KOMATSU

IR-Day 2021

Forestry Machine Business

Contribution to Sustainable Forestry

Komatsu
Construction Equipment Solution Division
Green Business Promotion Department (Forest and Agriculture)

16th December 2021

Forestry and the SDGs
(Overview of Forestry and Forestry Machine Methods)

- Forestry sector contributes 14 targets of SDGs.
- Carbon sequestration, wood construction, biomass energy or etc. can contributes a Carbon Neutral Society.
- Appropriate forestry operation is necessary for a sustainable forest management.

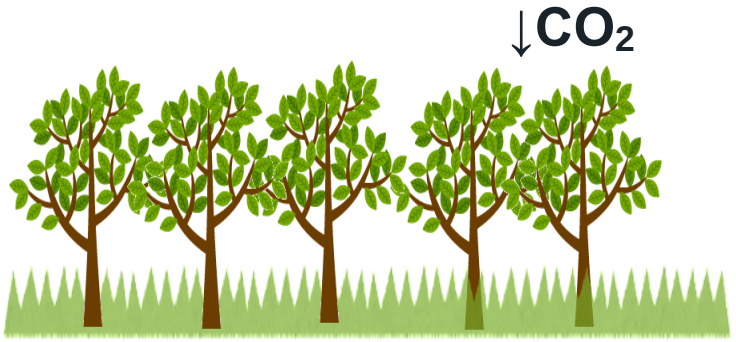
Forest contribution

Proper management of forests(From 2018Forestry White Paper, Forestry Agency)

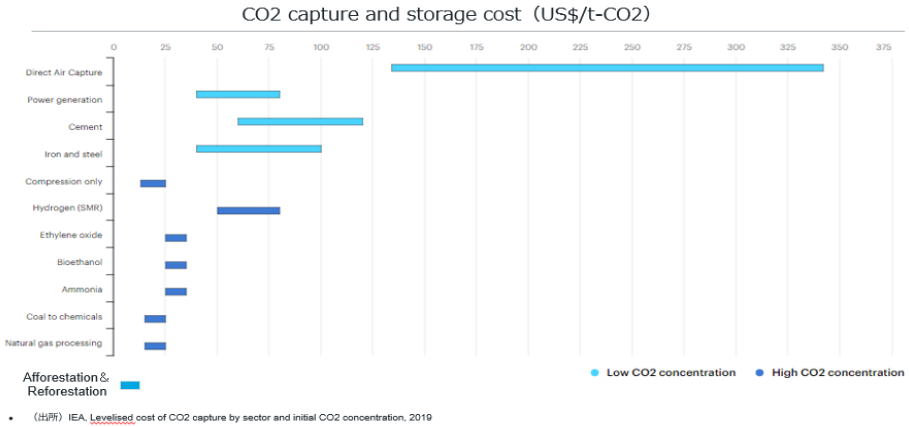
method	operation	featuer
(1) CTL	Felling, processing & bucking → extracting → loading havester → Forwarder **Processing and bucking in forest and extracting cut logs**	• Felling • Processing and bucking in forest and extracting cut logs • European style
(2) FTL	felling → extracting → (processing) → loading Feller buncher → skidder → Log loader → Processor → Knockeboom **Exstracting full trees from forest**	• Felling • Extracting full trees from forest • American style

Forestry Contributes Carbon Neutral Society

1. Growing forests absorb CO2 and planting trees on harvested areas is an effective forestry management.



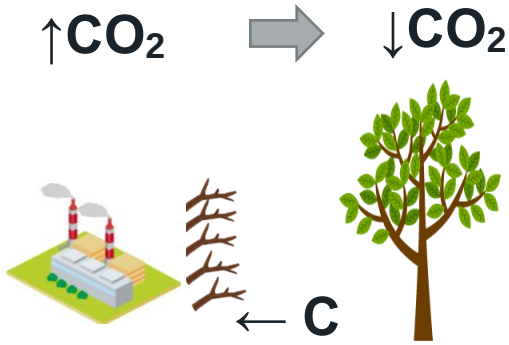
To absorb CO2 - forest is the most effective method in terms of cost compared with other methods.



