Low | Low |
| Tropical Latin America | Low | Low | Low | Low | Low | Low | Low |
| Tropical Africa | Low | Low | Low | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Medium | Low | Low | Low | Low | Low |
| United States | Low | Medium | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Medium | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Medium | Medium | Low | Low | Low | Low | Low |
| Canada | Low | Medium | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Medium | Medium | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Imports to region are likely to be limited

Imports to region are likely to require more stringent due diligence

Imports to region are likely not to be restricted

1. Market access is estimated by comparing regional policy stringency scores between producing and importing countries. When there exist a difference in policy stringency score, it is estimated that market access risk exist, which severity is based on the extent to which the scores differ. It is assumed that market access risk emerges regardless of the levels of commodity-driven deforestation. For more information see Annex III

Source: Based on analysis by Vivid Economics

INEVITABLE POLICY RESPONSE

- **Downstream companies face higher overall procurement costs**, including costs to upgrade operations, switching to new suppliers and higher input costs, which likely increases market-access risk

- **The risk is estimated to increase in 2025 for all commodities.** In fact, most key importing regions have already committed or pledged to halt deforestation by achieving deforestation-free imports. This signals that these regions are expected to implement regulation faster compared to key producing regions, which on the contrary have limitedly committed to halt deforestation or implemented policies in the climate area, signaling that implementing policies may take longer, creating a gap around 2025

*Example:* the European meat retailer – importing beef from Brazil - is expected to face medium market access risk, meaning it may have to switch suppliers, pay higher input costs and upgrade operations to be compliant with European import regulation

# 2 Deforestation can create market-based penalties and fines that can spill over to downstream companies

INEVITABLE POLICY RESPONSE

## 2a Fines

**As economic penalties are commonly defined in laws regulating production and trade of tropical soft commodities, downstream companies could face increased costs if sourcing from non-compliant suppliers**

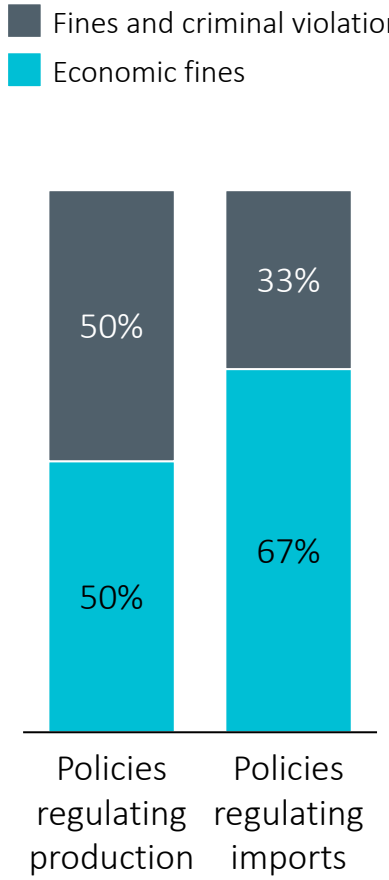
- Most countries have specific regulations that impose fines to companies that directly driver deforestation
- It is likely that fines could pass onto downstream companies' through higher input prices

## 2b Cost of capital

**Downstream companies which supply chains have deforestation embedded may be subject to the risk of more limited or costly financing, or even disinvestment and higher cost of capital**

- The TCFD and TNFD are requiring increasingly detailed disclosure that could lead to more difficult access to debt and capital for companies that have deforestation embedded in their supply chains
- This may result in higher finance-related transaction costs and higher cost of capital[2]

**% of policies[1] by type of penalty**
% over total




- **Not internalizing deforestation** may lead to **market-based penalties**, such as fines – either directly or indirectly when passed on from non-compliant suppliers – and limited or more costly access to finance
- In the majority on countries regulating production or trade of tropical soft commodities, non-compliance leads to economic penalties and potential criminal charges with a possibility of imprisonment
- As investors require increased disclosure, companies linked to deforestation may be affected by higher costs of capital

1. 80+ policies were analysed. For more information see Annex I
2. Orbitas (2020). Agriculture in the Age of Climate Transitions Stranded Assets. Less Land. New Costs. New Opportunities.

Source: Based on analysis by Vivid Economics

# 3 Companies procuring commodities linked to deforestation at a market price are exposed to potential reputational risk

INEVITABLE POLICY RESPONSE

## Drivers

### Commodity-driven deforestation

As commodity-driven deforestation drops in the future in all regions in IPR FPS, deforestation, as well as the speed at which regions halt deforestation compared to others, drive reputational risk

### Social preferences

Societal awareness of deforestation increases, while consumer tolerance to products linked with deforestation could decrease over time

### Policies and commitments

As policies to halt deforestation increase and become more stringent in FPS, regulating production and imports of tropical soft commodities, it becomes less tolerated to be associated with deforestation

## Risk

### Reputational risk

- Reputational risk emerges when downstream companies purchase commodities linked with deforestation **at market price** as the current market price does not internalize deforestation in most countries[1]
- Downstream companies suffer from reputational risk based on the **levels of commodity-driven deforestation at the region of procurement** [2]
- **Reputational risk flows through the supply chain** as companies import commodities. Increasing disclosure requirements are likely to exacerbate risks for downstream companies

## Impact[3]

### Downstream company's revenues at risk

- Reputational risk **can affect company's revenues** as consumers turn to deforestation-free products
- Reputational risk can impact on the **total yearly revenues of a downstream company** – regardless of the share of revenues that is associated with the selling of the commodity linked with deforestation and carrying reputational risk[4]
- **Reputational risk faced by downstream companies does not accumulate by commodity,** as it is assumed that reputational risk impacts the company based on the volumes of the commodity handled by the downstream company[5]

1. Companies that purchase commodities in countries that still have commodity-driven deforestation are implicitly creating the deforestation externality. The commodity market price does not not fully internalize the cost of deforestation until commodity-driven deforestation ends globally in 2030 according to FPS.
2. For example, if a company procures beef from a region in Brazil with little deforestation, but does not disclose the price at which commodities are procured at, the company is could suffer from the same reputational risk as if it was procuring commodities from a region of Brazil with higher deforestation levels
3. There are additional impacts driven by potential reputational risk, including impacts on the market share and share value in both short- and long-run. Source: Chain reaction Research, 2019. "Deforestation-Driven Reputation Risk Could Become Material for FMCGs".
4. For example, if a downstream company is associated with deforestation in Southeast Asia driven by palm oil production, consumers are expected to turn away from all products sold by the company – whether or not these include palm oil. Therefore, all revenues a company makes are at risk – regardless of the share each commodity drives
5. See Section: Example application of value drivers for more details on the application of value drivers

# 3 Reputational risk could emerge in the region of procurement where deforestation occurs and flows through the supply chain

INEVITABLE POLICY RESPONSE

## Risk flow

### Reputational risk emerges in the region of procurement

Reputational risk emerges based on the levels of deforestation in the region from which the downstream company procures commodities from

### Commodities carry reputational risk when purchased – locally or imported

Reputational risk associated with procuring commodities linked with deforestation flows through trade, especially through the commodities the downstream company imports

### Economic sectors using tropical soft commodities are exposed to reputational risk

Each economic sector relying on the use of tropical soft commodities is exposed based on:

i) the volumes of consumption of each and all commodities
ii) the volumes that are locally sourced and the volumes that are imported
iii) the risk associated with commodities imported or locally sourced

## Indicator and application

**3a** Reputational risk (low/medium/high) **by commodity and region** from which the downstream company is procuring - over period 2020-2050

Use this risk value driver to evaluate companies when **volumes and region of procurement are disclosed**

**3b** Reputational risk (low/medium/high) given the **economic sector and region** in which the company is active - over period 2020-2050

Evaluate companies when **volumes and regions of procurement are not disclosed**

Indicator 3b is calculated based on the risk of the **regional import mix, and the average sectoral consumption of commodities.** This implies that a company that does not disclose will likely need to be valued based on average values which may result in a less accurate valuation

1. For more information on the methodology see Annex iii

# 3a Companies procuring commodities from regions with high levels of deforestation put revenues at risk

INEVITABLE POLICY RESPONSE

Reputational risk from domestically produced and sourced beef for all world regions over time[1]

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | High | High | High | Low | Low | Low | Low |
| Southeast Asia | High | High | High | Low | Low | Low | Low |
| Tropical Latin America | High | High | Low | Low | Low | Low | Low |
| Tropical Africa | High | High | High | Low | Low | Low | Low |
| Latam's Southern Cone | Medium | Medium | Low | Low | Low | Low | Low |
| United States | Medium | Low | Low | Low | Low | Low | Low |
| Southern Africa | Medium | Medium | Low | Low | Low | Low | Low |
| Greater China | Low | Medium | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union an UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Annual revenues at risk[2]

- 6-15%
- 3-6%
- 0-3%

1. Reputational risk levels are estimated based on i) overall levels of deforestation related to commodity production, both in terms of absolute values of deforestation for a specific commodity, as well as non-specific to commodities. Risk is also dependent on relative levels of deforestation compared to other procurement regions and through time (there is risk associated with a relatively slow rate of reduction in deforestation). Additionally, consumer preferences as to (or consumer intolerance to) deforestation are factored in, as they are assumed to increase (decrease) over time, by defining increasingly lower thresholds after which certain levels of deforestation become less and les tolerated. Results for other commodities, and details on the methodology can be found in Annex III
2. Revenues at risk are estimated based on literature review and expert's opinions. The value is indicative, and its generalization limited due to limited research and empirical data available. See more details on the limitation of these estimates in the conclusions section.
3. Source: Reputation and Its Risks. (2022). Retrieved 29 July 2022, from https://hbr.org/2007/02/reputation-and-its-risks

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- Commodities from Brazil, Tropical Latin America, Southeast Asia and Tropical Africa are estimated to carry the highest levels of reputational risk due to high levels of commodity-driven deforestation
- For some regions, risk is estimated to become higher in 2025 and 2030, as consumer scrutiny increases. It is the case for soybean sourced from Southeast Asia and Tropical Africa, which is expected to drive increased reputational risk in 2025. Given the same level of deforestation, reputational risk increases over time because consumers' tolerance for deforestation is likely to decrease, and ability to trace deforestation increase

*Example:* a food and beverage European company procuring beef from Brazil at the market price may have revenues at risk ranging between 6-15% between 2020 and 2030. Reputational risks could affect brands and all the products associated with it[3]

# 3b Reputational risk differs across economic sectors and depending on where commodities are sourced from

Potential Risk of different economic sectors in the European Union over time, with risk calculated for imported commodities and domestically sourced commodities[1]

| | Sector | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|
| Imported | Food and beverage service | Low | Low | Low | Low | Low | Low | Low |
| | Manufacturing of food products | Medium | Low | Low | Low | Low | Low | Low |
| | Manufacture of oils and fats and not the processing | High | Medium | Low | Low | Low | Low | Low |
| | Manufacture of prepared animal feeds | Medium | Low | Low | Low | Low | Low | Low |
| | Seed processing for propagation | Medium | Low | Low | Low | Low | Low | Low |
| | Construction of buildings<br>Manufacture of pulp, paper and paperboard | Low | Low | Low | Low | Low | Low | Low |
| | Manufacture of rubber products | Low | Low | Low | Low | Low | Low | Low |
| Domestically sourced | Food and beverage service | Low | Low | Low | Low | Low | Low | Low |
| | Manufacturing of food products | Low | Low | Low | Low | Low | Low | Low |
| | Manufacture of oils and fats and not the processing | Low | Low | Low | Low | Low | Low | Low |
| | Manufacture of prepared animal feeds | Low | Low | Low | Low | Low | Low | Low |
| | Seed processing for propagation | Low | Low | Low | Low | Low | Low | Low |
| | Construction of buildings<br>Manufacture of pulp, paper and paperboard | Low | Low | Low | Low | Low | Low | Low |
| | Manufacture of rubber products | Low | Low | Low | Low | Low | Low | Low |

Annual revenues at risk[2]
- 6-15%
- 3-6%
- 0-3%

1. Details on the methodology and results for other regions can be found in Annex III.
2. Revenues at risk are estimated based on literature review and expert's opinions. The value is indicative, and its generalization limited due to limited research and empirical data available. See more details on the limitation of these estimates in the conclusions section.

