

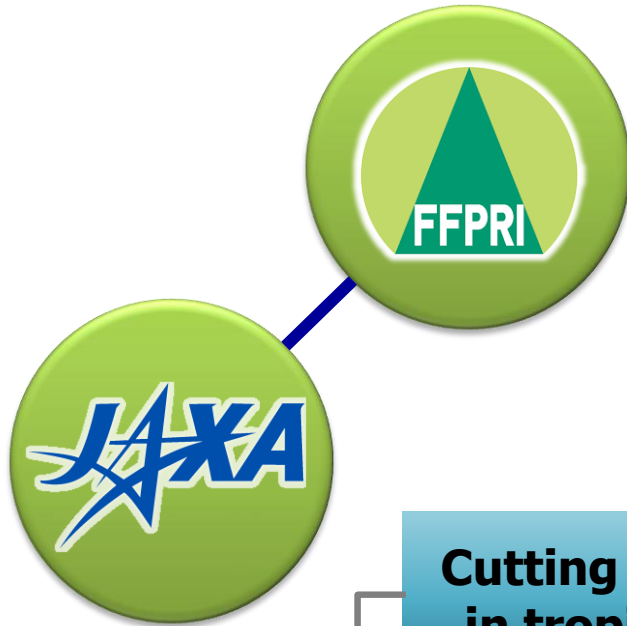
EORC research results:

**Development of forest-cutting detection method
and forest biomass research platform**

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Japan Aerospace Exploration Agency (JAXA)*

Cooperation with FFPRI

Forestry and Forest Products Research Institute (FFPRI) signed a basic agreement with JAXA in 2018 to promote satellite data utilization.



Cutting monitoring in tropical region

JJ-FAST (JICA-JAXA Forest Early Warning System in the Tropics) algorithm improvement.

Cutting monitoring in Japan

Algorithm development for improving the efficiency of governmental forest management.

Forest biomass observation

Algorithm development for above-ground biomass estimation using PALSAR-2/3 and MOLI.

Cutting monitoring in Japan

Logger must submit "cutting report" to the local government in advance. And, local government officers need to monitor for illegal activities.



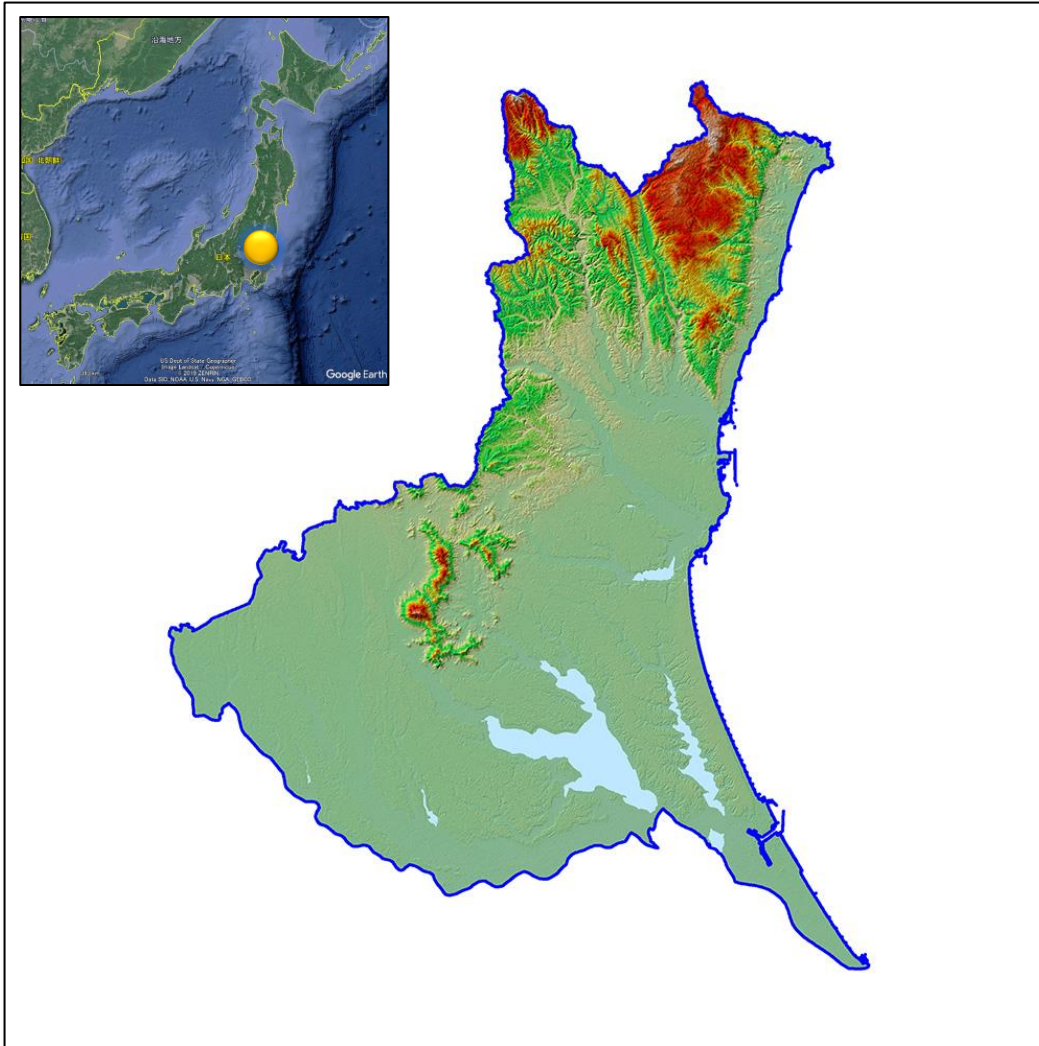
They are looking for efficient forest monitoring technologies using satellite data to detect cutting area.