（出所）IEA, Levelised cost of CO2 capture by sector and initial CO2 concentration, 2019

2. Wood products continue to store carbon until the day the product decays or is burned.

3. Substitution, Wood products replacing fossil products, reduces the volume of new CO2 released into the atmosphere , Carbon neutral energy.



Contribute to the forestry industry through the forestry machinery business

- Komatsu has been contributing to **the safety and efficiency** of the forestry with its forestry machinery.
- **We will contribute a sustainable forestry management by mechanized silviculture and remote sensing of forest with forestry machines for the carbon neutral society.**

Forestry cycle

Planting and nursery



Clearing a logging site and Preparing compacted forest land.

Planting seedlings.

Removing undergrowth to encourage saplings to grow.

Land preparation ⇨ Planting ⇨ Weeding

Logging and Transportation





Examine the tree volume of standing trees and make a plan for management.

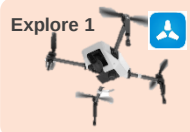
Trees are felled and cut to the appropriate size using a harvester.

The logs are transported to the mountain yard.

Transporting logs from the mountain yard to the market.

survey ⇨ Felling・Gathering ⇨ Logging ⇨ Transporting

Komatsu's assets



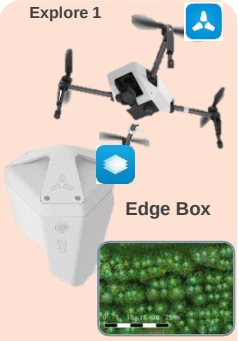
Remote sensing for silviculture activity



Land preparation D85EX subsoiler

Planting machine D61EM Planter

Weeding KIM SSL



Remote sending of forest



KFAB Harvester

KLTD Feller buncher

TimberPro Feller buncher




Felling and logging at steep slope by harvester

Felling at steep slope By Feller buncher

KFAB Fowerder

Transporting at steep slope Fowerder

◆ **To contribute sustainable forestry through mechanized silviculture & remote sensing for forest management.**

◆ **To reduce industrial accidents, it is important that people do not descend to the ground.**

History of Komatsu's expansion of forestry machinery business through M&As

2004 Komatsu Forest(Base machine)

CTL

2012 Log Max(Attachment)

CTL

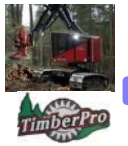
2018 Quadco(Attachment)

FTL

CTL

2018 Oryx Simulations

2019 TimberPro(Base machine)



FTL

Forestry machine

1. Forestry machine

Dev.	Sweden	USA	TimberPro USA	JPN/Indo/Ru	USA	Indonesia	JPN
Pro.	Sweden	USA	TimberPro USA	Bra/Ru/Indo	Bra	Indonesia	JPN
	  Harvester ・ Forwarder	  Feller buncher Log loader	 Feller buncher	 Harvester (PC200F)	 Feller buncher (PC350F)	  Harvester/feller buncher (PC135F)	 Harvester (PC138US)
method	CTL	FTL	FTL	CTL	CTL・FTL	CTL・FTL	CTL
market	Eur, Ru, N.A, Aus, Bra, Indo.	N.A & Aus	N.A & Aus	Bra, Ru, Indo	Bra	Indo	JPN
category	Purpose build	Purpose build	Purpose build	CE	CE	CE	CE

2. Attachement

Dev.	LogMax Sweden	Quadco Canada	Southstar NZ
Pro.	LogMax	Quadco	Southstar
	 harvester	 Felling	 harvester
method	CTL	FTL	CTL

3. Silviculture

Dev.	JPN	Italy
Pro.	Brazil	Italy
	  D85 subsoiler & D61 planter	 Weeding
market	Brazil	Indonesia

Challenge to carbon neutral ;　KFAB new factory

- The new plant has consolidated old plants located separately mainly in Umea, optimizing the production process and layout.
- It has also adopted new manufacturing engineering benefits, including an automatic assembly line with automated guided vehicles (AGVs) for the first time in the Komatsu, achieving 30% improvement of productivity compared to old plants.
- it has achieved carbon neutrality, for the first time in Komatsu's plants, through a substantial reduction of power consumption volume by adopting renewable energy supply facilities, such as solar panels which cover about 19,000 m2 of the roof and heating equipment which uses geothermal energy.

