

Mathematic Equation:

$\text{Harvest_Cummulative}(t) = \text{Harvest_Cummulative}(t - dt) + (\text{Harvest}) * dt$

INIT Harvest_Cummulative = 0

INFLOWS:

$\text{Harvest} = \text{if } \text{mod}(\text{time}, \text{Harvesting_Age}-1) = 0 \text{ then } \text{Stand_density} \text{ else } 0$

$\text{Income_Oil}(t) = \text{Income_Oil}(t - dt) + (\text{Additional_Income_Oil}) * dt$

INIT Income_Oil = 0

INFLOWS:

$\text{Additional_Income_Oil} = \text{if } \text{Oil_Feasibility} > 0 \text{ then } \text{Oil_Cost} * \text{OIL} \text{ else } 0$

$\text{Stand_density}(t) = \text{Stand_density}(t - dt) + (\text{Planting} - \text{Harvest} - \text{Mortality} - \text{OilHarvesting}) * dt$

INIT Stand_density = 0

INFLOWS:

$\text{Planting} = \text{if } \text{mod}(\text{time}, \text{Harvesting_Age}) = 0 \text{ and } \text{Management_form} = 1 \text{ then } 10000/9 \text{ else}$

$\text{if } \text{mod}(\text{time}, \text{Harvesting_Age}) = 0 \text{ and } \text{Management_form} = 0 \text{ then } 100 \text{ else } 0$

OUTFLOWS:

$\text{Harvest} = \text{if } \text{mod}(\text{time}, \text{Harvesting_Age}-1) = 0 \text{ then } \text{Stand_density} \text{ else } 0$

$\text{Mortality} = \text{Tree_dynamic}$

$\text{OilHarvesting} = \text{if } \text{Management_form} = 1 \text{ then } \text{Thinning_presentation} * \text{Stand_density} \text{ else } 0$

$\text{Total_Cost_of_Oil}(t) = \text{Total_Cost_of_Oil}(t - dt) + (\text{Additional_Cost_Oil}) * dt$

INIT Total_Cost_of_Oil = 0

INFLOWS:

$\text{Additional_Cost_Oil} =$

$\text{Oil_Processing}[\text{VariableCost1}] + \text{Oil_Processing}[\text{FixedCost1}] + \text{Installing_Equipment}$

$\text{Total_Cost_Plantation}(t) = \text{Total_Cost_Plantation}(t - dt) + (\text{Planting_Cost}) * dt$

INIT Total_Cost_Plantation = 0

INFLOWS:

$\text{Planting_Cost} = \text{if } \text{Management_form} = 1 \text{ then}$

$\text{Stand_density} * (\text{Total_Planting_Cost} + \text{Inoculation_Cost} + \text{Security} + \text{Harvesting}) \text{ else}$

$\text{Stand_density} * (\text{Total_Planting_Cost} + \text{Inoculation_Cost})$

$\text{Total_Income_of_Kemedangan}(t) = \text{Total_Income_of_Kemedangan}(t - dt) + (\text{Kemendangan_Income}) * dt$

INIT Total_Income_of_Kemendangan = 0

INFLOWS:

Kemendangan_Income = if ChipFeasibility>1 then Kemendangan_Product*Kemendangan_Cost else 0

Benefit_Cost_Ratio = if Total_Income=0 then 0 else Total_Income/Total_Cost

Benefit_of_Kemendangan = if Management_form=1 then $30 \cdot (1+0.03)^{\text{time}}$ else
 $\text{RANDOM}(1,10) \cdot (1+0.01)^{\text{TIME}}$

ChipFeasibility = if Kemendangan_Cost>0 then Benefit_of_Kemendangan/Kemendangan_Cost else 0