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

INEVITABLE POLICY RESPONSE

- Companies in sectors and regions that procure commodities from high-deforestation regions (at market prices) inherit its reputational risks (see previous slide) unless they import into a region with high import policy stringency
- As commodities are imported from a mix of regions, the average risk accruing to downstream companies in a specific region differs based on the import mix. A downstream company importing beef is exposed to potentially higher reputational risk in China than in the EU, given the different import mix. China imports more beef from regions at high risk of deforestation compared to European Union
  - Regions that are more heavily dependent on imports from regions with high levels of deforestation and have low import stringency are likely more subject to risk. For instance, their downstream companies in China, Russia and Middle Eastern countries could face reputational risk associated with imports
- Across developed regions, short-term reputational risk could arise for importers in the manufacture of oils and fats and not the processing sector, due to a reliance on palm oil imports from Southeast Asia

*Example:* a European company in the food product manufacturing sector may have revenues at risk ranging between 3-6% considering the average risk carried by imported commodities into Europe

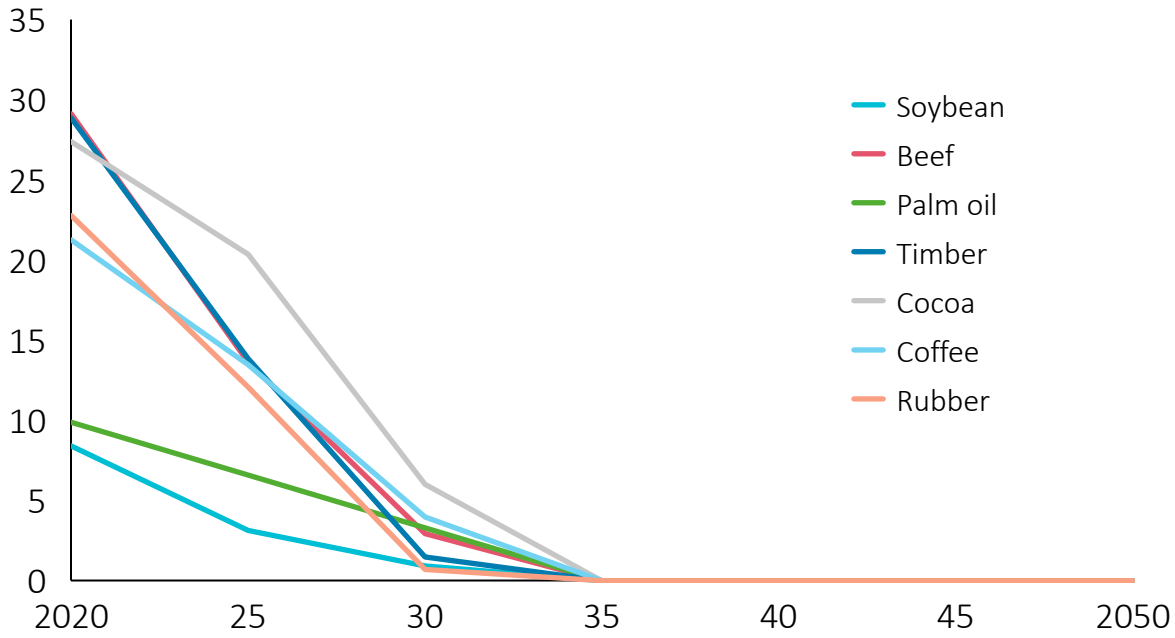
4

# Companies can avoid risks by internalizing the costs of deforestation by paying a price premium on commodities

INEVITABLE POLICY RESPONSE

**Global price premium index for deforestation-free commodities[1,2] in IPR FPS**

% of commodity price




**Price premiums are positive until deforestation falls to zero in 2030-2035 and the market price fully internalizes deforestation.** Until then, downstream companies that purchase at market prices are generating an externality (deforestation) and are exposed to reputational and market access risk, as well as to market-based penalties

- **Price premiums for beef, timber, cocoa, rubber and coffee are the estimated to be highest,** to compensate for high levels of commodity-driven deforestation
- The price premium associated with **cocoa** is estimated to remain above that of other commodities through to 2030, as production stringency remains low until 2035 in major producers (South-East Asia and Tropical Africa)
- Although **palm oil** drives substantial deforestation, the premium is relatively lower to other commodities driving high levels of deforestation, as the palm oil price internalizes deforestation earlier on compared other commodities, as the palm oil market has already advanced in production standards, also confirmed by the drop in palm oil- driven deforestation in recent years

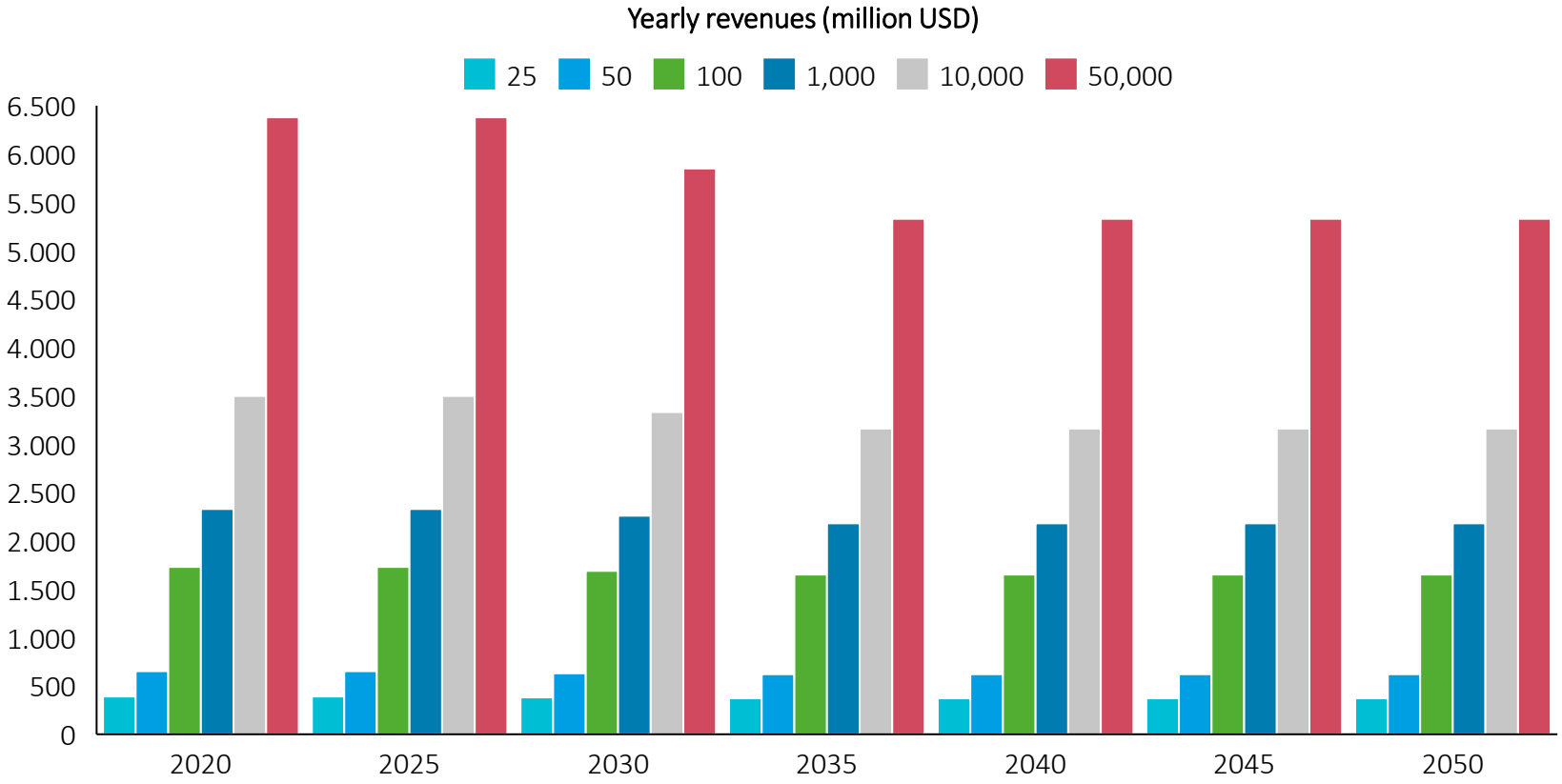
*Example*: the European meat retailer who used to spend USD 10 million per year purchasing Brazilian meat would have to pay USD 12.9 million in 2020 for deforestation-free beef

1. Price premia are here defined as the **prime premia companies must pay** to purchase deforestation-free commodities.
2. Price premiums are estimated based on Fairtrade Foundation price premiums and the Fair Rubber price premium. Fairtrade price premiums are available for cocoa, coffee and soybean. Coconut was used as a proxy for palm oil. The price premium for beef is based on the highest available price premium (cocoa). The price premium for Fair Rubber is applied to timber, as a similar system for timber was not available. The Fairtrade certification requires farmers to adhere to environmental standards including the prevention of cutting down protected forests. Price premiums are estimated based on the size of the price premium as a percentage of market prices in 2020, and price premiums (%) are applied to modelled commodity prices. The proportion of the price premium applied decreases with import policy stringency. Deforestation-free commodities in countries with the highest degree of import stringency (5) are not associated with a price premium.

Sources: Based on analysis by Vivid Economics, drawing on data from FairTrade (available at: https://www.fairtrade.net/standard/minimum-price-info) and FairRubber (available at: https://fairrubber.org/about/criteria/), and using MAgPIE

# 5 Companies can avoid deforestation risks by upgrading operations that involve extra costs

5-year potential costs of upgrading operations for companies with different revenues[1] (1000 USD)




1. Costs of upgrading operations are estimated for the year 2020 based on literature review. Future values of cost of upgrading operations are estimated to decrease over time as regulation tightens up across world regions, requiring suppliers to increasingly disclose information on deforestation and production. This is expected to decrease due diligence costs, although costs for audits and due diligence are expected to still be positive when regulation is entirely stringent. Costs of upgrading operations include CAPEX costs (e.g. setting up costs, employee and staff training) for the year 2020 only.
2. Cost of switching to new suppliers are estimated as a percentage (5%) of the costs due diligence for commodities with low liquidity markets - beef and timber. For other commodities, costs of switching to a new supplier are assumed to be zero, since markets have high liquidity.