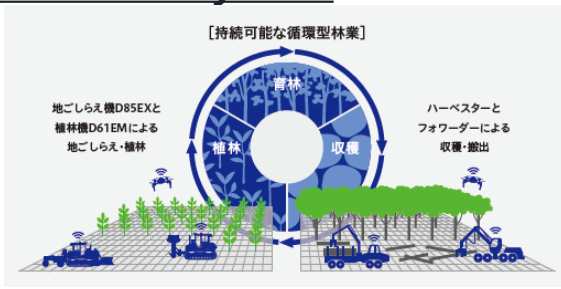
Mechanized silviculture system for sustainable forestry cycle

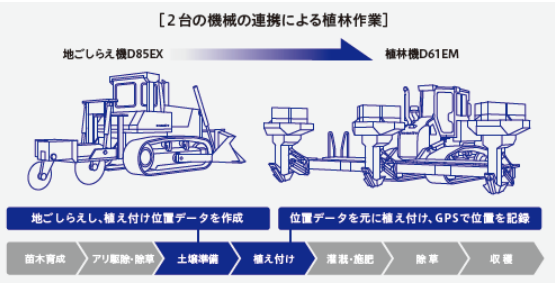
- Wood production is increasing app. 2.5% annually and globally. → Plantation forest is necessary.
- Planting tree is labor intensive and hard job. → Manpower is decreasing.
- Mechanized planting can promote efficient and safety forestry cycle.

