



USING TECHNOLOGY TO DEVELOP PRODUCTION AREA MAPS FOR EUDR COMPLIANCE:

ROLE, STRENGTHS AND SOME LIMITATIONS

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1. Context

With the coffee, rubber and timber sectors working to meet the requirements of the EU Deforestation Regulation (EUDR), remote sensing technology is regarded as a foundational tool for developing production area maps. Using high-quality satellite imagery, remote sensing specialists can accurately identify production areas, planting year, boundaries and the size of plots planted with commodity crops. When this data layer is overlaid with land-use data or forest-boundary data held by government agencies, overlaps between commodity production areas and forest land can be identified. This supports the identification of safe - or green - areas (for example, production areas located on land where cultivation is permitted and not associated with deforestation) and risk areas (production areas that do not comply with land-use purposes and/or are associated with deforestation).

The use of remote sensing technology to develop coffee production area maps is being piloted in Sơn La Province under a pilot program to develop coffee production area data for EUDR compliance, agreed between the Sơn La Provincial People's Committee and the Ministry of Agriculture and Environment.¹ The program focuses on two communes with existing coffee areas: Mường Chanh and Nậm Lầu. The pilot activities are directly led by the provincial Department of Agriculture and Environment, with direct technical support from Forest Trends, under the auspices of the Society for Agricultural Economics and Rural Development. The pilot has been implemented since April 2026.

¹*The pilot model has four main components: (1) developing production area maps from remote sensing imagery; (2) collecting data at household and production-plot level; (3) identifying no-/low-risk areas (green areas) and risk areas (red areas); and (4) developing recommended solutions for red areas.*

Forest Trends is working with the Forest Inventory and Planning Institute (FIPI), a consultant to Forest Trends, to implement the component on applying remote sensing technology to map the current production areas in the two pilot communes. This component runs from March to August 2026. FIPI is preparing a detailed technical report, currently being finalized, covering input imagery, image interpretation methods, field surveys, development of production area maps, and identification of the location and extent of risk areas - coffee areas currently located on forest land. The report also discusses the scalability of the method to the remaining communes in the province. It is highly technical and is intended for readers with some knowledge of remote sensing. Scaling up the pilot model (using remote sensing technology to develop coffee production area maps) to other communes in Sơn La, and to areas outside the province, depends heavily on local leaders, who are generally not technical specialists. Drawing on the technical report being finalized by FIPI, this paper summarizes the main features of the remote-sensing-based method used to develop coffee production area maps in the two pilot communes in Sơn La. It also provides a preliminary assessment of the method's usefulness and some of its limitations, particularly in the context of EUDR requirements.

2. Objective

The purpose of this paper is to provide basic information on the use of technology to develop coffee production area maps and identify coffee areas located on forest land (risk areas). More specifically, it summarizes the main features of the technology-based mapping method for managers and provides information on its strengths and limitations in meeting EUDR requirements.

3. Method for developing coffee production area maps using remote sensing

Developing production area maps from satellite/remote sensing imagery requires high-quality imagery. For the two pilot communes (Nậm Lầu and Mường Chanh), Forest Trends and FIPI used very high-resolution imagery (50 cm or finer). In general, satellite imagery used to map production areas should meet the following criteria:

- High resolution (below 1.5 m), ideally < 1 m (to ensure high accuracy);
- Captured as recently as possible (to provide up-to-date information on planted area);
- Low cloud cover (below 10% over the area of interest).

Commercial ultra-high-resolution satellite imagery is usually very expensive (the imagery used to develop coffee production area maps for Nậm Lầu and Mường Chanh cost about USD 10,000). If funding for imagery is limited, local authorities can use SPOT 5, 6 and 7 imagery currently acquired and provided by the National Remote Sensing Station, National Remote Sensing Department, at much lower cost. Where no budget is available, local authorities can access free imagery sources such as

Google Earth, Planet, etc. However, free imagery generally has a spatial resolution of 5-10 m, resulting in lower accuracy and requiring substantial resources for field verification and updating.

Image interpretation requires remote sensing specialists. The process involves several technical steps, including: (i) image preprocessing (e.g. geometric correction); (ii) OBIA classification (object-based image analysis: image segmentation, feature construction, machine-learning classification using Random Forest, post-processing, etc.); (iii) field verification; (iv) accuracy assessment (confusion matrix, Kappa coefficient, etc.); and (v) finalization of the map.

In summary, the three most important factors in developing production area maps are: (1) high-quality imagery; (2) experienced remote sensing specialists; and (3) field verification.

