# SMART Mobile System

SMART Mobile Training, Pra Tu Muang Community Forest

# Final Report

ITTO Project PD-A/60-369

"Strengthening Surveillance and Monitoring to Tackle the Surge in Forest Loss and Land Degradation, Induced by Intensifying Conflict in Thailand's Border Areas"

*By Mr. Sitthichai Jinamoy and Mr. Tanavi prasopsuk, March 2025*

## Project duration

The duration of the assignment is 12 months from 1 July 2024 to 30 June 2025.

## Objective

Strengthening SMART and NCAP Surveillance and Monitoring Systems for citizen science and community reporting illegal activities in Mae Hong Son Province, Thailand.

## Summary

### Background and Context

Mae Hong Son, a province in northern Thailand bordering Myanmar, is distinguished by its mountainous terrain, rich biodiversity, and diverse ethnic communities. Despite its natural beauty, the region faces persistent threats, including illegal logging, poaching, and land encroachment. Additionally, increasing border conflicts have contributed to accelerated deforestation and land degradation, underscoring the need for improved monitoring and conservation strategies.

To counter these environmental challenges, the initiative *"Enhancing Surveillance and Monitoring to Address Escalating Forest Loss and Land Degradation Amid Rising Border Conflicts in Thailand"* has introduced advanced technologies such as the **SMART Patrol System** and **NCAPs** *(Nature Crime Analysis Platforms, particularly Camera Traps)*. These tools have proven instrumental in supporting local conservation efforts, enabling better law enforcement, and engaging communities in safeguarding Mae Hong Son's forests and wildlife.

For over two decades, Thailand has utilized the "**SMART Patrol System"**, a surveillance approach that integrates **SMART** *(Spatial Monitoring and Reporting Tool)*, a data-driven system that incorporates GPS tracking, systematic monitoring, and real-time reporting. This technology has played a critical role in improving ranger efficiency, enhancing area protection, and stabilizing wildlife populations, particularly tigers. The system has also contributed to a decrease in illegal activities by aiding in the detection of poaching camps and other environmental crimes.

The SMART program is currently in operation across multiple wildlife sanctuaries under Thailand's **Department of National Parks, Wildlife, and Plant Conservation (DNP)**, including Thungyai Naresuan East (TYE), Thungyai Naresuan West (TYW), and Huai Kha Khaeng Wildlife Sanctuary (HKK), with the support of Wildlife Conservation Society (WCS) Thailand. Recent advancements in SMART technology have introduced mobile applications like SMART Mobile, SMART Connect, and SMART Sensor, which integrate GPS tracking, communication systems, and real-time data sharing. These tools, combined with drones, camera traps, and GPS trackers, enhance surveillance and facilitate proactive conservation efforts.

In response to the growing environmental concerns in Mae Hong Son, the **SMART Patrol System and NCAPs** have become essential for monitoring and mitigating threats to the region's forests. Beyond law enforcement, these technologies are being leveraged for **citizen science initiatives and community-led monitoring**, allowing local stakeholders to report and prevent illegal activities such as deforestation, wildlife poaching, and land encroachment. The program has been successfully implemented within **key Community Forests and a National Reserve Forest in Mae Hong Son Province**, strengthening regional conservation initiatives

This initiative marks a significant milestone, as it represents the first time in Thailand that the **SMART Patrol System, originally developed by the Department of National Parks, Wildlife, and Plant Conservation (DNP), has been adapted for use by the Royal Forest Department (RFD)**. This adaptation highlights an important step in utilizing advanced surveillance technology to safeguard both **community-managed and national reserve forests**, reinforcing Thailand's national conservation strategies.