Source: Based on data from OECD, CSES and European commission, compiled and harmonized by Vivid Economics

INEVITABLE POLICY RESPONSE

- **In order to avoid risk, downstream companies could upgrade their operations, by making significant investments into monitoring, due diligence and suppliers' risk assessment**
- **Costs largely vary depending on the company size and yearly revenues, ranging from ~400,000 USD to 6 million USD every five year for larger companies in 2020.** Costs embedded within the costs of upgrading operations are:
  - setting up costs
  - costs for improving IT systems
  - costs for employing and training staff
  - costs for reporting and publishing
  - costs of legal audits and due diligence
  - Cost of switching to new suppliers[2]
- **Costs of upgrading operations decrease slightly over time as procurement markets become increasingly regulated, therefore facilitating due diligence and reducing costs**
- Costs are estimated to stabilize after 2030-2035, when markets become fully regulated

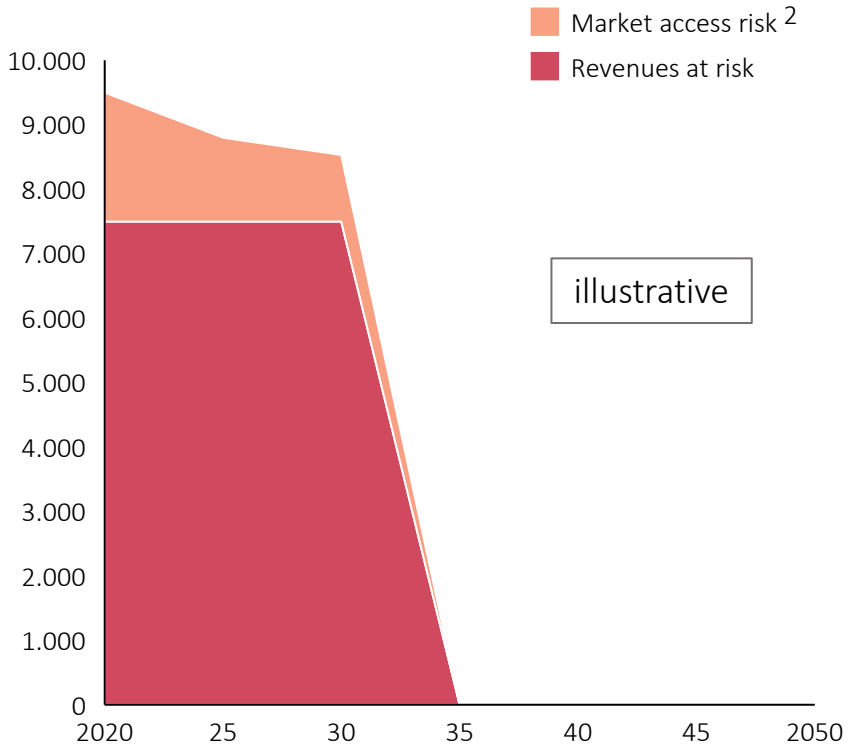
***Example:*** the European meat retailer who has USD 50 million in yearly revenues and procuring beef from Brazil, invests USD 620-650.000 every 5 years over the 2020-2050 period to upgrade its operations

# Early action can lead to large revenue savings as reputational, market access and compliance risks increase

*Example: company in the food and beverage sector in Europe, making 50 million USD in yearly revenues and procuring beef from Brazil (10 million USD per year)*

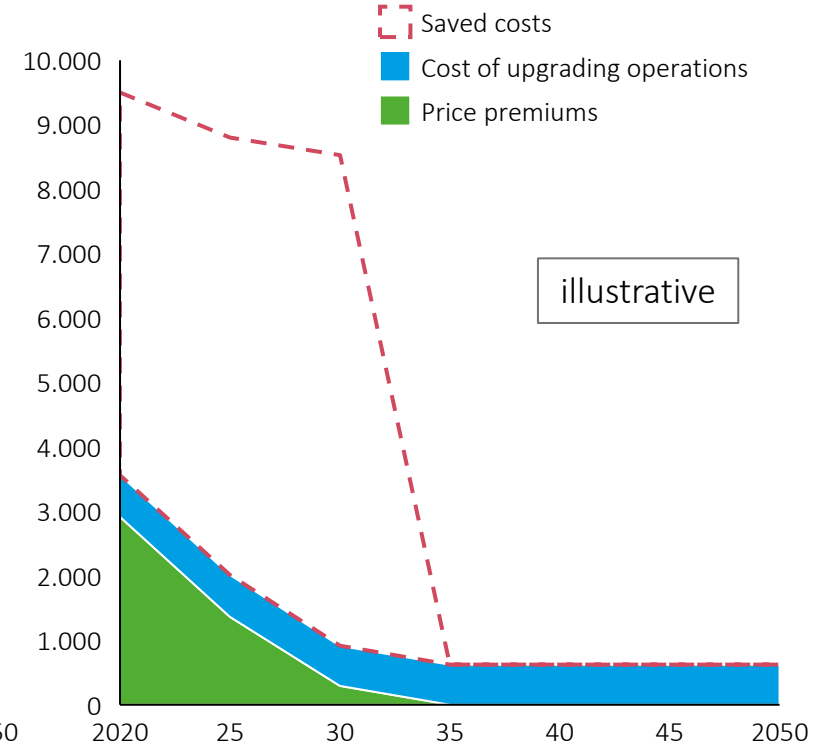
Estimated revenues at risk and costs[1] when company is not internalizing the cost of deforestation

1000 USD




Estimated costs [1] for company to internalize the costs of deforestation

1000 USD



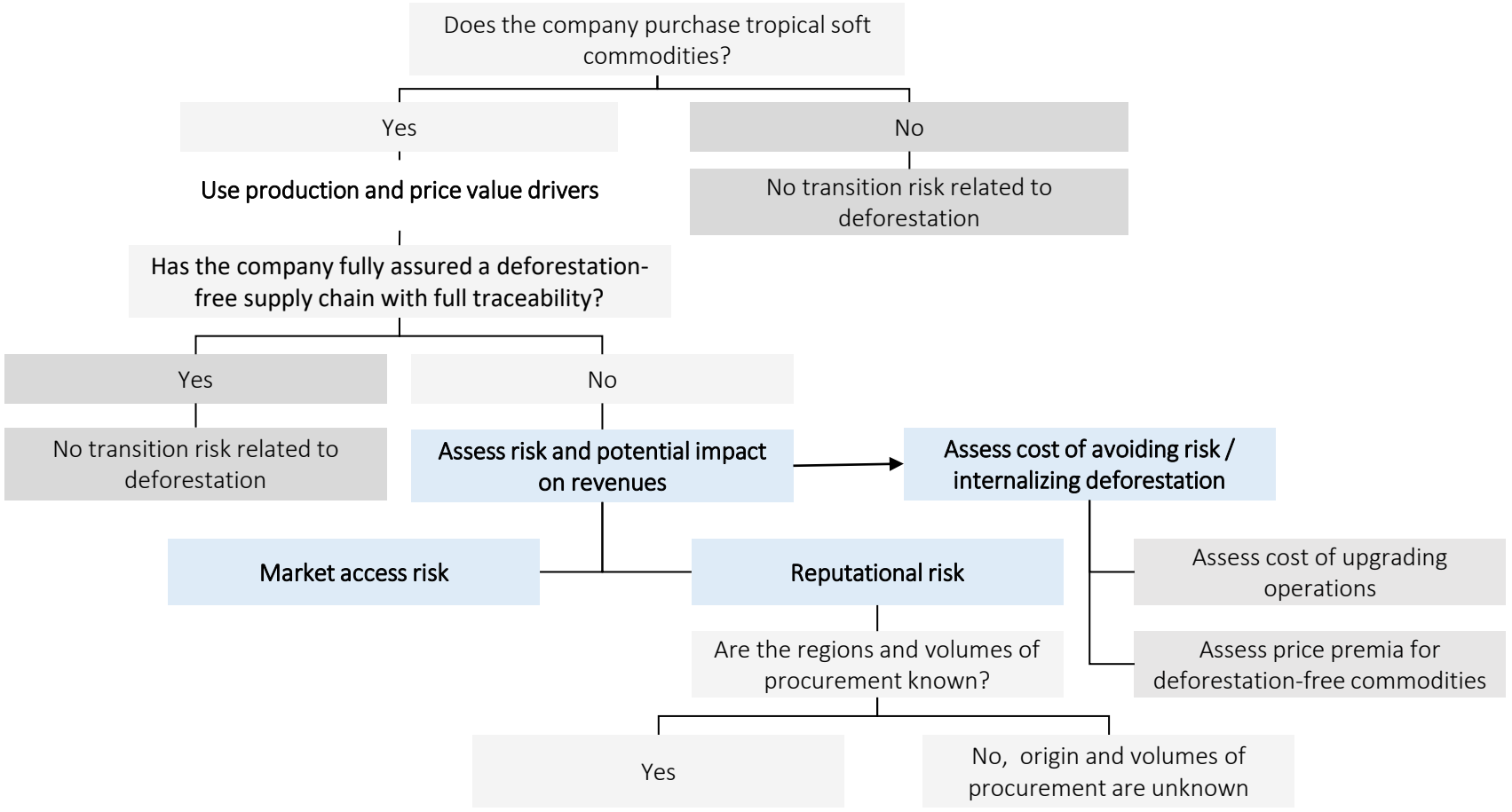

1. Market-based penalties are excluded rom the example as only assessed qualitatively in this study
2. Costs for market access risk are here estimated to be equal to the price premium
3. Such as beef from China, palm oil from Tropical Africa and Brazil, soybean form southeast Asia and other

Source: Based on analysis by Vivid Economics

- For companies not internalizing deforestation, revenues at risk remain high up until 2030 for some regions, while in some cases risk can even increase over the next 5 years[3]
- Market-based penalties and market access risk can in some cases increase until 2035
  - The likelihood of loosing revenues increases, as both regulation becomes more stringent and consumers less tolerant towards deforestation
  - Market-based penalties as well as market access risk increase as regulation tightens
- Costs of upgrading operations and premiums for deforestation-free commodities decrease over time, providing an incentive for companies to act immediately
  - Price premiums are estimated to fall to zero by 2035 at the latest
  - Costs of upgrading operations slightly decrease over time

# Contents

# Investors can use the value drivers to estimate the impact of the transition on downstream companies' financials




Note: See next slide for example

- **Depending on the level of disclosure of downstream companies regarding their commodities procurement, different value drivers can be used to assess transition risk**
- There are different pathways and ways in which value drivers should be used according to data available:
  - Disclosure on prices, regions and volumes of procurement are key to assess whether a downstream company is internalizing the price of deforestation
- **Indicators can be alternatively used to assess risk depending on the information the downstream company discloses:**
  - If the company does disclose volumes and region of procurement, the indicator 3a (see above) can be used
  - Alternatively, if there is no disclosure on the volumes and regions of procurement, indicator 3b (see above) can be used

# 3a When region and volumes of procurement are known, regional value drivers can be used

Example | Relevant information to use for risk assessment

## 1 Identify company

Collect information on the downstream company

**Company:** Company in the Food and Beverage service sector

Commodities **traded and consumed:**

Beef, palm oil, coffee, cocoa

**Market of destination:** US, Europe

**Yearly revenues:** 25 billion USD

## 2 Assess company

Assess ability of the company to internalize cost of deforestation

- Whether company purchases commodities at market price or with price premium
- **When average price of commodity is not disclosed, assumption is the company is not internalizing risk**
- Assess supply chain monitoring, presence of track & trace systems

## 3 Assess risk

When **both volumes and regions of procurement are known,** collect value drivers for all regions for each year in time, and use information on volumes to assess overall potential risk to the company. The overall reputational risk that is accruing to the downstream company is the risk of the *majority* of the commodity

*Example: risk for beef in different regions of procurement*

| Region | Volumes (%) | 2025 Risk |
|---|---|---|
| Brazil | 60% | High |
| Tropical Latam | 30% | Medium |
| USA | 10% | Low |
| **Total** | | **High** |

The criteria used to assess the overall risk is if >50% of the commodity is sourced form a region with high risk, then the high risk applies to the entirety of the commodity. If low and medium risk commodities make up together for >50% then risk is medium

## 4 Estimate costs and opportunity

- Use information on risk and on revenues to estimate potential damage form transition risk
- Use value drivers on price premiums and costs of upgrading operations to assess cost of avoiding transition risk

- **Revenues at risk.** Since risk is high, revenues at risk are 6-15%. Revenues at risk are assumed to apply to the entirety of a company's revenues for the year
- **Risk premium**
  - **Commodity price premium value drivers**
  - **Costs of upgrading operations**

*Example: beef*

| Premium | 2025 value | Unit |
|---|---|---|
| Price premium | 2000 | US$05 / t DM |
| Upgrading operation costs | 5 | M USD |

## 5 Insights

Elaborate results on risks and opportunities and discuss its relevance to their transition plans and disclosure

- Company purchases commodities from regions causing **high reputational risk** sector
- Risk is expected to increase over time and puts **~1.5 to ~3.7 USD billion of revenues at risk in each year**
- Given the purchased volumes of commodity, internalizing the cost of deforestation could costs **~100 million USD over the next 10 years**