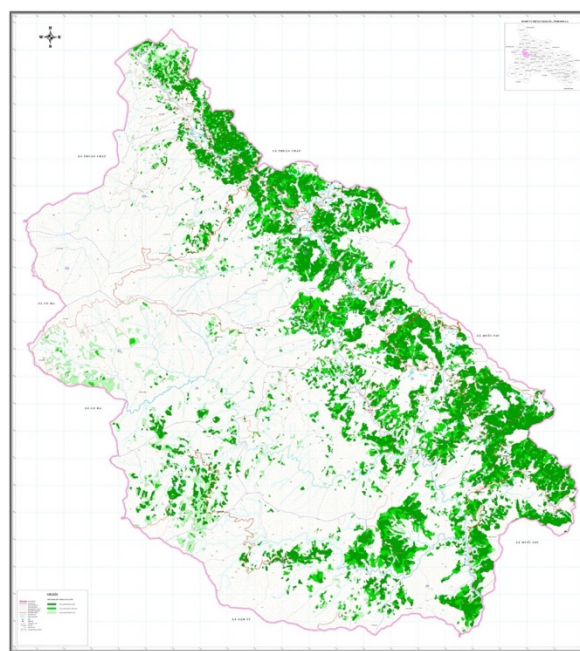
4. Using remote sensing technology: Strengths

The main strengths of using remote sensing technology to develop production area maps, particularly where resources are available to access high-quality and up-to-date imagery, include:

- Accurately identifying the location and area of coffee production;
- The output (production area map) can be completed within a very short period;
- Identifying the planting year of coffee areas.

Map 1 below shows the current coffee production areas in Nậm Lầu. Map 2 shows the coffee production areas in Mường Chanh. The maps were developed using image interpretation and the methods described in Section 3.

Map 1. Coffee production area map for Nậm Lầu (January 2026)



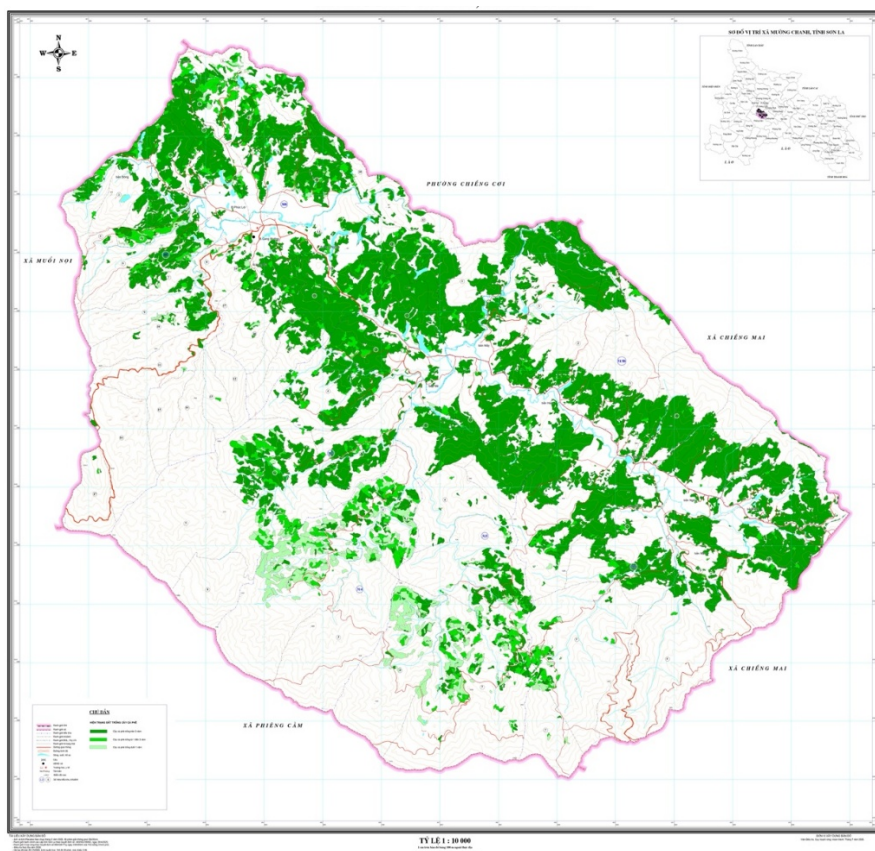
Map 2. Coffee production areas in Mường Chanh Commune (January 2026)

Table 1 presents coffee area figures by planting period, based on image interpretation results for Nậm Lầu and Mường Chanh communes.

