



# Simulation of Indonesian Palm Oil Sustainability (SIPOS)

A tool for modelling sustainable palm oil policy scenarios using a value chain dynamics approach.

Photo by Ricky Martin/CIFOR

## About SIPOS

SIPOS (Simulation of Indonesian Palm Oil Sustainability) is a value chain dynamics approach-based modelling tool designed to simulate scenarios for sustainable palm oil policies and their impacts on economic and ecological values at the national level. SIPOS is displayed in a web-based application that can be used as a simulation tool for analysis, studies or decision-making processes in policy formulation at the national level (Figure 1).



Figure 1. The user interface of the web-based tool SIPOS

## Value chain dynamics modelling for palm oil

SIPOS was developed for system dynamics modelling using STELLA software (iThink). System dynamics modelling is a mathematical modelling technique used to build an understanding of the interconnected parts or components of a system that interact with each other and produce outputs as a result of the interactions that occur (Voinov 2008).

The architecture of SIPOS consists of three components: the palm oil supply chain; the development of interventions or policy scenarios; and indicators to evaluate the outputs of each scenario (Figure 2). The policy scenarios developed by interventions in production, forest and peat protection, and market expansion are modelled into the existing palm oil supply chain system. The outputs of this policy/intervention are then monitored by indicators under observation such as impact on crude palm oil (CPO) and refined palm oil (RPO) production, forest coverage, emissions and volumes, and the value of palm oil trade, including farmers' income.

The SIPOS model was developed based on baseline data from 2019, which is assumed to be year zero, while its simulations can be for periods up to 30 years. The length of the simulation period can be changed according to user needs. There are three main sub-models in SIPOS:

### 1. Sub-model on oil palm plantation area and palm oil production:

The baseline data used for this sub-model

include extent of oil palm planted area in corporate palm oil plantations (state-owned enterprises and large private companies) and smallholder plantations (in hectares), and their annual productivity measured in CPO per hectare per year. This data, which was obtained from Palm Oil Statistics published by the Ministry of Agriculture's Directorate General of Plantations is categorized by plant type: immature, mature and damaged.

### 2. Sub-model on deforestation and emissions from the palm oil sector:

Land-use change data is projected using historical data provided by Mapbiomas for the 2010–2019 period. Emission factors from land-use change and the palm oil sector reference the Life Cycle Assessment (LCA) from ERIA (2007) and Indonesia's National Forest Reference Emission Level (NFREL) (2022). The simulations also identify new oil palm plantations in areas of convertible production forest, production forest, and protection and conservation forest, and in other land use areas; as well as two different land types, peatland or mineral soil.

### 3. Sub-model on the trade of palm oil and its derivatives in domestic and international markets:

The baseline data used for this sub-model originated from trade data based on the Harmonized System (HS) Codes analysed by TRASE. Two sectors were developed in this sub-model: a green sector and a red sector. The green sector is used to represent legal palm oil trade (palm oil produced from other land use areas), while the red sector is used to represent illegal palm oil trade (palm oil produced from state forest areas).

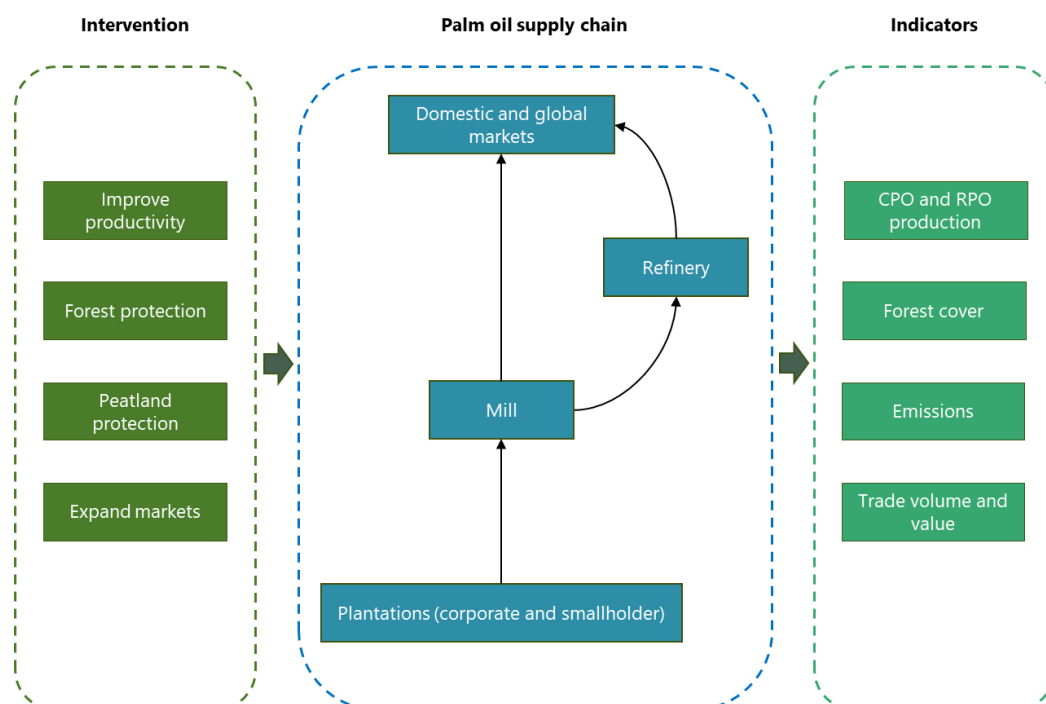


Figure 2. Architecture of the SIPOS model based on the palm oil value chain approach

## SIPOS as a tool for policy scenario simulation

As a simulation tool, SIPOS is displayed through a web-based application. Through the SIPOS interface, users can create policy scenarios by moving sliders on sub-models according to the output focus under observation.