# 3b When region and volumes of procurement are not known, sectoral value drivers can be used

Example | Relevant information to use for risk assessment

## 1 Identify company

Collect information on the downstream company

**Company:** Company in the Food and Beverage service sector

Commodities **traded and consumed:**

Beef, palm oil, coffee, cocoa

**Market of destination:** US, Europe

**Yearly revenues:** 25 billion USD

## 2 Assess company

Assess ability of the company to internalize cost of deforestation

- Whether company purchases commodities at market price or with price premium
- **When average price of commodity is not disclosed, assumption is the company is not internalizing risk**
- Assess supply chain monitoring, presence of track & trace systems

## 3 Assess risk

**When the regions of procurement are unknown, the value drivers from the region of market of destination together with information on the economic sector of activity can be used:**

*Example: risk accruing to the Food and Beverage sector*

| | Region | 2025 Risk |
|---|---|---|
| Imported | US | HIgh |
| | EU | Medium |
| Domestically sourced | US | High |
| | EU | Medium |

Risk for imported commodities is based on the **average import mix of the region of market of destination.** If the company does not disclose where it sources commodities from it will likely be assessed based on average values, which may result in a less favorable valuation in the case the downstream company is effectively sourcing from certified zero-deforestation producers

## 4 Estimate costs and opportunity

- Use information on risk and on revenues to estimate potential damage form transition risk
- Use value drivers on price premiums and costs of upgrading to assess cost of assess cost of avoiding transition risk

- **Revenues at risk.** Since risk is high in the US, revenues at risk are 6-15%. Revenues at risk are assumed to apply to the entirety of a company's revenues for the year
- **Risk premium**
  - **Commodity price premium value drivers**
  - **Costs of upgrading operations**

*Example: beef*

| Premium | 2025 value | Unit |
|---|---|---|
| Price premium | 2000 | US$05 / t DM |
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## 5 Insights

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# Contents

# Conclusions

Policy analysis

## In FPS, policy stringency to stop deforestation is estimated to increase substantially in the coming decade

- In the period 2013-2015, more than **4 million hectares of forest cover were lost** due to production of tropical soft commodities. Countries producing tropical soft commodities have implemented several policies to halt deforestation, but they are often undermined by low enforcement capacity, ineffective regulatory systems and corruption
- **88% of countries** have made **commitments either in climate or forestry**, and **67% have committed to reduce or eliminate deforestation before 2035**

Production and price value drivers

## The FPS policy response slows the growth in production of beef, soybean and palm oil, while it favours timber production

- **Global beef, soybean and palm oil production are estimated to decrease in IPR FPS compared to a business-as-usual scenario,** due to diets gradually shifting away from beef and towards alternative proteins, and due to increased regulation on deforestation and bioenergy.
- The use of timber to replace other less sustainable construction materials is estimated to lead to an **increase in timber production under FPS.**
- Cocoa production is mildly negatively affected by the climate transition, and coffee and rubber production is estimated to grow in FPS as much as in BAU.
- **Downstream companies in sectors procuring timber, cocoa and rubber may experience input price increases.** Beef and soybean prices decrease over 2020-2050, while palm oil and coffee remain fairly stable over the period.

Risk analysis

# Conclusions

Policy analysis

Production and prices value drivers

**Risk analysis**

## Commodity production tied to deforestation poses a material risk for downstream companies that could increase in the coming 5 years

- Commodities from Brazil, Tropical Latin America, Southeast Asia and Tropical Africa potentially carry the highest levels of reputational risk due to high levels of commodity-driven deforestation, leaving downstream companies with 6-15% of revenues at risk
- Downstream companies in China, Russia and Middle Eastern countries, especially in the food and beverage sector with 6-15% of their revenues at risk
- The European Union, USA, Canada Australia and the southern cone of Latin America see their imports limited
- 50% of policies regulating the production of tropical commodities and 33% of policies regulating imports include fines and even criminal violation charges for companies driving deforestation
- Price premiums for beef, soybean and cocoa are the highest, to compensate for high levels of commodity-driven deforestation
- Costs largely vary depending on the company size and yearly revenues, ranging from ~400,000 USD to 6 million USD every five year for larger companies in 2020
- The costs of avoiding risk is decreasing while reputational risk is likely to increase over the next decade

# Results are subject to limitations driven by several assumptions used throughout the study

INEVITABLE POLICY RESPONSE

| Study limitations | |
|---|---|
| 1 | **The analysis of policies was conducted on a best effort basis through an extensive review of the most relevant policies for key producing and importing regions. The list of policies selected and analysed is however not exhaustive and is expected to evolve quickly.** For more details on the methodology used to identify, select, analyze policies please see Annex I |
| 2 | **Data on prices and production are modelled through MAgPIE and are based on several assumptions.** Scenarios are designed based on assumptions on a number of variables such as: population growth, diet shifts, carbon prices, etc. (for more details, see the main land use results on the IPR website |
| 3 | **Value drivers assessing risk are limited to the risk associated with deforestation.** Additional risks may emerge from additional impact of companies on nature. Air and water emissions, as well as impact on biodiversity, constitutes similar risk which is not addressed in this study |
| 4 | The value proposed for **revenues at risk** associated with varying levels of reputational risk is an estimate based on limited empirical research and experts' opinions. The value is an indicative value, and may vary based on a number of factors, among which:<br>• **Market of destination.** Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future<br>• **Risk management and communication strategy.** Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e., communication and active social responsibility can largely mitigate damages) |

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- Annexes
  - **Annex I. Policy deep dives methodology and results**
  - Annex II. Commodity prices and production
  - Annex III. Risk assessment and sector risk exposure methodology and results

# Several types of policies and initiatives were assessed to capture the diversity of policies impacting on production and trade

INEVITABLE POLICY RESPONSE

Within scope
Relevant for producing countries
Relevant for trade

| Policy type | Description | Treatment | Examples |
|---|---|---|---|
| National forestry policies | National legislation regulating forests and logging | Included for top producing countries, when possible | • Argentina: Forest Law (2007)<br>• China: Forest Law (revised in 2020) |
| NDCs (Nationally Determined Contributions) | Commitments to reduce emissions, often linked to deforestation reduction | Included only when not already incorporated into MAgPIE model | • Brazil's updated NDC (to enhance integrated agroforestry) |
| Commodity-specific laws | Laws relating to the production of specific soft commodities | Included for top producing countries, when possible | • Malaysia's Sustainable Palm Oil standard (certification required for all producers) |
| Private sector initiatives | Actions and agreements created and undertaken by the private sector in relation to forests or commodities | Out of scope | • Brazil's Soy Moratorium |
| Trade policies | National legislation regulating trade and prescribing guidelines for items being brought into the country. May require due diligence on the part of companies. May be articulated in bilateral agreements | Included for top importing countries, when possible | • US: proposed FOREST Act to prohibit entrance of agricultural commodities produced with illegal deforestation<br>• EU: Timber Regulation prohibits entrance of illegally sourced wood |
| Public procurement policies | Requirements related to purchase of goods and services by governments and public organisations. Not mandatory for other actors, but can be used by them as best practice | Included when found | • UK: Government Buying Standards include a requirement for all palm oil to be sustainably produced |
| Declarations/ multilateral agreements | Declarations of commitment or agreements between single countries. | Out of scope | • The New York Declaration on Forests (2014),Amsterdam Declaration (2015), Glasgow Leaders' Declaration on Forests and Land Use (2021) |

Top producing countries where deforestation is linked to agriculture include Brazil, Indonesia, Malaysia, Bolivia, Paraguay, China, Cote d'Ivoire, Argentina, Thailand, Madagascar, Ghana, Cambodia, Colombia, Papua New Guinea, Peru, Cameroon, Lao People's Democratic Republic, Viet Nam, and the Democratic Republic of the Congo
Top importing countries for tropical soft commodities include China, the US, India, the Netherlands, Argentina, Japan, Germany, Malaysia, Pakistan, France, Mexico, Italy, Belgium, Spain, the UK, and Viet Nam.

# An extensive survey of the policy landscape revealed relevant policies selected for deep dives

| | Step 1 | Step 2 | Step 3 |
|---|---|---|---|
| Action | Search websites and **publications of key organisations** engaging in work on forests and commodities | Conduct a more **detailed search on relevant policies** | Conduct **additional research for key importing and exporting countries** using keyword searches, as needed |
| Result | • A long-list of potentially relevant policies was compiled | • Specific information on relevant policies was obtained<br>• Additional policies that were encountered were added to the long-list | • Relevant policies were added to the long-list and researched further |
| Detail | Organisations considered include: WRI; Tropical Forest Alliance; TRASE/Global Canopy; European Forest Institute; World Bank/IMF; IDH; Chain Reaction; Global Forest Watch<br>Reports consulted include:<br>• European Soy Monitor (link)<br>• Global Green Value Chains (link)<br>• Ending Tropical Deforestation (link)<br>• Pending and Proposed Legislation (link)<br>• Commodities and Forests Agenda (link) | • Research enabled snowball sampling to further expand the universe of policies considered<br>• Relevant policies included a limited number of bilateral agreements and public procurement policies | • Keywords used include policy, mandate, law, deforestation, and specific commodities<br>• Additional policies/programmes considered include NDCs, when relevant |

# This project identifies the most relevant policies, and makes an estimation of current and future stringency

INEVITABLE POLICY RESPONSE

| Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---|---|---|---|---|
| Identify key policies | Policy mapping and scoring | Assess country-level enforcement capacity and commitment | Calculate year of fully regulated production or import | Aggregate at regional level |

- **Top importing countries** of the 7 tropical soft commodities are identified through the value of imports
- **Top producing countries** at risk of deforestation due to production of the tropical soft commodities are identified through the value to deforestation linked to agriculture[1]
- **Trade policies** affecting the production and trade of tropical soft commodities are identified in top producing and importing countries, with special attention to policies regulating deforestation

- Each policy identified is categorized based on the whether it regulates production of a **specific commodity or if it is crosscutting**
- **Stringency assessment** of each policy, which is defined as the extent to which a policy is binding, and it is assessed based on i)whether the policy is a country-level mandate or not (e.g., voluntary standards), and ii) on the severity of penalties established.

- To inform the date of fully-regulated production and imports, the **governments' policy enforcement capacity and climate and forestry commitments** were assessed
- **Policy enforcement capacity is** defined as the governance effectiveness, regulatory quality, political stability, etc.
- **Climate and forestry commitment** which indicates whether a country's government implements or commits to long-term environmental measures

- **The year of fully regulated and deforestation-free production or imports** is a combination of the current policies and future policy developments
- This defines the time by when producing countries **achieve zero-deforestation production** for each of the seven tropical soft commodities and importing countries achieve **deforestation-free supply chains**

- Results at the country-level are then aggregated at the **regional level:**
  - Through a weighted average based on **imports of tropical soft commodities** for importing countries
  - Based on **deforestation linked to production of tropical soft commodities** for producing countries

1. Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber." Technical Note. Washington, DC: World Resources Institute. Available online at: wri.org/publication/estimating-the-role-of-sevencommodities-in-agriculture-linked-deforestation.