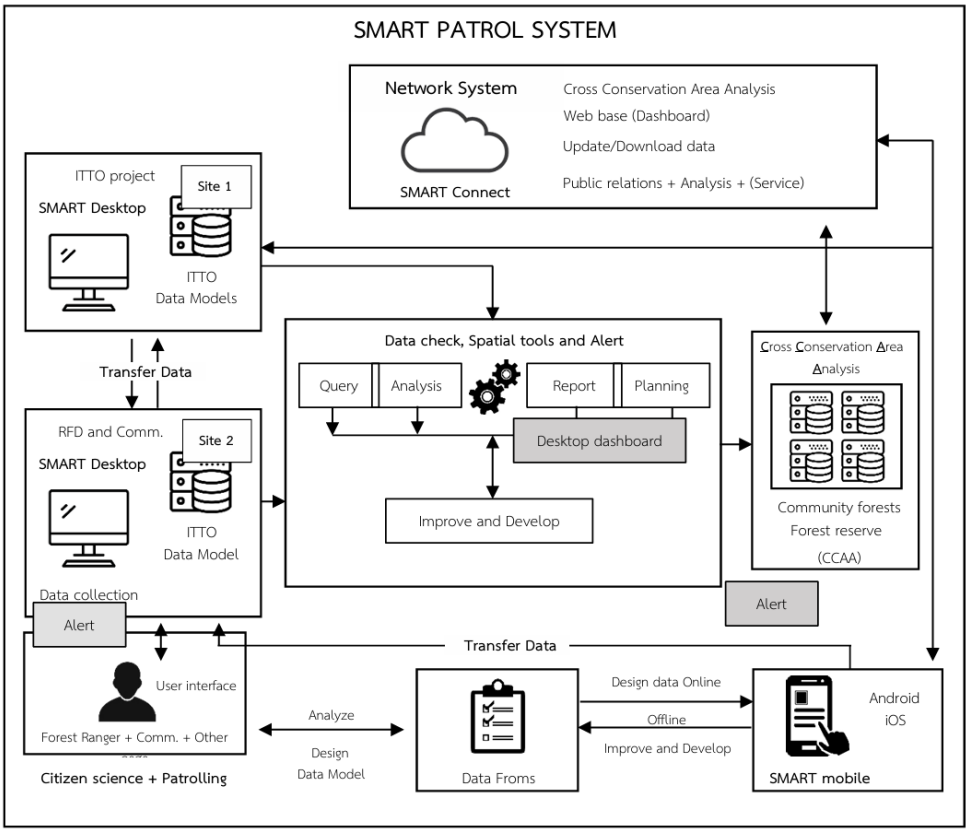
Ultimately, the **SMART Patrol System** has proven to be a highly effective conservation tool, not only for security and patrol operations but also for fostering **community engagement in environmental protection**. By incorporating citizen science and local participation, the initiative strengthens efforts to combat illegal activities in the **four designated Community Forests and a National Reserve Forest in Mae Hong Son Province, northern Thailand.**

## What is the SMART System?

The SMART System (Spatial Monitoring And Reporting Tool) is a technology-driven approach designed to enhance wildlife and forest protection through systematic patrols, data collection, and real-time monitoring.

SMART has been successfully implemented in various wildlife sanctuaries in Thailand, including Thungyai Naresuan and Huai Kha Khaeng. For the first time, it has now been adapted for community forests and national reserve forests under the Royal Forest Department (RFD), expanding conservation efforts beyond National Parks (NP) and Wildlife Sanctuary (WS).

The overall SMART PATROL system for this project:




Overall SMART Patrol in 2024 for ITTO project


# SMART System

## DEVELOP SMART PATROL AND SMART SYSTEM (SMART MOBILE SYSTEM)

## Main activities

The principal task of the Sub-contractor is to collaborate and assist the project staff to develop and install SMART PATROL smart technologies for citizen science and community reporting illegal activities (logging, poaching and encroachment) in and around the target community forests *(support - activity 1.3, item 44.2 SMART mobile system).*

The specific functions and responsibilities will include the following:

### SMART Patrol

SMART Patrol is a strategic system designed to enhance the protection of forests and wildlife through systematic monitoring, data collection, and law enforcement. It is a key component of the SMART System, which uses GPS, mobile applications, and real-time data analysis to improve conservation efforts.

SMART Patrol has been successfully implemented in Thailand's national parks and wildlife sanctuaries. For the first time, this system has been adapted for use in community forests and national reserve forests under the Royal Forest Department (RFD) to improve conservation and security in areas like Mae Hong Son Province.