1. Manual labor

Tree planting in Brazil

2. Mechanized system





1) Flat area

D85 subsoiler

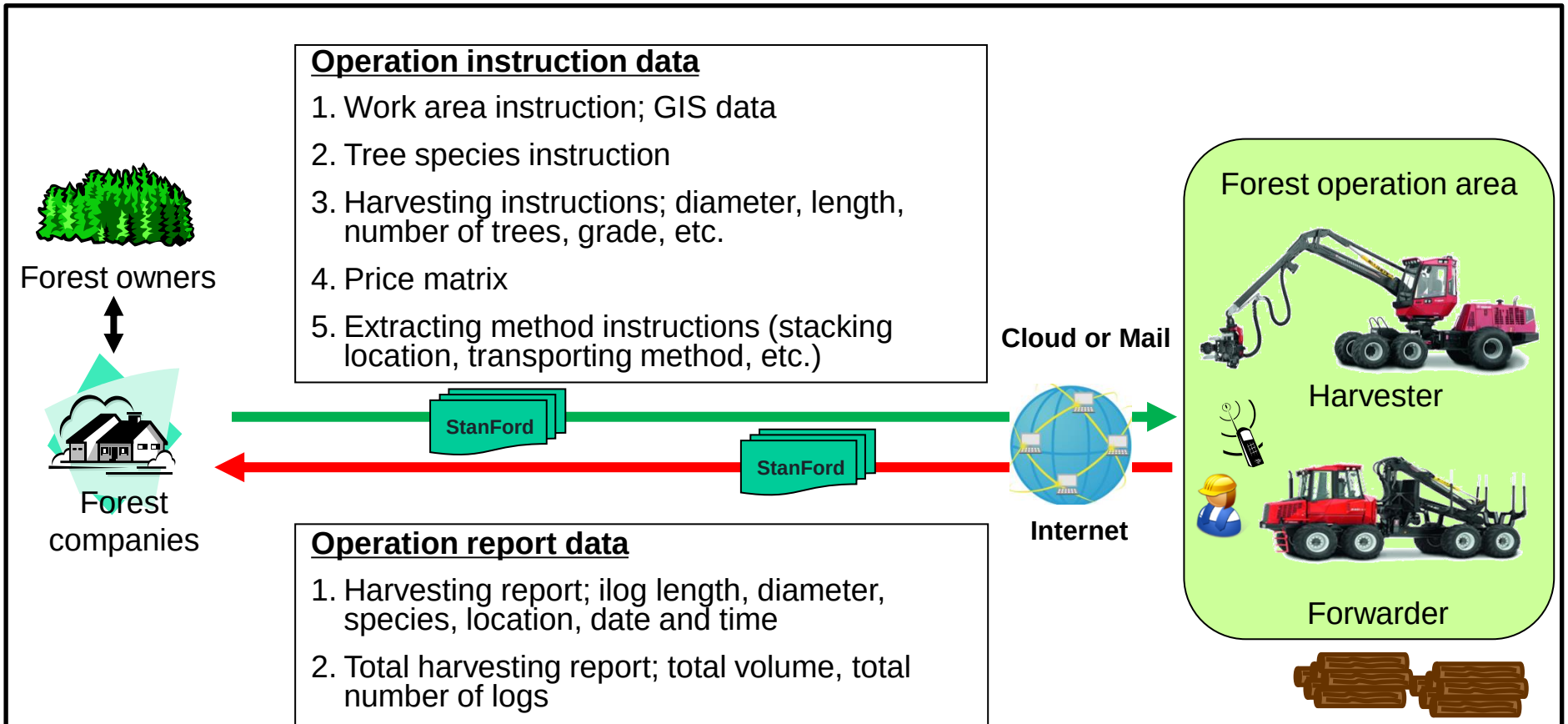
D61 planter（Video）

2) Steep area

H/E PC240 planter

MaxiFleet; Improving forestry efficiency by visualizing the supply chain (Europe)

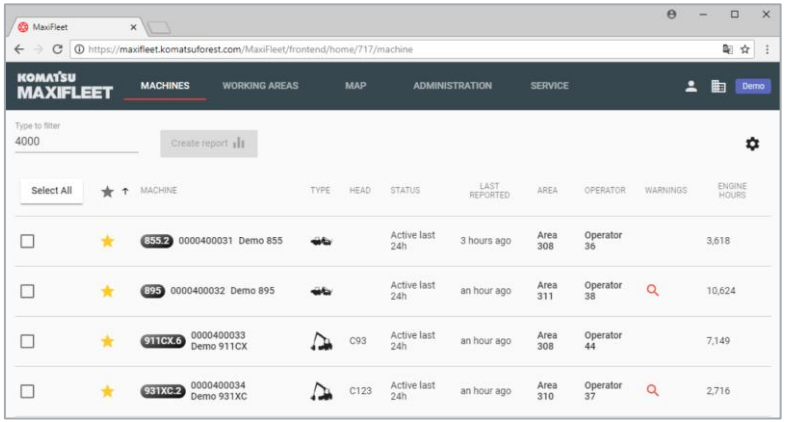
- Forest companies (forest owners) and forestry machines are connected via the Internet（Cloud or Mail）.
- StanForD* data manages the supply chain by communicating information in a standardized data format.



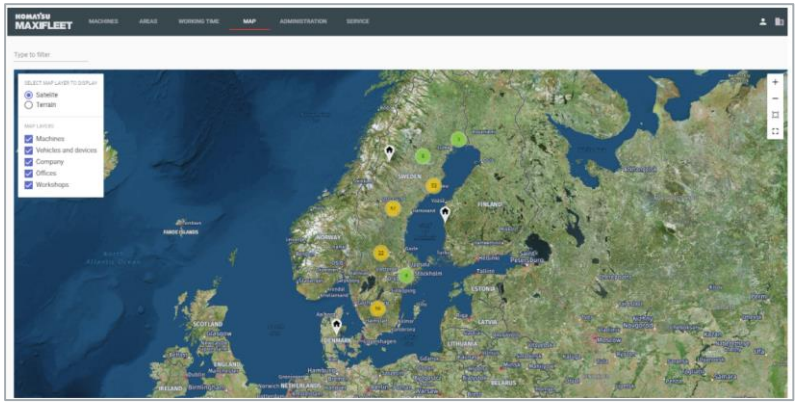
*StanForD (Standard for Forest Machine Data & Communication); Format of forestry data for exchange with forestry machines.