# Step 1: Identify key policies

| Rank top producing and importing countries | Identify relevant policies | Experts interviews |
|---|---|---|
| Sort countries by import values of the seven tropical soft commodities and by deforestation linked to agriculture | Desk research into additional policies affecting the production and trade of tropical soft commodities<br>~ 40 policies analyzed on four areas of interest:<br>• **Global policies** (CBAM, TCFD, TNFD, RSPO, sectoral initiatives)<br>• **Additional to NDCs** | • **Conduct experts' interviews** to explore policy developments and confirm scope<br>• Conducted interviews with experts form TRASE, Chain Reaction, Kaya, Profundo |

Example

| Country | Commodity | Area | Policy development |
|---|---|---|---|
| **Brazil** | Crosscutting | Production | The 1965 Forest Code requires landowners in the Amazon to maintain 35 to 80 percent of their property under native vegetation, so that farmers can only farm 20% of the bought land. The Law is virtually impossible to monitor given the size of Brazil and Amazonian forest. Moreover, a 2012 law update reduced the area required to be protected and gave pardons to illegal deforestation occurred before 2008 |
| **EU** | Timber | Imports | EU passed in 2010 the EU Timber Regulation, which prohibits the placing of illegally sourced wood products on the European market and requires operators and traders to exercise due diligence to minimize the risk of Importing illegally harvested timber. Although it represented a huge effort to halt deforestation in supply chains, it was found to be breached consistently |
| **China** | Crosscutting | NDC | The target for the period 2021-25 is to achieve a 24.1% of forest cover, and to plant ~30 Mha of forests in the next 5 years |

# Step 2. Policy mapping and scoring

**Policy stringency**
it measures the extent to which the set of policies is binding in halting deforestation - at the country level for producing countries[1], or over the supply chain for importing countries. It is given at the **policy- (and country-) level and specific to commodities.** It is measured as the sum of:

| Indicator | Scoring method | Score |
|---|---|---|
| **Mandate**<br>*Is the policy a mandate?* | •2 if law is imposing a mandate (e.g. prohibition on…)<br>•1 if voluntary standards<br>•0 otherwise | 0-2 |
| **Penalties**<br>*Are penalties established and how severe are they?* | Penalties is scored as follows:<br>•3: whenever there are fines and the possibility of imprisonment<br>•2: where there are fines for which the amounts are specified<br>•1: When there are fines the amount is not specified or when there are permits revoked but no fines | 0-3 |

**Example**

| Country | Policy development | Commodity | Mandate | Penalty | Stringency |
|---|---|---|---|---|---|
| **Brazil** | Forest Law imposes landowners to maintain 20% of natural vegetation/ forest on land property greater than 20 ha. | Crosscutting | 2 | 2 | **4** |
| **Indonesia** | All palm oil growers need to have the Sustainable Palm Oil certification | Palm oil | 2 | 1 | **3** |

1. For producing countries, the minimum score to country-level policy stringency is set at 1 (and not 0). This aims at capturing the fact that in (assumed) all countries there exist laws that to some extent regulate forestry, forest products and more in general environmental laws. Therefore, countries which policies were not exhaustively analyzed given time and resources constraints, as well due to relevancy, should therefore not be scored 0.

# Step 3. Assess country-level policy enforcement capacity

## Policy enforcement capacity

The extent to which a country's governance is able to enforce policies, measured though five World Bank Governance indicators[1].

| Indicator | Description | Score |
|---|---|---|
| Political stability and absence of violence | Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. | 0-5 |
| Government effectiveness | Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the policy enforcement capacity of the government's commitment to such policies. | |
| Regulatory quality | Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. | |
| Control of corruption | Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. | |
| Rule of Law | Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. | |

## Example

| Country | Political stability and no violence | Government effectiveness | Regulatory quality | Control of corruption | Rule of Law | Enforcement capacity |
|---|---|---|---|---|---|---|
| Brazil | 3 | 2.5 | 3 | 2.5 | 3 | **3** |
| Indonesia | 2.5 | 3.5 | 3 | 3 | 3 | **3** |

1. Source: http://info.worldbank.org/governance/wgi/Home/Documents

# Step 3. Assess country-level climate and forestry commitment

**Climate and forestry commitment sore**

It measures the commitment to or implementation of long-term environmental measures. The climate and forestry commitment indicator is measured as the country-level as the sum of the indicators described below:

| Indicator | Scoring method | Score |
|---|---|---|
| NDC submission | •0.5 if country updated NDC<br>•1 if country updated NDC with reduced emission targets | 0-1 |
| Long-term strategy | •0 if country hasn't submitted long-term strategy<br>•1 if country submitted long-term strategy | 0-1 |
| Carbon price<br>*Measures whether there is a carbon tax or ETS scheduled or implemented* | •1 if ETS or Carbon TAX is **implemented** at **national level**, 0.8 if at at **subnational** level score is 0.8<br>•0.6 if ETS or Carbon TAX is **scheduled** at **national** level, 0.4 if at **subnational** level<br>•0.2 if ETS or carbon tax is under consideration<br>•0 otherwise | 0-1 |
| Avoided deforestation pledge in NDC | •1 if there is avoided deforestation target in NDC, 0 otherwise | 0-1 |
| Committed to zero-deforestation pledge by 2030 | •1 if yes, 0 otherwise | 0-1 |

## Example

| Country | NDC submission | Long-term Strategy | Carbon price | Avoided Deforestation targets in NDC | Zero-deforestation pledges | NDC |
|---|---|---|---|---|---|---|
| Brazil | 0.5 | 0.0 | 0.0 | 0 | 1 | 1.5 |
| Indonesia | 0.5 | 1.0 | 0.0 | 1 | 1 | 3.5 |

# Step 4. Calculate year of fully regulated production or import

## Year of fully regulated and deforestation-free imports / production[1]

It estimates the year by which importing countries achieve deforestation-free supply chains, and producing countries achieve zero deforestation driven by agriculture. The year is estimated based on the scores of policy enforcement capacity and climate and forestry commitment ,as described below

**If current levels of commodity-driven deforestation are low[1]**

| Score | If condition holds | Rationale |
|---|---|---|
| 2025 or earlier | The average of climate and forestry commitment & enforcement capacity is 3 to 4 | This means that the country has long –term vision on carbon policies and committed to reducing deforestation. Moreover, the country has a high score in political stability, regulatory quality, absence of violence and low corruption |
| 2025-2030 | The average of climate and forestry commitment & enforcement capacity is < 3 | The assumption is that countries with average score in policy enforcement capacity and climate and forestry commitment is expected to fully regulate their production or imports by 2030, when levels of deforestation are low. This is based on the assumption that countries with low levels of deforestation are expected to halt deforestation with relative more ease compared to countries with high levels of deforestation |

**If current levels of commodity-driven deforestation are high[1]**

| Score | If condition holds | Rationale |
|---|---|---|
| 2025 or earlier | The average of climate and forestry commitment & enforcement capacity is > 4 | This means that the country has long –term vision on carbon policies and committed to reducing deforestation. Moreover, the country has a high score in political stability, regulatory quality, absence of violence and low corruption |
| 2025-2030 | The average of climate and forestry commitment & enforcement capacity is 3 to 4 | The assumption is that countries with average score in policy enforcement capacity and climate and forestry commitment are expected to fully regulate their production or imports by 2030 |
| 2030-2035 | The average of climate and forestry commitment & enforcement capacity is < 3 | In this case, the country has low policy enforcement capacity and no policy in place to ensure long-term environmental improvement. The country's government most likely did not commit to zero-deforestation pledge nor has committed to reducing deforestation<br>The assumption is that all countries end deforestation between 2030-2035 |

1. Commodity-driven deforestation levels are low if commodity-driven deforestation in 2015 is <10,000 hectares. It is high if >10,000.

# Step 4. Calculate year of fully regulated production or import: example

| Country | Enforcement capacity | Climate and forestry commitment | Year of fully regulated production | Stringency score | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2025 | 2030 | 2040 |
| Indonesia | 3.5 | 4 | 2025-2030 | 2 | 3.5 | 5 | 5 |
| Cote d'Ivoire | 3 | 1.2 | 2030-2035 | 1 | 2.5 | 4 | 5 |
| US | 5 | 5 | 2025 or earlier | 3 | 5 | 5 | 5 |

- The initial **stringency** score is calculated through **policy analysis**
- Having assessed the year in which production or imports are likely to be fully regulated, it is assumed that the **stringency score could increase linearly** until it reaches 5 in the year of fully regulated production.

- **Indonesia** scores relatively high in policy enforcement capacity and shows that has climate and forestry commitment (i.e., committed to zero deforestation by 2030). This places Indonesia in the range 2030
- **Cote d'Ivoire** has communicated in a limited way on commitments (carbon policy is only under consideration, and has no avoided deforestation targets in their NDC), therefore it is estimated that it will likely only reach zero deforestation in 2030-2035
- **the US** is expected to achieve zero-deforestation before 2025 as the climate and forestry commitment score is high as well as policy enforcement capacity

# Results for producing countries

## Year in which regions achieve fully regulated and deforestation-free production for each commodity

| Region | Soybean | Beef | Palm oil | Timber | Cocoa | Coffee | Rubber |
|---|---|---|---|---|---|---|---|
| Brazil | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| Southeast Asia | 2030-2035 | 2030-2035 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 |
| Tropical Latin America | 2030-2035 | 2025-2030 | 2030-2035 | NA | 2025-2030 | 2025-2030 | NA |
| Tropical Africa | 2030-2035 | 2030-2035 | 2030-2035 | 2025 or earlier | 2030-2035 | 2030-2035 | 2030-2035 |
| Latin America's Southern Cone | 2025 or earlier | 2025 or earlier | NA | NA | NA | NA | NA |
| United States | 2025 or earlier | 2025 or earlier | NA | NA | NA | 2025 or earlier | NA |
| Southern Africa | 2025-2030 | 2025-2030 | NA | NA | NA | NA | NA |
| Greater China | 2025-2030 | 2025-2030 | NA | NA | NA | NA | NA |
| Australia and New Zealand | 2025 or earlier | 2025 or earlier | NA | NA | NA | NA | NA |
| South Asia | 2025-2030 | 2025-2030 | 2025-2030 | NA | 2025-2030 | 2025-2030 | NA |
| India | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 |
| European Union and UK | 2025 or earlier | 2025 or earlier | NA | NA | NA | NA | NA |
| Canada | 2025 or earlier | 2025 or earlier | NA | NA | NA | NA | NA |
| Middle East Asia and North Africa | 2025 or earlier | 2025-2030 | NA | NA | NA | NA | NA |
| Non-EU Europe | 2025-2030 | 2025-2030 | NA | NA | NA | NA | NA |
| Russia | 2025-2030 | 2025-2030 | NA | NA | NA | NA | NA |

Note: NA means that data is not available, as deforestation likely driven by the production of each tropical soft commodity is close to zero, and therefore it was deemed to be not relevant for the exercise.

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

# Results for importing countries

## Year in which regions achieve fully regulated deforestation-free supply chains for each commodity

| Region | Soybean | Beef | Palm oil | Timber | Cocoa | Coffee | Rubber |
|---|---|---|---|---|---|---|---|
| Brazil | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| Southeast Asia | 2025-2030 | 2025-2030 | 2030-2035 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 |
| Tropical Latin America | 2025-2030 | 2025-2030 | 2030-2035 | 2030-2035 | 2025-2030 | 2025-2030 | 2025-2030 |
| Tropical Africa | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| Latin America's Southern Cone | 2025-2030 | 2025 or earlier | 2025-2030 | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier |
| United States | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier |
| Southern Africa | 2025-2030 | 2030-2035 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 |
| Greater China | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 | 2025-2030 |
| Australia and New Zealand | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier |
| South Asia | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| India | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| European Union and UK | 2025 or earlier | 2025 or earlier | 2025-2030 | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier |
| Canada | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025 or earlier |
| Middle East Asia and North Africa | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |
| Non-EU Europe | 2025-2030 | 2025 or earlier | 2030-2035 | 2025 or earlier | 2025 or earlier | 2025 or earlier | 2025-2030 |
| Russia | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 | 2030-2035 |