JJ-FAST can detect minimum of 3 ha area, which is not suitable for small forest management units in Japan. Therefore, we studied a method using StripMap images.



Study site: Ibaraki Prefecture



North part

- mountainous area
- forestry activities

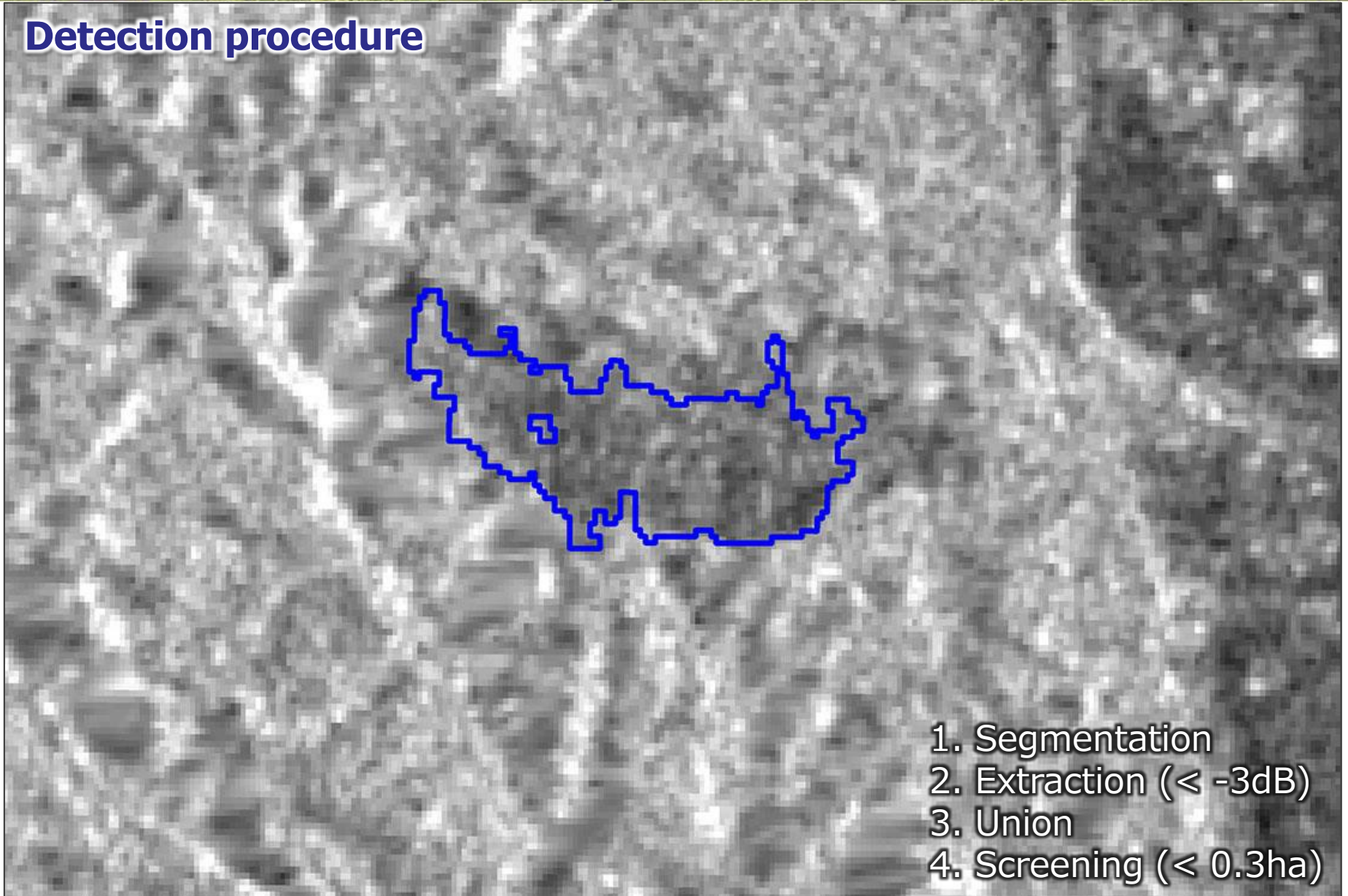


South part

- plain area
- land-use change