Cost_Plantation[Plantation] = 0.75

Cost_Plantation[InoculantMaterial] = 0.64

Cost_Plantation[OtherChemicalMaterial] = 0.39

Cost_Plantation[Equipment] = 0.06

Cost_Plantation[FuelPlant] = 0.03

Cost_Plantation[SpecialTechnicalLabor] = 0.1

Cost_Plantation[TechnicalAssisstant] = 0.06

Cost_Plantation[UnskilledLabor] = 0.1

Cost_Plantation[TransferofInoculant] = 0.6

Cost_Plantation[Security] = 0.77

Cost_Plantation[HarvestingCost1] = 3.3

Cost_Reduction = 0

Form_Value = $-0.018 \cdot \text{Tree_Height} + 0.869$

Harvesting = if time=15 then Cost_Plantation[HarvestingCost1] else 0

Harvesting_Age = 15

Harvesting_Biomass = if mod(time,0)> 4 then Tree_Volum*Wood_Density else 0

Innocation_refining = 0

Inoculation_Cost = if time=3 and Innocation_refining=0 and Cost_Reduction=0 then
Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssisstant]+Cost_Plantation[TransferofInoculant] else

if time=Harvesting_Age+3 and Innocation_refining=0 and Cost_Reduction=0 then
Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssisstant]+Cost_Plantation[TransferofInoculant] else

if time=(2*Harvesting_Age+3) and Innoculation_refining=0 and Cost_Reduction=0 then
Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssistant]+Cost_Plantation[TransferofInoculant] else

if Cost_Reduction=0 and Innoculation_refining=1 and time=3+Harvesting_Age then
((Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssistant]+Cost_Plantation[TransferofInoculant])*0.3)+
((Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssistant]+Cost_Plantation[TransferofInoculant])) else

if Cost_Reduction=0 and Innoculation_refining=1 and time=3+(2*Harvesting_Age) then
((Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssistant]+Cost_Plantation[TransferofInoculant])*0.4)+((Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TechnicalAssistant]+Cost_Plantation[TransferofInoculant])) else

if Cost_Reduction=1 and Innoculation_refining=1 and time=3+Harvesting_Age then
Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TransferofInoculant] else

if Cost_Reduction=1 and Innoculation_refining=1 and time=3+(2*Harvesting_Age) then
Cost_Plantation[InoculantMaterial]+Cost_Plantation[OtherChemicalMaterial]+Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant]+Cost_Plantation[SpecialTechnicalLabor]+Cost_Plantation[TransferofInoculant] else

if Cost_Reduction=1 and Innoculation_refining=0 and time=3+Harvesting_Age then
Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant] else

if Cost_Reduction=1 and Innoculation_refining=0 and time=3+(2*Harvesting_Age) then
Cost_Plantation[Equipment]+Cost_Plantation[FuelPlant] else 0

Installing_Equipment = if time=0 then 15729 else 0

Interest_Rate = 0.12

Kemendangan_Cost = if Kemendangan_Product>0 then
(Total_Cost_Plantation*(1+Interest_Rate))/Kemendangan_Product else 0

Kemendangan_Production = if Innoculation_refining=1 and Cost_Reduction=0 and time >
Harvesting_Age then 3.78 else

if Innoculation_refining=0 and Cost_Reduction=1 and time > Harvesting_Age then 1.38 else

if Innoculation_refining=1 and Cost_Reduction=1 and time > Harvesting_Age then 3 else 1.68

Kemendangan_Product = Harvest*Harvesting_Biomass*Kemendangan_Production

Management_form = 1

Number_of_stem_for_oil_production = if Oil_products>0 then
(Oil_Production_capacity/Oil_products)*10*5 else 0

OIL = Oil_products

Oil_Benefit = 17.8*(1+Interest_Rate)^time

Oil_Cost = if OIL>0 and time <15 then (Total_Cost_of_Oil*(1+Interest_Rate)^time)/OIL else

if OIL>0 and (time >15 and time<30) then (Total_Cost_of_Oil*(1+Interest_Rate)^(time-15))/OIL else

if OIL>0 and (time >30 and time<45) then (Total_Cost_of_Oil*(1+Interest_Rate)^(time-30))/OIL else

if OIL>0 and (time >45 and time<60) then (Total_Cost_of_Oil*(1+Interest_Rate)^(time-45))/OIL else
0