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

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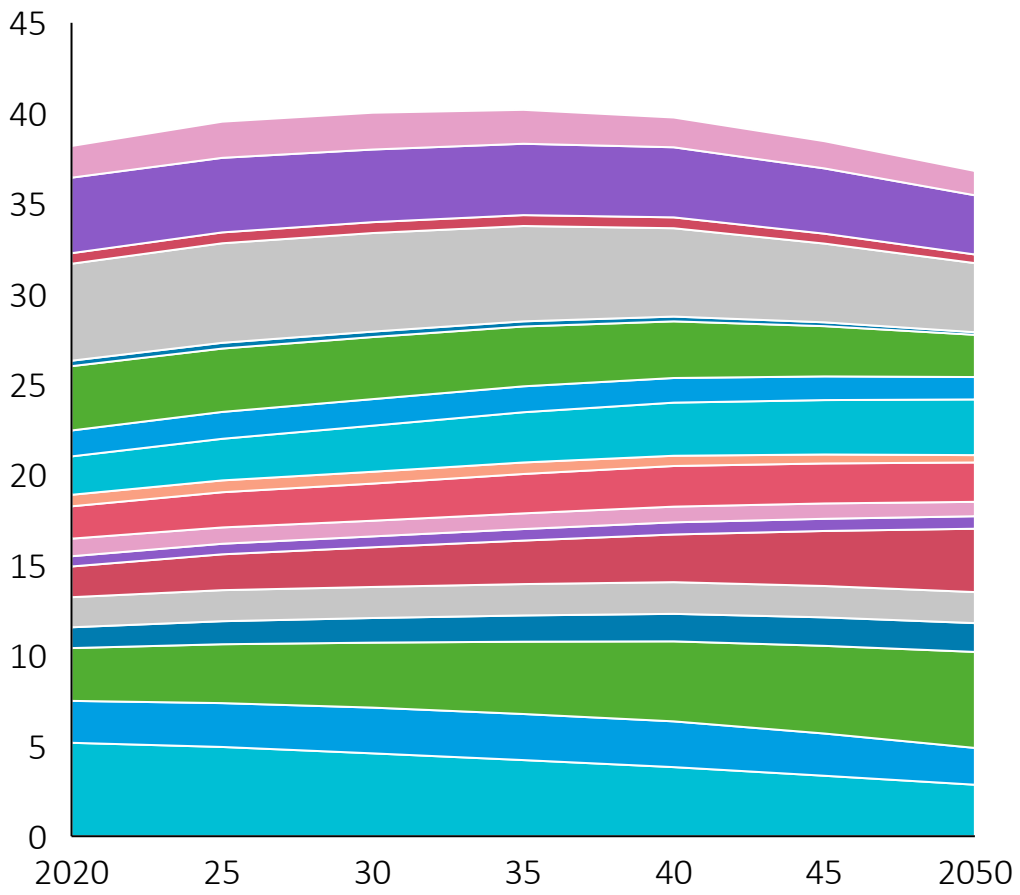
  - Annex III. Risk assessment and sector risk exposure methodology and results

# In FPS, production increases until 2035 and decreases thereafter

**Beef production in FPS scenario by region over time**

Mt DM year$^{-1}$




**Regions**

- Australia and New Zealand
- Brazil
- Canada
- Greater China
- Developed East Asia (Japan and Korea)
- European Union and UK
- India
- Middle East Asia
- Non-EU Europe
- Eastern Europe and Central Asia
- Russia
- Southern Africa
- South Asia
- Latin America's Southern Cone
- South East Asia
- Tropical Africa
- Tropical Latin America
- United States

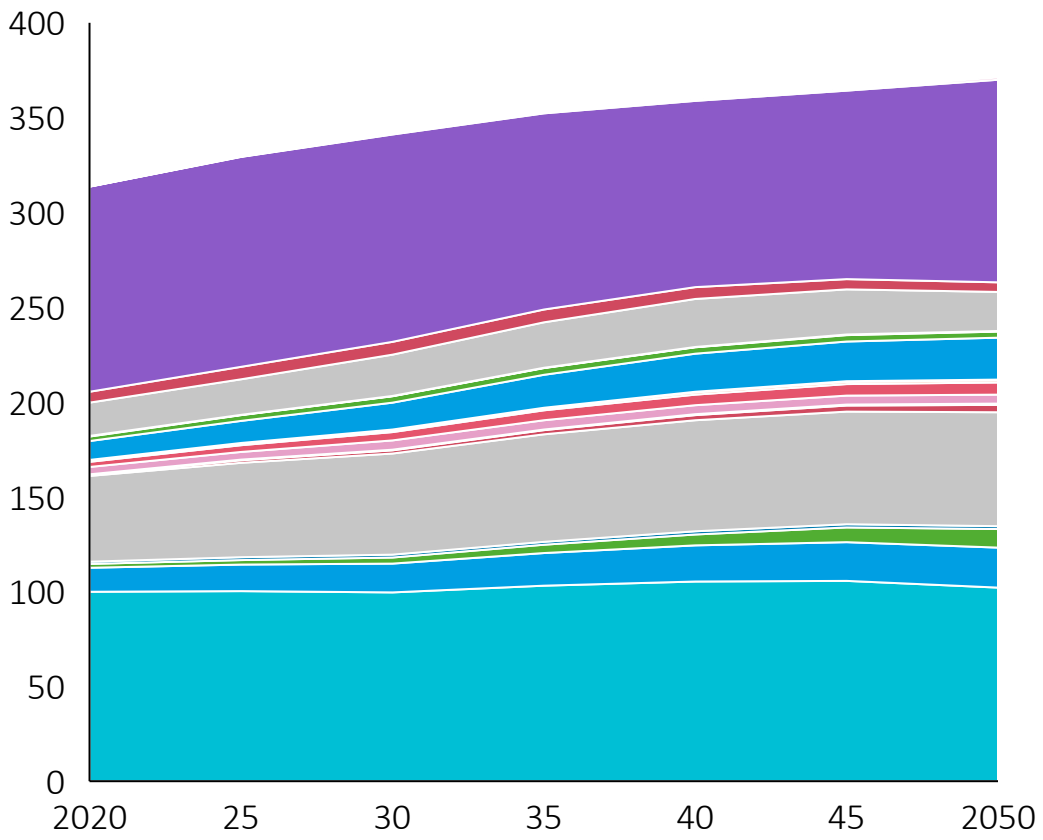
- Beef production slightly decreases after 2035, dropping by about 4% in 2050 compared to 2020 levels
- Reduction in per capita meat consumption is led by tier 1 countries, in addition to China and Brazil
- In IPR FPS, production of beef declines significantly in the EU USA, Canada, Australia and New Zealand, Developed East Asia, China and Brazil
- BAU foresees a ~60% increase in beef production over the same period
- Beef prices increase across Tier 1 regions, as high carbon prices drive up the cost of production

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

# In IPR FPS, soy production increases steadily over the 2020-50 period

**Soybean production in FPS scenario by region over time**

Mt DM year$^{-1}$




**Regions**

- Australia and New Zealand
- Brazil
- Canada
- Greater China
- Developed East Asia (Japan and Korea)
- European Union and UK
- India
- Middle East Asia
- Non-EU Europe
- Eastern Europe and Central Asia
- Russia
- Southern Africa
- South Asia
- Latin America's Southern Cone
- South East Asia
- Tropical Africa
- Tropical Latin America
- United States

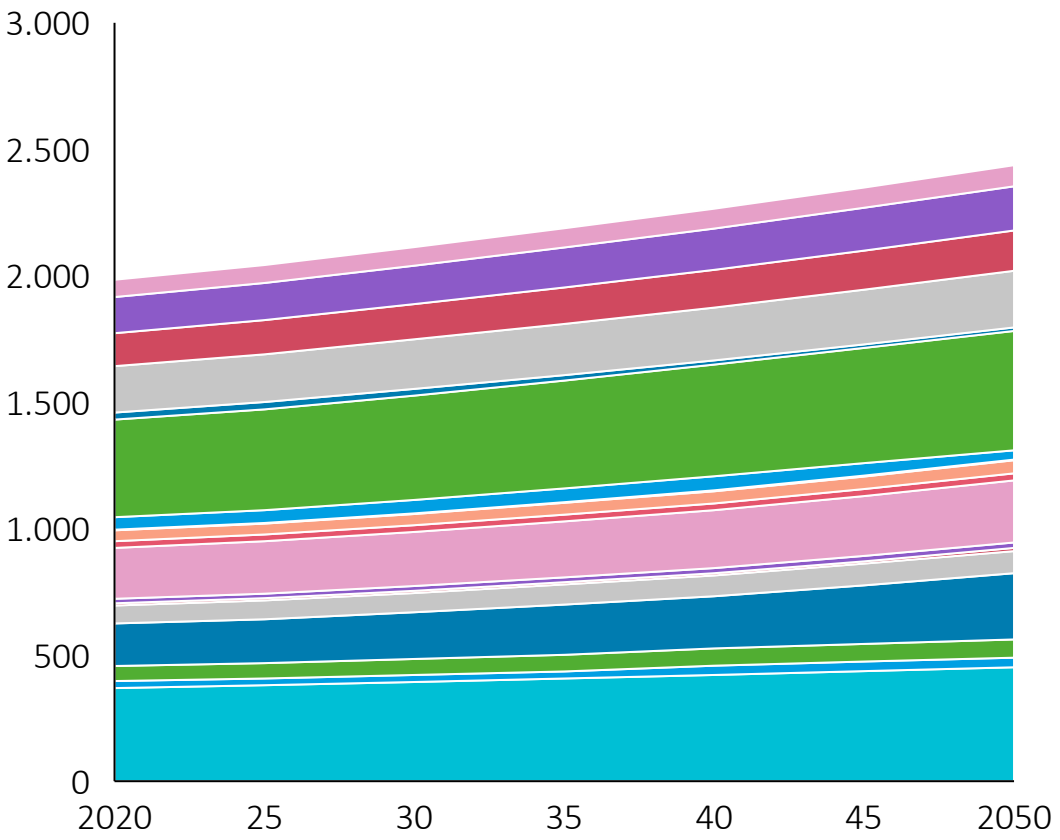
- In IPR FPS, global soybean production increases steadily, increasing by 18% over the 2020-50 period
- Soybean production continues to be concentrated in USA, Brazil and Latin America's Southern Cone
- India's share of the global soybean market grows from about 3% in 2020 to 6% by 2050, in line with increasing demand for both plant-based meat and feed for animal meat, driven by population and income growth

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

# In IPR FPS, timber production steadily increases over the 2020-50 period

Timber production in FPS scenario by region over time

$Mm^3\ year^{-1}$




Regions

- Australia and New Zealand
- Brazil
- Canda
- Greater China
- Developed East Asia (Japan and Korea)
- European Union and UK
- India
- Middle East Asia
- Non-EU Europe
- Eastern Europe and Central Asia
- Russia
- Southern Africa
- South Asia
- Latin America's Southern Cone
- South East Asia
- Tropical Africa
- Tropical Latin America
- United States

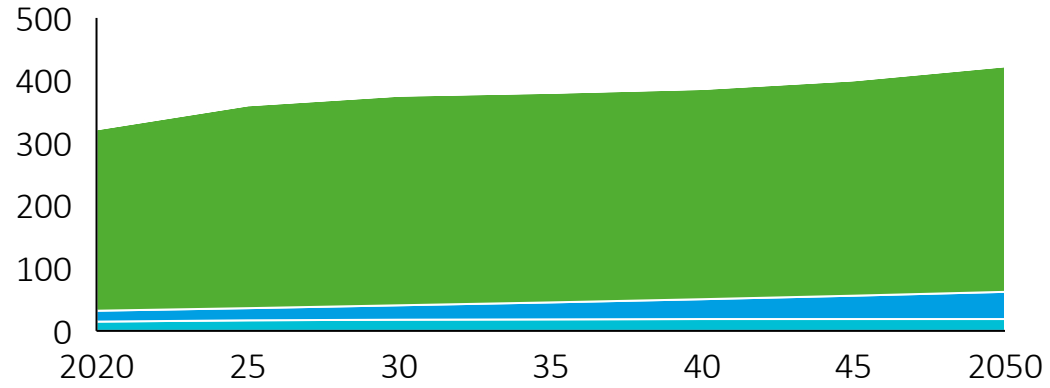
- **Global timber production increases by 23% in 2050 compared to 2020, driven by demand for more sustainable production materials**
- Timber production increases in most world regions. Largest producers by volumes are Southeast Asia, European Union and UK, USA and China and Russia, all producing in 2050 more than 200 $Mm^3$ per year.
- Southeast Asia's production increases by 55% over the 2020-50 period, gaining a 11% market share in 2050 compared to 8% in 2020