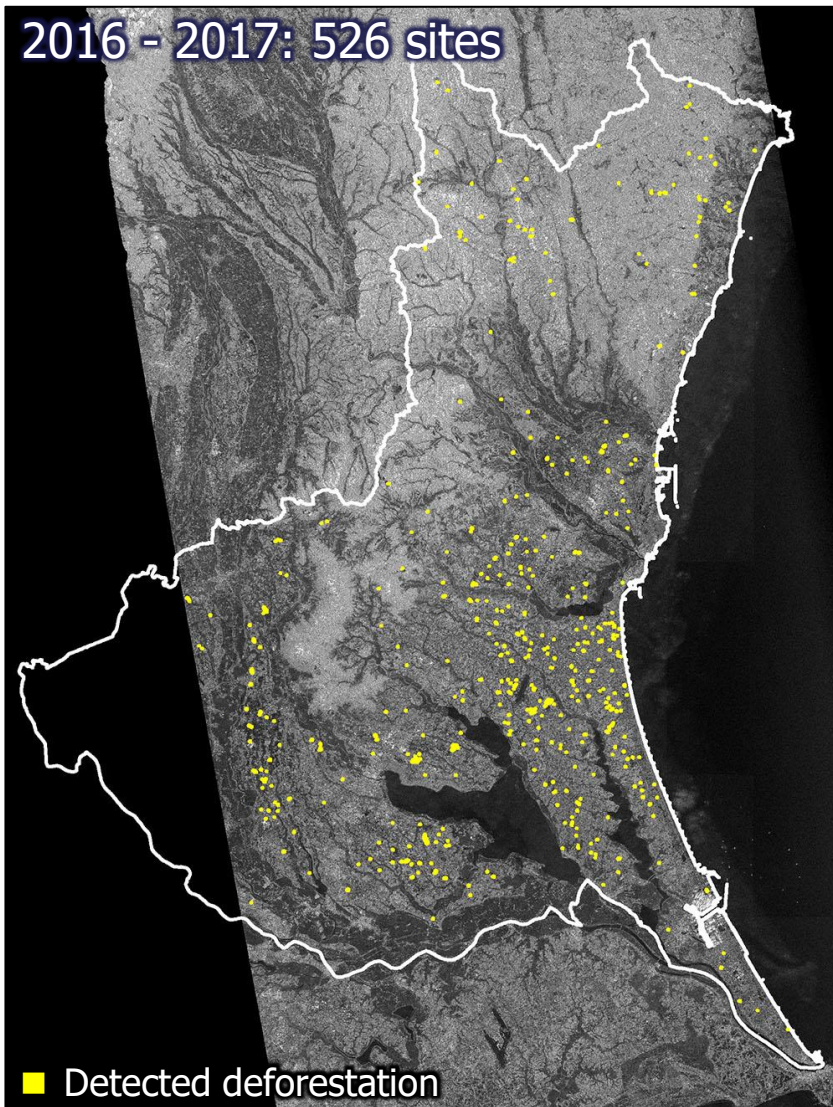
Detection procedure



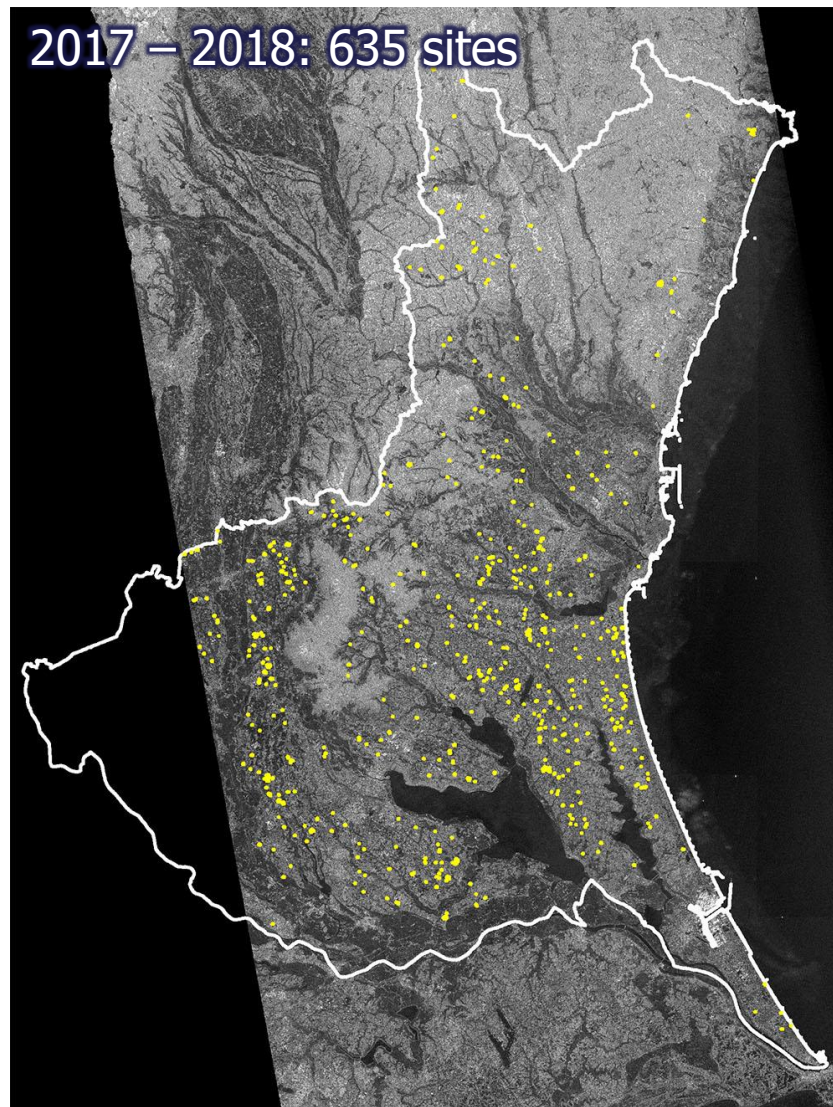
1. Segmentation
2. Extraction ($\leq -3\text{dB}$)
3. Union
4. Screening ($\leq 0.3\text{ha}$)