Oil_Efficiency = 0.002

Oil_Feasibility = if Oil_Benefit/Oil_Cost > 1 then 1 else 0

Oil_Processing[Investment] = if time=0 then 15728.6 else 0

Oil_Processing[VariableCost1] = 894.1

Oil_Processing[FixedCost1] = 7600.4

Oil_Production_capacity = 3000

Oil_products = if Management_form=1 and Harvesting_Biomass>0 then
OilHarvesting*Oil_Efficiency*Harvesting_Biomass*1000 else 0

Optimal_Area = if Stand_density>0 and Management_form=1 then
((Number_of_stem_for_oil_production/Stand_density)/1000) else 0

Security = if time>7 then Cost_Plantation[Security] else 0

Thinning_delay = 0

Thinning_presentation = if Thinning_delay=0 and mod(time,Harvesting_Age)>4 then 0.001*10*5
else

if Thinning_delay=1 and mod(time,Harvesting_Age)>8 then 0.001*10*5 else 0

Total_Cost = if Management_form=0 then Total_Cost_Plantation else
Total_Cost_Plantation+Total_Cost_of_Oil+Oil_Processing[Investment]

Total_Income = if Management_form=0 then Total_Income_of_Kemedangan else
Total_Income_of_Kemedangan+Income_Oil

Total_Planting_Cost = if Planting>0 then Planting*Cost_Plantation[Plantation] else 0

Tree_Diameter = if time <= 7 then 2.8*(time) + 0.37 else

if time >7 and time<=Harvesting_Age then (1.6*time)+(2.8*3) else

if time-Harvesting_Age <= 7 then 2.8*(time-Harvesting_Age) + 0.37 else

if time >7 and time<=2*Harvesting_Age then (1.6*(time-Harvesting_Age))+(2.8*3) else

if time-(2*Harvesting_Age) <= 7 then 2.8*(time-(2*Harvesting_Age)) + 0.37 else

if time-(2*Harvesting_Age) >7 and time<=3*Harvesting_Age then (1.6*(time-(2*Harvesting_Age)))+(2.8*3) else

if time-(3*Harvesting_Age) <= 7 then 2.8*(time-(3*Harvesting_Age)) + 0.37 else

if time-(3*Harvesting_Age) >7 and time<=4*Harvesting_Age then (1.6*(time-(3*Harvesting_Age)))+(2.8*3) else 0

Tree_dynamic = if time<Harvesting_Age then 0.9867*EXP(-0.04*Time) else

if time<2*Harvesting_Age then 0.9867*EXP(-0.04*(Time-Harvesting_Age)) else

if time<3*Harvesting_Age then 0.9867*EXP(-0.04*(Time-(2*Harvesting_Age))) else

if time<4*Harvesting_Age then 0.9867*EXP(-0.04*(Time-(3*Harvesting_Age))) else 0

Tree_Height = if time <= 13 then 2*(time) + 4 else

if time >13 and time<=Harvesting_Age then (1.1*time)+ 16 else

if time-Harvesting_Age <= 13 then 2*(time-Harvesting_Age) + 4 else

if time-Harvesting_Age>13 and time<=2*Harvesting_Age then (1.1*time-Harvesting_Age)+ 16 else

if time-2*Harvesting_Age <= 13 then 2*(time-(2*Harvesting_Age)) + 4 else

if time-2*Harvesting_Age>13 and time<=3*Harvesting_Age then (1.1*time-(2*Harvesting_Age))+ 16 else

if time-3*Harvesting_Age <= 13 then 2*(time-(3*Harvesting_Age)) + 4 else

if time-3*Harvesting_Age>13 and time<=3*Harvesting_Age then (1.1*time-(3*Harvesting_Age))+ 16 else 0

Tree_Volum = 0.25*3.14*(Tree_Diameter/100)^2*Tree_Height*Form_Value

Wood_Density = 0.32