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

# In IPR FPS, palm oil and rubber production continue growing in Southeast Asia

**Palm oil production in FPS scenario by region over time**

Mt DM year$^{-1}$

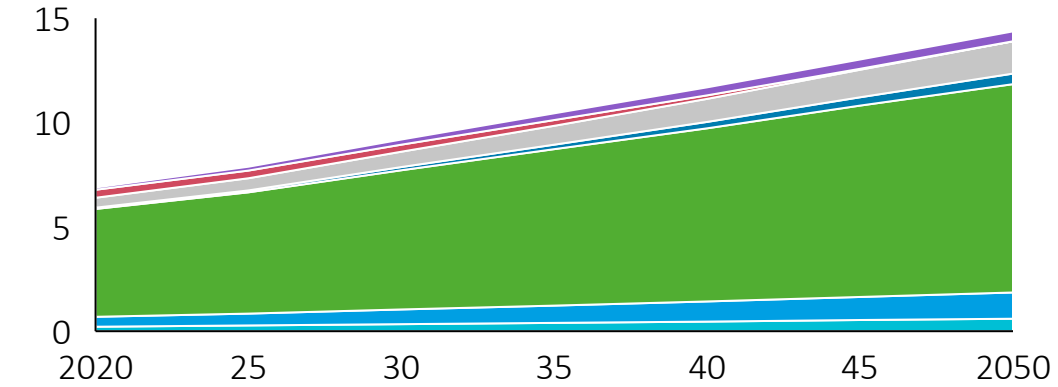



**Regions[1]**

- Brazil
- Greater China
- South East Asia
- Tropical Africa
- Tropical Latin America

**Rubber production in FPS scenario by region over time**

Mt DM year$^{-1}$




**Regions[1]**

- Brazil
- Greater China
- India
- South Asia
- South East Asia
- Tropical Africa
- Tropical Latin America

1. All regions in which production is ~0 are excluded

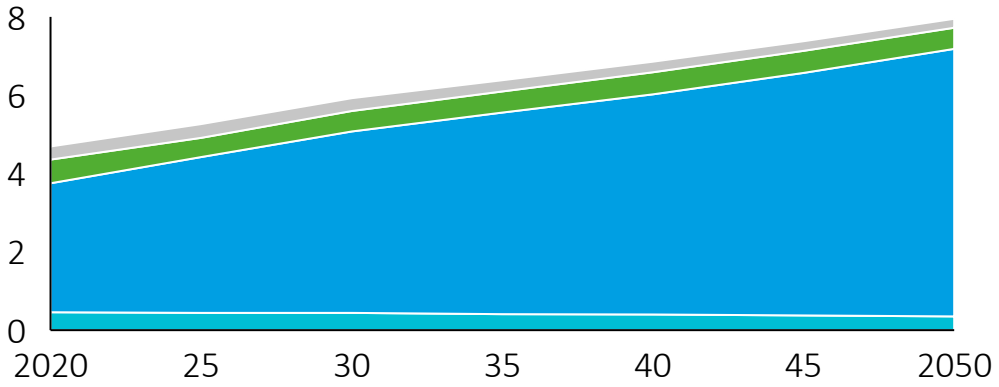
Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

- **Global palm oil production increases by 31% over the 2020-2050 period**
- Southeast Asia continues to dominate the palm oil market
- Tropical Africa increases its market share, from 5% in 2020 to 10% in 2050, while Latin America maintains its market share
- **Global rubber production doubles by 2050**
- In 2050, the majority of the world's rubber continues to be produced in Southeast Asia

# In IPR FPS, cocoa and coffee production continue to grow

Cocoa production in FPS scenario by region over time

Mt DM year$^{-1}$

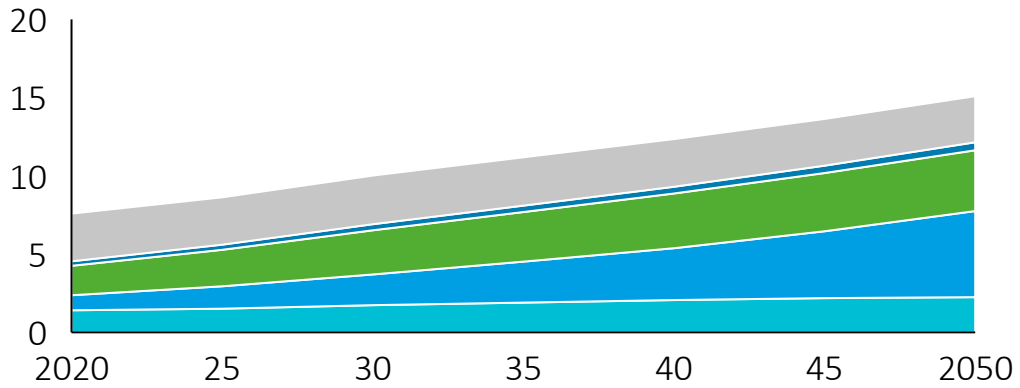



Regions[1]

- Brazil
- South East Asia
- Tropical Africa
- Tropical Latin America

Coffee production in FPS scenario by region over time

Mt DM year$^{-1}$




Regions[1]

- Brazil
- India
- South East Asia
- Tropical Africa
- Tropical Latin America

1. All regions in which production is ~0 are excluded.

Source: Based on analysis by Vivid Economics, drawing on MAgPIE data and modelling

- Demand for cocoa increases sharply, with the majority of this growth supplied by Tropical Africa
- Global cocoa production increases by 67% by 2050 compared to 2020 levels
- Coffee production increases sharply over the period, with a four-fold increase in Tropical Africa.

# Content

- Annexes
  - Annex I. Policy deep dives methodology and results
  - Annex II. Commodity prices and production
  - **Annex III. Risk assessment and sector risk exposure methodology and results**

# Methodology: fines and costs of capital, market access risk

## 1 Market access risk

Market access risk is calculated by comparing the regional policy stringency scores as to production and imports

- Each exporting region can export commodities to 17 importing regions. The policy stringency score as to production for the exporting region (scored 0-5) is compared to the policy stringency score as to imports of each importing region (0-5)
- If the policy stringency as to imports is higher than the policy stringency as to production, there is market access risk as regulation differs.
- It is assumed that, for every time step, if the difference of the policy stringency of importing region score and the policy stringency score as to production of the exporting region is:
  - = 3, market access risk is high
  - =2, market access risk is medium
  - =1, market access is low
- It is assumed that market access risk occurs regardless of the levels of deforestation in the producing region

## 2 Fines and cost of capital

- Assessed qualitatively

# Methodology: reputational risk

## 3 Reputational risk

**Step 1. Calculate commodity-driven deforestation over time**

- The levels of deforestation linked to the production of each commodity in each region over time are:
- Based on 2015 value for year 2020. data used are from WRI data[1]
- Future values are modelled using the results of the policy deep dives and future production trends for each commodity and region
- Risk is based on both the absolute values of deforestation by commodity, as well as on the deforestation rate by commodity, but also it accounts for deforestation values regardless of the commodity
- Social preferences indicate that risk tolerance is reduced overtime

**3a Step 2. Calculate reputational risk of domestically sourced commodities**

The risk of each commodity by region of procurement calculated in Step 1 directly applies for the commodities domestically sourced, meaning all commodities produced and not exported (data obtained from MAgPIE)

**Step 3. Calculate risk of imported commodities**

- Using data on imports – obtained through MAgPIE -, as well as data from the World Bank on the import flows across countries (i.e. the proportion of commodity imports being imported by all world region), the 'average' risk of each imported commodity is estimated
- The risk for each commodity is the same as the risk of the majority of the imported commodity

**3b Step 4. Calculate sectoral risk exposure for imported and domestically sourced commodities**

- Using data from FAO, the proportions of each commodity going to each economic sector (e.g. palm oil is used by both food manufacturing and oil manufacturing) are estimated
- The risk of each commodity applies to the commodities handled by each sector
- The risk exposure of each sector is calculated by **aggregating the risk of each commodity multiplied by the total imports**, or the **total amount of commodities domestically sourced**

1. Source: WRI data. Goldman, E., M.J. Weisse, N. Harris, and M. Schneider. 2020. "Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fibre, Cocoa, Coffee, and Rubber." Technical Note. Washington, DC: World Resources Institute. Available online at: wri.org/publication/estimating-the-role-of-sevencommodities-in-agriculture-linked-deforestation., For more information see: https://research.wri.org/gfr/forest-extent-indicators/deforestation-agriculture

# Risk premium methodology: costs of inputs and costs of upgrading operations

## 4 Price premia for deforestation-free commodities

Estimates as to the price premia for each commodity were informed by literature review

- Price premiums are estimated based on Fairtrade Foundation[2] price premiums and the Fair Rubber[3] price premium. The Fairtrade certification requires farmers to adhere to environmental standards including the prevention of cutting down protected forests
- Price premiums are estimated based on the size of the price premium as a percentage of market prices in 2020, and price premiums (%) are applied to modelled commodity prices
- The proportion of the price premium applied decreases with import policy stringency. Deforestation-free commodities in countries with the highest degree of import stringency (5) are not associated with a price premium

## 5 Cost of upgrading operations

- Costs of upgrading operations by company with different revenue ranges is an estimate based on literature review for the year 2020. This includes both CAPEX costs (e.g. setting up costs, employee and staff training) for the year 2020 only, and assumed to exist only for year 2020.
- Future values of cost of upgrading operations are estimated to decrease over time as regulation tightens up across world regions, requiring suppliers to increasingly disclose information on deforestation and production. This is expected to decrease due diligence costs, although costs for audits and due diligence are expected to still be positive when regulation is entirely stringent. The assumption is that if regional policy stringency as to production is:
  - 5, audit costs drop to 20% of the audit costs of 2020
  - 0 or 1, audit costs are 100% the audit costs of 2020
  - For each additional point in the policy score, the costs increase by 20% compared to 2020 audit costs
- For commodities with low liquidity markets – beef and timber – it is assumed that costs of upgrading operations include the costs of switching to new suppliers. This is estimated as a percentage (5%) of the costs due diligence for. For other commodities, costs of switching to a new supplier are assumed to be zero, since markets have high liquidity

# Carbon costs: assumptions and results for early adopters

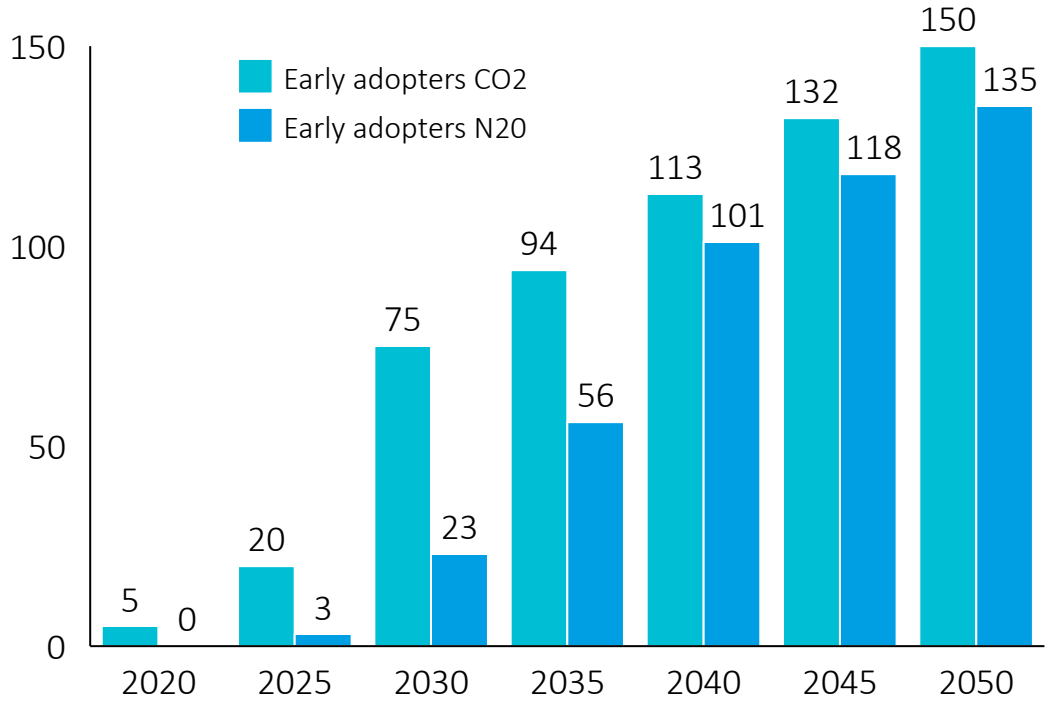
**Early adopters are already putting in place broad policies to encourage sustainable land use, and are expected to cover the land use sector in compliance-based carbon pricing by 2030, with prices converging to energy and industry sectors in 2040**