Basic functions of MaxiFleet

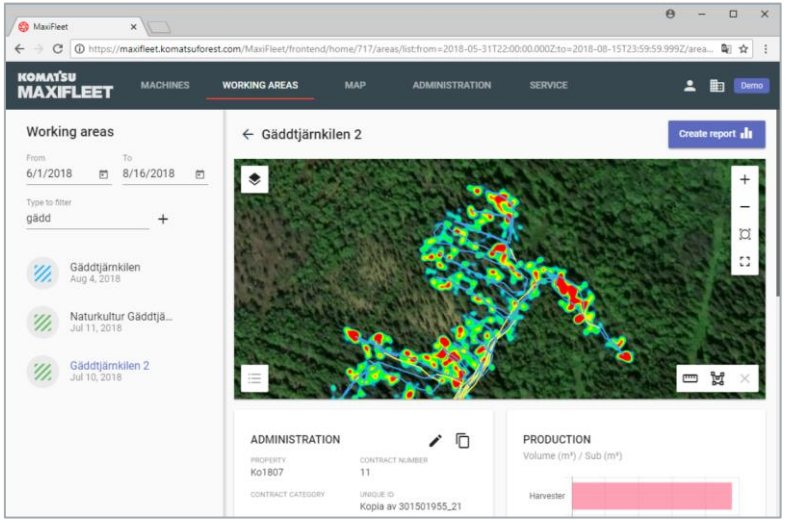
- MaxiFleet is a connected business in global operated by KFAB (Web app.).
- Machine information is sent to the server by an attached modem (4G or Satellite).



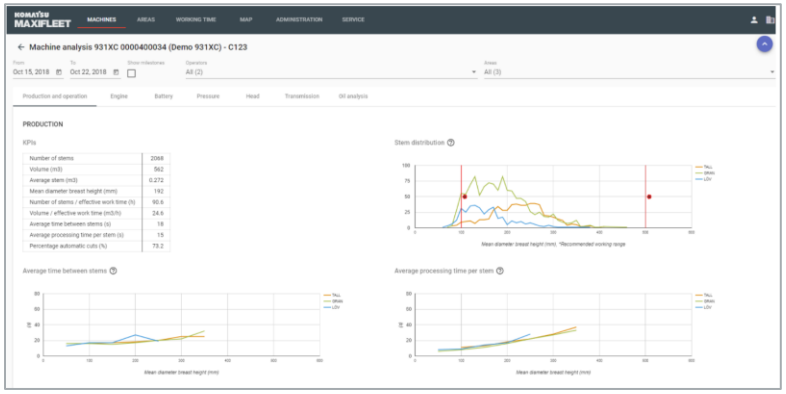
Machine operation overview (type, machine number, area, operating hours, etc.)



Operating location



Harvesting location, track of machine movement



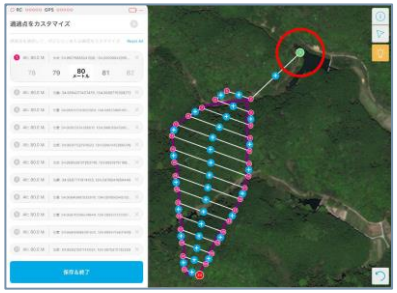
Production progress (number of logs, m^3 , etc.)

https://www.komatsuforest.com/services/maxifleet

Remote sensing using UAV in Japan

Flight plan making

- Making flight plan on the selected area by original software.



Aerial photo by drone

EXPLORE 1

- Auto flight according to flight plan.