Detection results

2016 - 2017: 526 sites



2017 - 2018: 635 sites



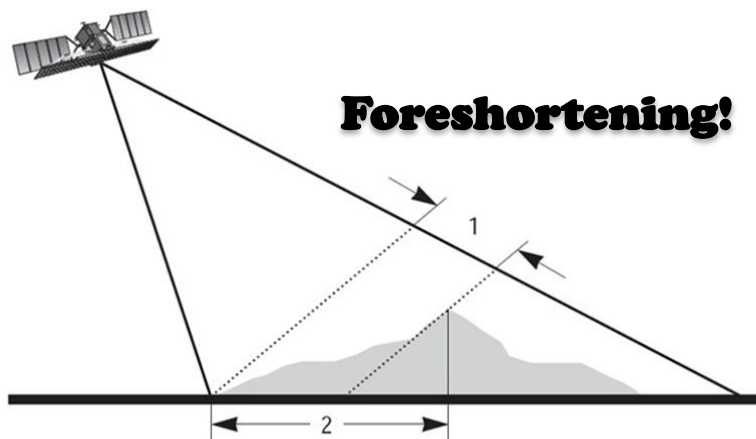


Verification by field survey

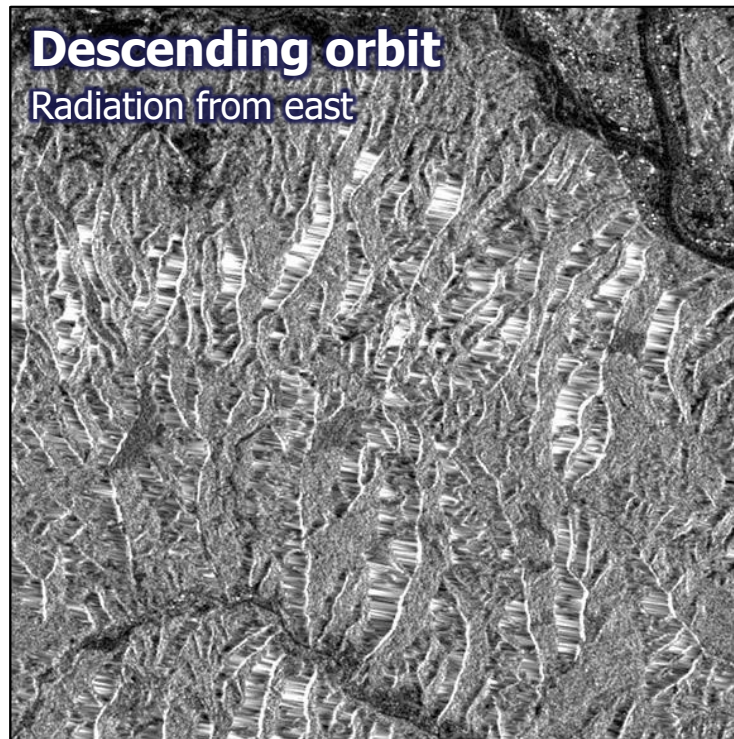
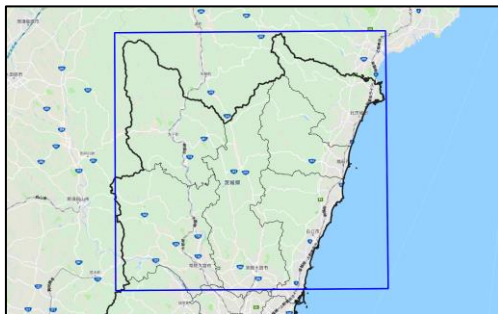
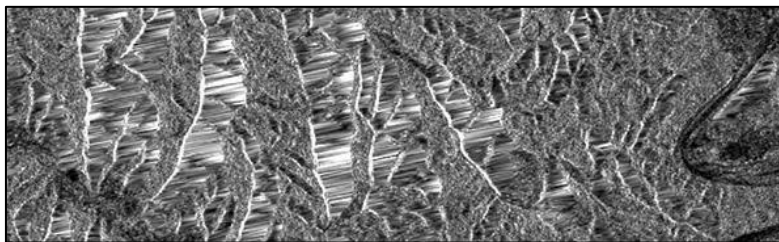
- Area: Naka City (in plane area)
- Date: April 8 & 23, 2019
- Result: 18/20 sites were correct (user's accuracy = **90%**)
- Error factor: cropland and forest degradation



Issue for mountainous area



RADARSAT International 1996. *Radarsat Geology Handbook* Richmond, B.C.