## Main assumptions

- Land use carbon prices gradually rise to align with the FPS estimates for carbon price in energy and industry, representing the gradual incorporation of the former into the latter
- There is a price differential between energy and land use until compliance markets start covering land use - until that happens, LU is expected to be covered by voluntary market price
  - ◊ **Land use is estimated to be covered by compliance markets before 2030 for early adopters**, with the inclusion of land use in compliance markets expected to be a major component of COP negotiations
- Carbon pricing for BAU (used as a comparator in this presentation) is 0 in line with no carbon pricing systems covering AFOLU
- For $N_2O$, $CO_2$ prices are scaled to account for the reduced participation agriculture may play in carbon pricing

**Potential emissions prices in IPR FPS 2021 for early adopters***

2021 USD/ t CO2e




Note: *Early adopters correspond to the policy forecast tier 1 countries for carbon pricing, with gradual convergence of land-use sectors to energy and industrial sector prices as the markets are gradually integrated

Source: Vivid Economics

# Carbon costs: assumptions and results for late adopters

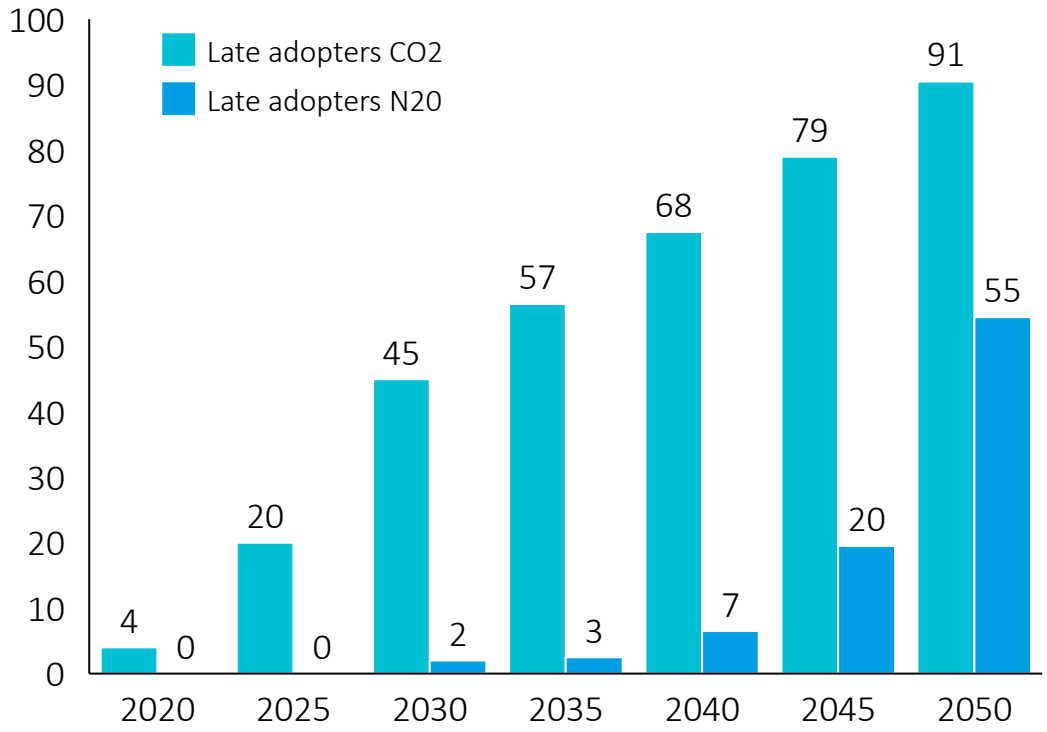
Late adopters have a mixture of policies to encourage sustainable land use, and are expected to more slowly cover the land use sector in compliance-based carbon pricing with prices converging to energy and industry sectors beyond 2050

## Main assumptions

- Land use carbon prices gradually rise to align with the FPS estimates for carbon price in energy and industry, representing the gradual incorporation of the former into the latter
- The land use sector is estimated to begin to be covered by compliance markets in 2030 for late adopters, but not fully converge to similar markets in energy and industry until after 2050
- For $N_2O$, the $CO_2e$ prices are expected to be lower to account for the reduced participation agriculture may play in carbon pricing
  - ◊ **Late adopters**: 60% participation reached in 2050

Potential emissions prices in IPR FPS 2021 for late adopters*

2021 USD/ t CO2e




Note: *Late adopters correspond to the policy forecast tier 2 and 3 countries for carbon pricing, with gradual convergence of land-use sectors to energy and industrial sector prices as the markets are gradually integrated

# Reputational risk from procurement region: soybean

Risk of domestically produced and sourced soybean for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | High | High | High | Low | Low | Low | Low |
| Southeast Asia | Medium | High | Medium | Low | Low | Low | Low |
| Tropical Latin America | High | High | High | Low | Low | Low | Low |
| Tropical Africa | Medium | High | Medium | Low | Low | Low | Low |
| Latam's Southern Cone | Medium | Medium | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

- 6-15%
- 3-6%
- 0-3%

Revenues at risk are estimated based on the reputational risk downstream companies may face when purchasing commodities linked to deforestation:

- Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future
- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics , drawing on Chain Reaction Research estimates for revenue at risk estimations

- Reputational risk is high and persistent in both Brazil and Tropical Latin America
  - Substantial commodity-specific deforestation continues in both regions
  - In Southeast Asia and Tropical Africa, risk increases in the short-term

# Reputational risk from procurement region: palm oil

Risk of domestically produced and sourced palm oil for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | Low | Low | Medium | Low | Low | Low | Low |
| Southeast Asia | High | High | High | Low | Low | Low | Low |
| Tropical Latin America | Medium | Medium | Medium | Low | Low | Low | Low |
| Tropical Africa | Low | Medium | Medium | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Low | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

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- 3-6%
- 0-3%

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- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- Deforestation associated with palm oil production in Southeast Asia is high and projected to continue through to 2030, creating reputational risk for downstream companies
  - Reputational risk impacts global supply chains since the majority of the world's palm oil is imported from Southeast Asia
- Tropical Africa has relatively low production stringency, leading to a relatively slow reduction in deforestation, creating reputational risk associated with domestically sourced palm oil in the latter half of the 2020s

# Reputational risk from procurement region: Timber

Risk of domestically produced and sourced timber for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | Low | Medium | High | Low | Low | Low | Low |
| Southeast Asia | High | High | Low | Low | Low | Low | Low |
| Tropical Latin America | Low | Low | Low | Low | Low | Low | Low |
| Tropical Africa | Low | Low | Low | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Low | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Medium | Medium | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

- 6-15%
- 3-6%
- 0-3%

Revenues at risk are estimated based on the reputational risk downstream companies may face when purchasing commodities linked to deforestation:

- Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future
- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- A sharp increase in policy stringency in Southeast Asia drives down (relatively high) levels of deforestation associated with timber, but timber sourced from Southeast Asia carries reputational risk in the short-term
- On the other hand, lower policy stringency in Brazil generates reputational risk over 2025-2030

# Reputational risk from procurement region: Cocoa

Risk of domestically produced and sourced cocoa for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | Medium | Medium | Medium | Low | Low | Low | Low |
| Southeast Asia | Medium | Medium | Low | Low | Low | Low | Low |
| Tropical Latin America | Low | Low | Low | Low | Low | Low | Low |
| Tropical Africa | High | High | High | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Low | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe and Central Asia | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

- 6-15%
- 3-6%
- 0-3%

Revenues at risk are estimated based on the reputational risk downstream companies may face when purchasing commodities linked to deforestation:

- Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future
- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- Production stringency in the world's primary cocoa supplier, Tropical Africa increases slowly, leading to persistently high reputational risk associated with domestic production through to 2030
- Deforestation related to cocoa production in Southeast Asia declines rapidly, therefore, reputational risk is lower than in other major producing regions by 2030

# Reputational risk from procurement region: Coffee

Risk of domestically produced and sourced coffee for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | Medium | Medium | Medium | Low | Low | Low | Low |
| Southeast Asia | Medium | Medium | Low | Low | Low | Low | Low |
| Tropical Latin America | Medium | Medium | Low | Low | Low | Low | Low |
| Tropical Africa | High | High | High | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Low | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

- 6-15%
- 3-6%
- 0-3%

Revenues at risk are estimated based on the reputational risk downstream companies may face when purchasing commodities linked to deforestation:

- Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future
- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- Reputational risk is high in Tropical Africa, as production stringency remains lower than in other regions prior to 2035, which is expected to lead to persistently high levels of deforestation
  - This heightens international supply chain risk as Tropical Africa's market share grows significantly over time
  - In the world's largest producer, Brazil, production stringency is low relative to other regions during the current decade, leading to persistent reputational risk

# Reputational risk from procurement region: Rubber

Risk of domestically produced and sourced rubber for all world regions over time

| Region | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Brazil | Low | Medium | Medium | Low | Low | Low | Low |
| Southeast Asia | High | High | Low | Low | Low | Low | Low |
| Tropical Latin America | Low | Low | Low | Low | Low | Low | Low |
| Tropical Africa | Low | Medium | High | Low | Low | Low | Low |
| Latam's Southern Cone | Low | Low | Low | Low | Low | Low | Low |
| United States | Low | Low | Low | Low | Low | Low | Low |
| Southern Africa | Low | Low | Low | Low | Low | Low | Low |
| Greater China | Low | Low | Low | Low | Low | Low | Low |
| Australia and NZ | Low | Low | Low | Low | Low | Low | Low |
| South Asia | Low | Low | Low | Low | Low | Low | Low |
| India | Low | Low | Low | Low | Low | Low | Low |
| European Union and UK | Low | Low | Low | Low | Low | Low | Low |
| Canada | Low | Low | Low | Low | Low | Low | Low |
| Middle East Asia and North Africa | Low | Low | Low | Low | Low | Low | Low |
| Non-EU Europe | Low | Low | Low | Low | Low | Low | Low |
| Russia | Low | Low | Low | Low | Low | Low | Low |
| Japan and Korea | Low | Low | Low | Low | Low | Low | Low |
| Eastern Europe | Low | Low | Low | Low | Low | Low | Low |

Revenues at risk*

- 6-15%
- 3-6%
- 0-3%

Revenues at risk are estimated based on the reputational risk downstream companies may face when purchasing commodities linked to deforestation:

- Reputational risk varies depending on the product's market of destination, as reputational risk is higher in countries with higher consumer awareness and media coverage, as the impact of reputation events was found to have doubled since the advent of social media and is thus expected to rise in the future
- Reputational damage may also largely vary based on companies' management and preparedness to reputational risk (i.e. communication and active social responsibility can largely mitigate damages)

Source: Based on analysis by Vivid Economics, drawing on Chain Reaction Research estimates for revenue at risk estimations

- Reputational risk is high in Southeast Asia, as commodity-specific deforestation remains high through to 2030
- Despite relatively low levels of deforestation associated with rubber production, reputational risk in Brazil is attributable to a relatively slow reduction in deforestation

For additional results on:

- Reputational risk by sector and by region over time of both locally sourced and imported commodities
- Market access risk by region over time
- Average costs (1000 USD year-1) of upgrading operations to fully avoid deforestation over period 2020-2050 by company with different revenue ranges for all commodities

Please refer to the full set of value drivers available on the IPR homepage.

Please see PRI website for further details:

https://www.unpri.org/climate-change/what-is-the-inevitable-policy-response/4787.article Please

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