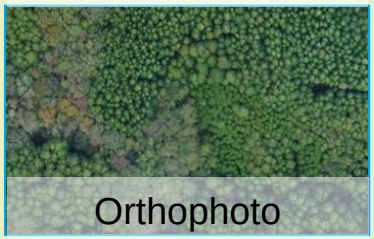
Data transfer using SD card

Data processing

Edge Box

- 3D point cloud and orthophoto are made through SfM-MVS processing using Edge Box.
- The data has highly position - fix accuracy by RTK & PPK positioning.

3D point cloud

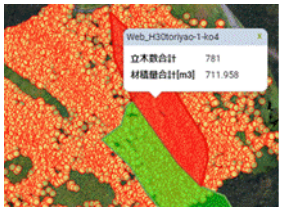


Orthophoto

Upload data to LANDLOG

Utilizing data

Volume estimation



Forest Scope

- Tree number & volume are estimated by Forest Scope.
- Users can download the data and perform their own analysis.

Silviculture inspection

- users can use the data for afforestation (planting, undercutting and thinning) inspections for subsidies.

Open Platform

オープンプラットフォーム Landlog

- 3D point cloud and orthophoto are stored on a secure server.

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Collaboration between MaxiFleet and smart forestry to visualize the entire forest cycle

- To provide forest monitoring data for planting, management, harvesting, and reforestation cycles to customers together with machine information.
- To realizing forest management with accurate and clear data.
  - **We will expand this solution not only to our current customer, forestry companies, but also to new customers who will plant trees for carbon sequestration or environment.**

- **Mechanized plantingn and drone-based planting management.**

Customer

- Production plan
- Machine operation status
- Machine maintenance planning
- Forest monitoring
- Re-forestation progress
- Harvesting progress

Web Appication

Landlog

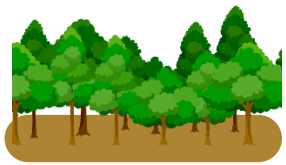
API

KOMATSU MAXIFLEET

- **Monitoring of growth, forest potential and biomass by remote sensing.**

Using UAVs to acquire small area but detailed data.

Acquiring data efficiently over a wide area by using satellites.

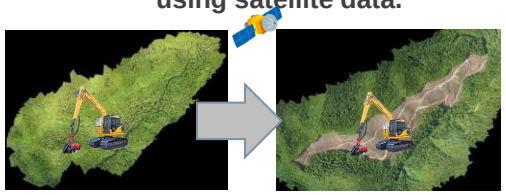


✓ Shoot with an appropriate UAV.

✓ Utilize appropriate satellite data.

✓ Analyze using appropriate analysis techniques.

- **Detection of forest change information using satellite data.**



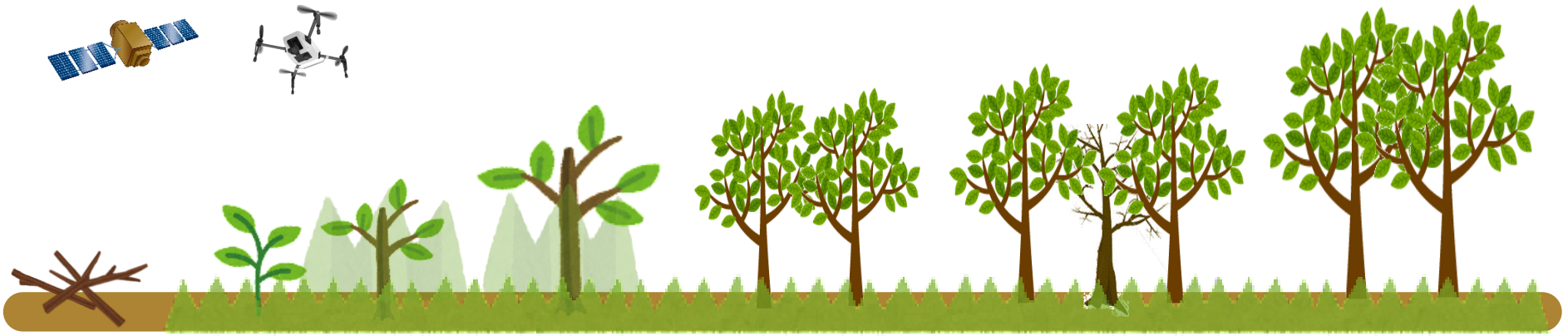
✓ Logging progress in the project area (forest change).