- ❑ We investigated the usage of different microwave-direction images.
- ❑ We clarified the accuracy using Sentinel-2 image interpretation data.

Validation results

Ascending orbit 2018.09.04 – 2019.04.30		Validation data			User's accuracy
		Deforestation	Non-Deforest.	Total	
PALSAR-2 detection	Deforestation	89(121)	23	144	<u>84.0%</u>
	Non-Deforst.	88			
	Total	177			
Producer's accuracy		<u>50.3%</u>			

Descending orbit 2019.01.24 – 2019.05.02		Validation data			User's accuracy
		Deforestation	Non-Deforest.	Total	
PALSAR-2 detection	Deforestation	29(37)	9	46	<u>80.4%</u>
	Non-Deforst.	46			
	Total	75			
Producer's accuracy		<u>38.7%</u>			

Ascending + Descending		Validation data			User's accuracy
		Deforestation	Non-Deforest.	Total	
PALSAR-2 detection	Deforestation	55(158)	32	190	<u>83.2%</u>
	Non-Deforst.	20			
	Total	75			
Producer's accuracy		<u>73.3%</u>			



80% of the detection was correct.

70% of actual cutting areas was detected by two-direction observation images.

Demonstration test



衛星データを利用した伐採地検出手法の開発 現況照会票

検出結果			
伐採地 ID	08226-18-008	衛星画像 1	衛星画像 2
市町村名	那珂市		
字名	田崎		
緯度	36° 28' 46.5"		
経度	140° 25' 44.4"		
衛星観測日 1	2017-09-05		
衛星観測日 2	2018-09-04		
伐採地面積	0.60 ha		
		国土地理院地図	GoogleEarth

現況確認結果	
組織・担当者	〇〇市農林課 茨城 太郎
確認方法	〇現地調査 / 書類調査 / 聞き取り調査 / その他 ()
土地利用	現況: 「県民の森」内の伐採跡地。マツクイムシ被害のため1年前に皆伐。 過去: アカマツ林。
現地写真	  伐採跡地の東端からの様子 案内板 (現在地という記載の上側に伐採地)
検出結果の正誤	〇正解 / 不正解 / 条件つき正解
コメント	実際の伐採範囲は衛星の検出範囲より数倍ほど広いが、衛星画像を見ると、2017年時点である程度伐採されていた可能性がある。
確認結果記載日	2019年4月23日

For actual operation, Trial usage and field survey are conducted by local governments.