Table 1. Coffee area by commune and planting period

Commune	Coffee >3 years old (ha)	Coffee 1-3 years old (ha)	Coffee <1 year old (ha)	Total coffee area (ha)
Nậm Lầu	3,523.6	1,491.7	812.9	5,828.1
Mường Chanh	2,465.0	358.7	248.9	3,072.7
Total	5,988.6	1,850.4	1,061.8	8,900.8

Before the areas were calculated through image interpretation, the communes had reported coffee areas of 1,623 ha for Nậm Lầu and 1,565 ha for Mường Chanh.

Image interpretation shows that the actual coffee area in Nậm Lầu is approximately 3.6 times the area previously reported by the commune; the actual coffee area in Mường Chanh is nearly twice the reported area.

Image interpretation also makes it possible to determine when the coffee was planted (Table 1). This information is highly useful for local authorities and technical agencies in management.

5. Identifying high-risk coffee production areas

Remote-sensing-based coffee production area maps make it possible to accurately identify the location of coffee plots.

Local forestry authorities currently have maps of forest status and forest-land-use planning (covering the three forest categories: production, protection and special-use forest).

Overlaying the production area map developed from image interpretation with the forest planning map and the forest status map makes it possible to accurately identify coffee plots located on forest land.

One EUDR requirement is that land be used in accordance with its designated purpose. Coffee plots established on forest land do not meet this land-use requirement under the EUDR.

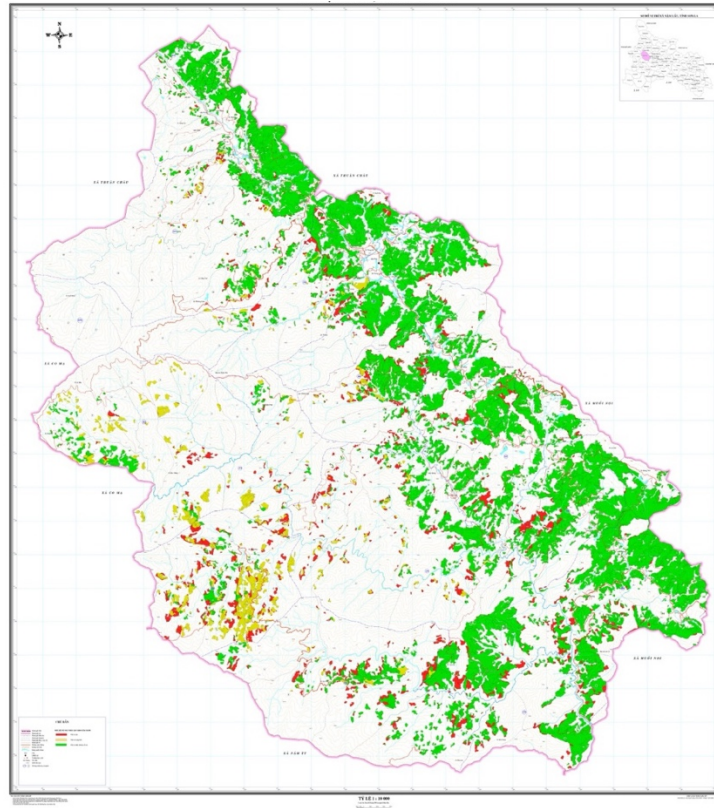
Remote sensing imagery can also identify coffee plots located outside forest land that were converted from forest to coffee on or after 31 December 2020.

The EUDR also does not allow coffee grown on areas converted from forest on or after 31 December 2020 to be imported into the EU.