✓ Operations at multiple sites.

A new approach to forest remote sensing

UAV sensor : Optical Camera, Multispectral camera or Lidar.

Satellite sensor : Optical, LiDAR, SAR (synthetic aperture radar).



Silviculture Monitoring

1. Seeding number
2. Seedling position
3. Survival rate

Forest Resource Monitoring

1. Tree number
2. Stem volume
3. Biomass amount (CO_2 stock)

Logging progress monitoring

1. Forest change detection

Challenge to improve forestry operation in Japan

1. **Trial of CTL method to improve productivity.**
   - Currently, only harvester heads are sold for processor.
2. **Investigate the possibility of KFAB machines** (In Hokkaido / Tohoku).



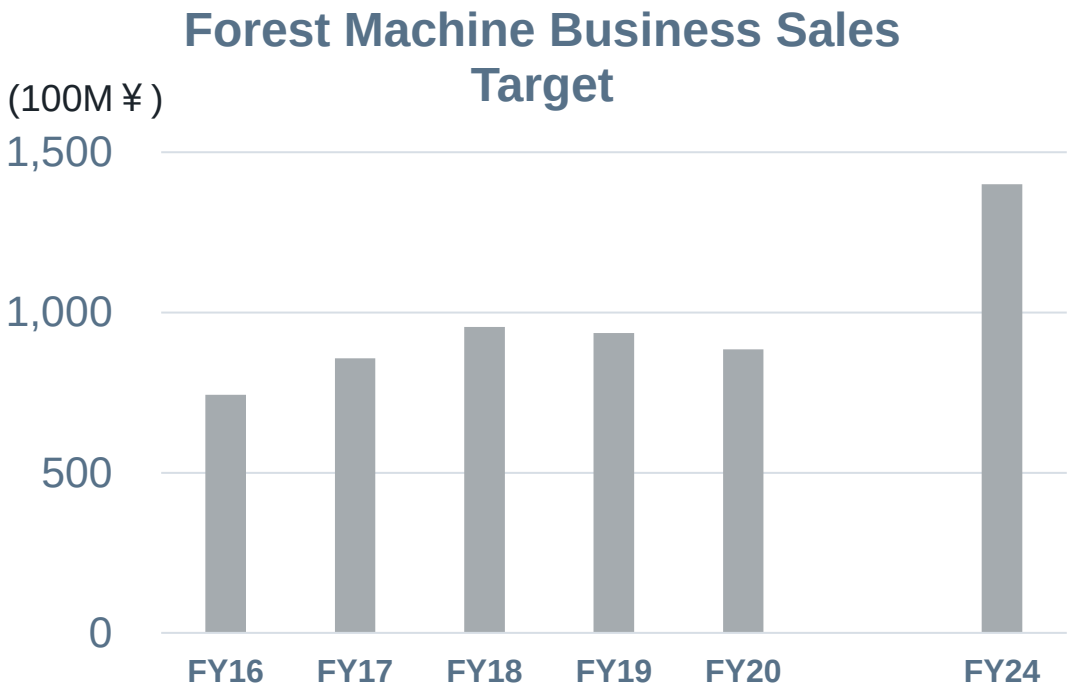


	Felling	Extracting	Processing	Transport	Transport
Current method	Chainsaw	Yarder / Excavator / Bulldozer	**Processor** (PC138 w/ C93 or S92 (Visualization of HPR data))	loading → Forwarder → loading	Track
CTL	**Harvester・Forwarder**			loading	track

KFAB	
	
vehicle height：3.79 m breadth：2.62 m Weight：17.6 t	vehicle height：3.80 m breadth：2.62 m Weight：15.8 t

Forest Machine Business Sales

- Forestry machine business aims for 140 billion yen in FY24.
  - Strengthen North America and strategic market (Russia, Asia & South America).
  - Create New business (Planting & Solution).



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