### 1. Simulations for oil palm plantation area and palm oil production

Users can experiment with scenarios for the magnitude of extensification and/or intensification rates of large plantations and smallholder plantations and study their impacts on oil palm plantation area and palm oil production (Figure 3).



Figure 3. Area and production simulation page

### 2. Simulations for deforestation and emissions from the palm oil sector

Users can try out scenarios on stopping further clearance of forest for plantations in state forest areas, other land use areas and peatlands so they can study impacts on forest cover and emissions generated from the palm oil sector (Figure 4).

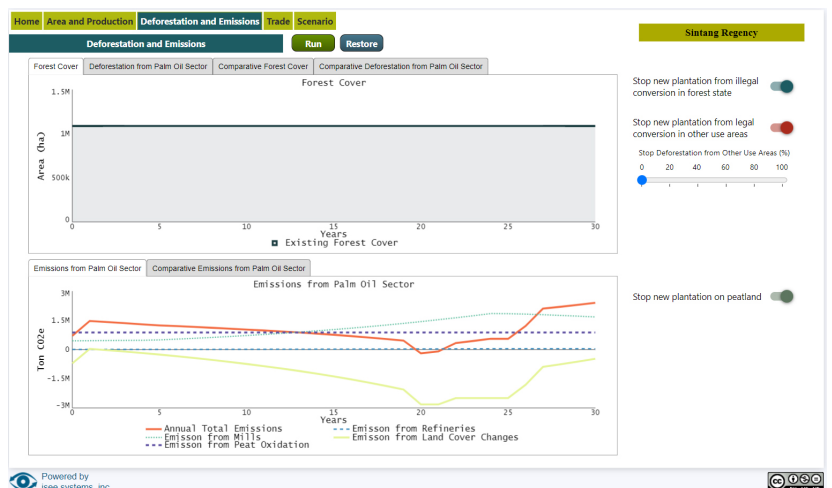


Figure 4. Deforestation and emissions simulation page

### 3. Simulations for palm oil trade

Users can experiment with scenarios for export ratio, certified palm oil trade and premium price implementation, and study their impacts on palm oil trade volume and economic value (Figure 5).



Figure 5. Palm oil trade simulation page

#### 4. Simulations for policy scenario combinations

Users can perform simulations based on various combinations of scenarios as needed, and study the impacts of these scenarios on various outputs, for example environmental outputs (plantation area, palm oil production, deforestation and emissions) and economic outputs (palm oil trade value and farmer income) (Figure 6).



Figure 6. Policy scenario combinations simulation page

## Links



The SIPOS tool is available in two languages and can be accessed through the following links:

- **Indonesian:** <https://exchange.iseesystems.com/public/cifor-vfi/sipos-id>
- **English:** <https://exchange.iseesystems.com/public/cifor-vfi/sipos-eng>

This simulation tool is part of CIFOR and partners' research on "Strengthening Jurisdictional Approaches to Sustainable Palm Oil in Indonesia" in 2020–2024 supported by the Walmart Foundation. A web-based simulation tool for subnational-level analysis, namely JAPOS (Jurisdictional Approach for Palm Oil Simulation), has also been developed for four regencies: Pelalawan in Riau, Pulang Pisau in Central Kalimantan, Kutai Kartanegara in East Kalimantan and Sintang in West Kalimantan. The JAPOS tool is available in two languages and can be accessed through the following links:

#### Indonesian language versions:

- Pulang Pisau: <https://exchange.iseesystems.com/public/cifor-vfi/japos-pulang-pisau-id>
- Pelalawan: <https://exchange.iseesystems.com/public/cifor-vfi/japos-pelalawan-id>
- Kutai Kartanegara: <https://exchange.iseesystems.com/public/cifor-vfi/japos-kukar-id>
- Sintang: <https://exchange.iseesystems.com/public/cifor-vfi/japos-sintang-id>

#### English language versions:

- Pulang Pisau: <https://exchange.iseesystems.com/public/cifor-vfi/japos-pulang-pisau>
- Pelalawan: <https://exchange.iseesystems.com/public/cifor-vfi/japos-pelalawan>
- Kutai Kartanegara: <https://exchange.iseesystems.com/public/cifor-vfi/japos-kutai-kartanegara>
- Sintang: <https://exchange.iseesystems.com/public/cifor-vfi/japos-sintang>

For more information,  
please visit



<https://www.cifor-icraf.org/project/scaling-JA-palmoil/home/>

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