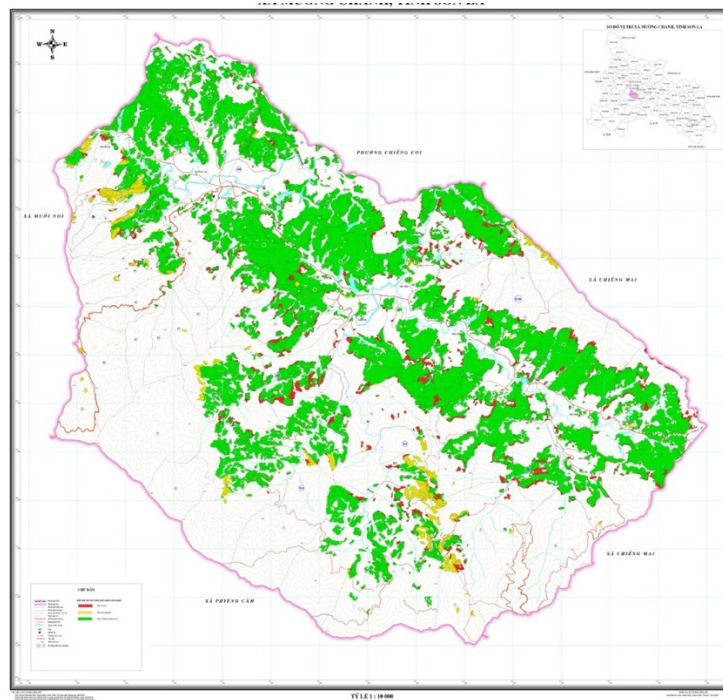
Coffee plots located on forest land and coffee plots established on areas converted from forest after 31 December 2020 are identified as high-risk areas because coffee from these areas does not meet EUDR requirements.

Remote sensing analysis helps identify high-risk coffee plots that do not meet EUDR requirements in Nậm Lầu (Map 3) and Mường Chanh (Map 4). High-risk plots are shown in red.

Map 3. High-risk areas not meeting EUDR requirements in Nậm Lầu



Map 4. High-risk areas not meeting EUDR requirements in Mường Chanh



Remote sensing image interpretation also makes it possible to determine when high-risk coffee areas were planted. Specifically:

For Nậm Lầu: Total high-risk coffee area is 625.4 ha, including:

- Coffee planted less than 1 year ago: 210.9 ha
- Coffee planted 1-3 years ago: 233.8 ha
- Coffee planted more than 3 years ago: 180.7 ha

For Mường Chanh: Total high-risk coffee area is 176.5 ha, including:

- Coffee planted less than 1 year ago: 10.9 ha
- Coffee planted 1-3 years ago: 16.1 ha
- Coffee planted more than 3 years ago: 149.5 ha

Mường Chanh is one of Sơn La's leading communes in coffee development. Its coffee area has now become relatively stable. By contrast, Nậm Lầu is an emerging coffee-growing area, where new coffee plantings are still expanding considerably.

Because the two communes are at different stages of coffee development (Mường Chanh developed earlier and is now relatively stable; Nậm Lầu developed more recently and has many new areas), their risk profiles differ. In Mường Chanh, risk areas are mainly coffee areas more than three years old, while in Nậm Lầu they are mainly newly planted areas. This means that Mường Chanh's risk areas have existed for a long time and reflect historical factors, whereas Nậm Lầu's risk areas are newer.

Identifying risk areas (and supply flows) is important because it enables businesses and local authorities to classify and select supply flows suitable for different market requirements, with safe supply flows (green areas) selected for export to the EU.

6. Using technology to map coffee production areas: Some limitations

However, using technology to develop production area maps also has several limitations. The main limitations include:

- Where budgets are limited, output quality is also limited. Many localities, particularly those with constrained budgets, cannot access high-quality remote sensing imagery. Using lower-quality imagery creates risks of error and outdated information on the current extent of coffee production areas.
- Relatedly, limited budgets and human resources may prevent field verification of image interpretation results. This directly reduces the quality of the final outputs.

- Low-quality imagery, including free imagery with low spatial resolution (5-10 m), makes coffee production areas difficult to distinguish. With coffee prices currently high, new production areas are expanding relatively quickly. Outdated imagery cannot accurately identify newly expanded areas.
- Remote sensing imagery can identify coffee plots but does not provide information on who manages them. A coffee plot identified from remote sensing imagery may include land belonging to several different households. These boundaries can only be established through direct household confirmation and field inventory and updating.
- Remote sensing imagery cannot identify coffee areas grown under forest canopy or under high-cover shade trees.

7. Conclusion: What else is needed to meet EUDR requirements?

Remote sensing technology has the potential to provide major advantages in identifying the location, area - i.e., developing production area maps - and establishment period of production areas within a relatively short time. When overlaid with forest-boundary maps/forest planning maps, these production area maps can identify risk areas that do not meet EUDR requirements. This has considerable potential for businesses and government authorities when selecting supply flows (safe/less safe) for different market requirements. However, EUDR compliance requires information on the location of each production plot of each household. Remote sensing interpretation cannot determine this. In other words, meeting EUDR requirements requires fieldwork with farming households to collect information on producers and each of their production plots. Remote sensing interpretation can significantly reduce the time and resources needed to collect data from households and production plots.



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