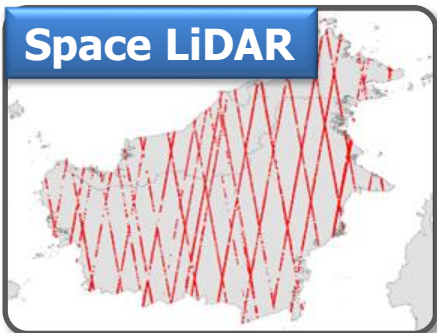
Forest biomass map development

Ground data



Cal/Val

Space LiDAR

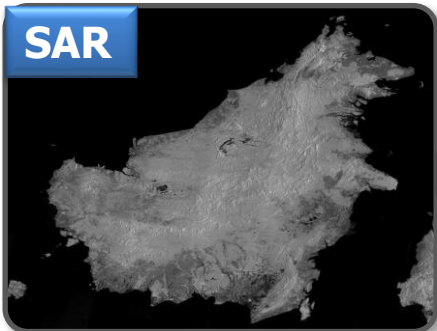


Estimation
model
development

Biomass at
LiDAR footprints

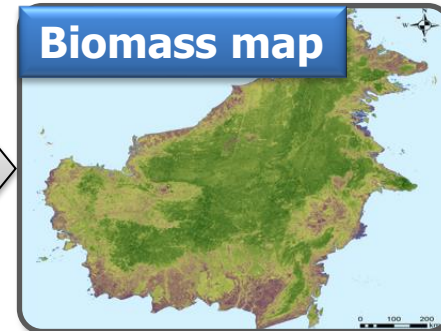
Cal/Val

SAR



Estimation
model
development

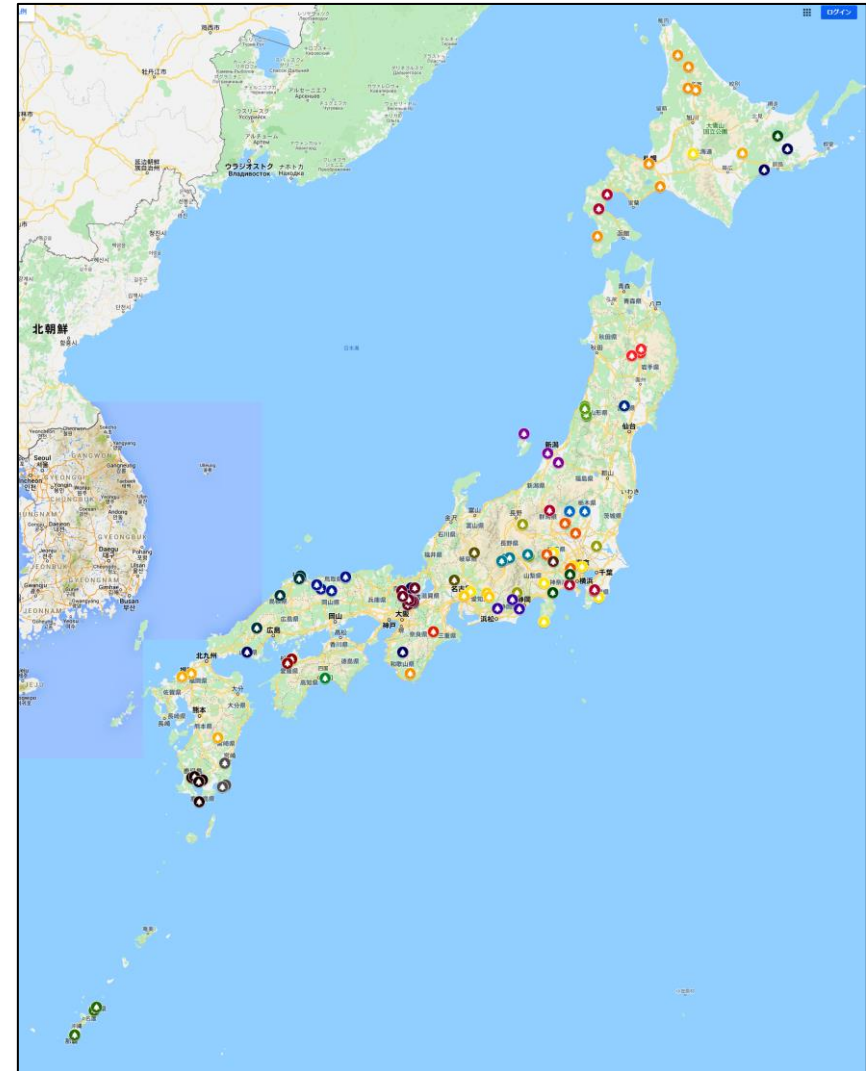
Biomass map



Ground data and airborne LiDAR data is essential for forest biomass mapping.

Cooperation with university experimental forests

- ❑ The Japan University Experimental Forest Council consists of 27 universities.
- ❑ Many of their forests have permanent field plots, which accurately measure above-ground biomass.
- ❑ Some of their forests also have airborne LiDAR data.



Forest biomass research platform

(under consideration)

Large-scale forest biomass observation platform



Open & Free Platform

Experimental Forests

- ❑ Data provision
 - GIS data
 - Ground plot data
 - Aircraft rider data
- ❑ Data usage
 - Forest biomass map

JAXA-FFPRI

- ❑ Data provision
 - Satellite data
- ❑ Data usage
 - Forest biomass data
- ❑ Algorithm development
 - Biomass estimation

Joint research

Algorithm development
Utilization research

Summary

- 1. We are collaborating with the Forestry and Forest Products Research Institute (FFPRI) to conduct study on satellite data utilization for forest observation.**
- 2. The study showed that cutting area can be detected with sufficient accuracy by using PALSAR-2 images with different microwave directions, in both plain and mountain areas.**
- 3. For the forest biomass mapping study, we are firstly developing a platform to collect data from university experimental forests in Japan.**