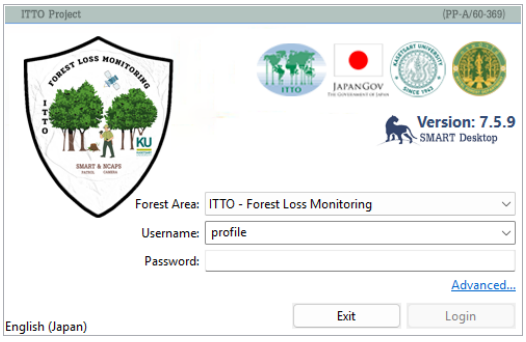
SMART Desktop

*Task:* this project aims to develop and install SMART PATROL technologies for citizen science and community-based reporting of illegal activities (such as logging, poaching, and encroachment). The project will establish four target Community Forests (Comm. Forests) and one National Reserve Forest (NRF):

- *Tor Pae Comm. Forest*
- *Thung Paem Comm. Forest*
- *Le Koh Comm. Forest*
- *Pra Tu Muang Comm. Forest*
- *National Reserve Forest, Forest Protection Unit Officers from M.S.3 and M.S.9.*

*Create a data model for the SMART program to collect data and report illegal activities (such as logging, poaching, and encroachment).*

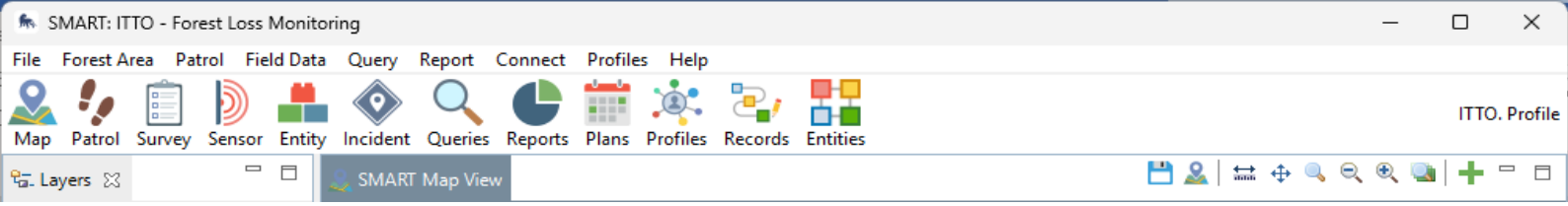
### SMART Desktop Program




Welcome to the SMART Desktop Program Login Page.

### SMART Desktop

Create the SMART database and provide training for ITTO field staff




## NCAPs

NCAPs (Nature Crime Analysis Platforms) is an advanced surveillance system designed to support environmental law enforcement and conservation efforts. It integrates camera traps, satellite imagery, and data analytics to monitor and analyze illegal activities such as deforestation, poaching, and land encroachment.

Training on Setting Up the Spartan GOCam 4G/LTE Camera Trap

In Mae Hong Son Province, NCAPs play a crucial role in enhancing the efficiency of SMART Patrols, supporting community-led conservation efforts, and improving data-driven decision-making for law enforcement Installed cameras and NCAPS technologies for real time monitoring and reporting illegal activities (logging, poaching and encroachment) in and around the 5 target forests.

NCAPs Setup Manual

*Task:* Review the camera trap technologies used in Thailand, known as 'NCAPs,' including their advantages, limitations, and recommendations for improvement. Additionally, provide the necessary equipment to support and integrate with the SMART PATROL SYSTEM.

Collaborate with forest rangers and the heads of target community forests to identify suitable sites (three sites per target area) for installing NCAP cameras.

- Purchase 15 Spartan GoCam 4G/LTE camera traps.
- Obtain 15 SIM cards from True service to transmit real-time data (videos and pictures).

Register the Spartan camera on the website for real-time data monitoring: https://my.spartancamera.com/home

NCAPs Training: How to set up tree-mounted and hidden camera traps. Training conducted by five trainers from the Phu Khieo Wildlife Sanctuary team.

The Spartan GoCam 4G/LTE is a wireless camera trap designed for remote surveillance and wildlife monitoring. It uses cellular connectivity to transmit images and videos in real time, making it an effective tool for integrating SMART Sensors and NCAPs in environmental protection and law enforcement.

Set up NCAP cameras to connect with the mobile phones of selected stakeholders, enabling alerts for evidence of illegal activities and ensuring continuous operation.

Prepare documents, reports, and manuals for the community and Royal Forest Department (RFD) officers. The manuals should include instructions on using NCAPs and GPS trackers.
Write NCAPs manual for training, how to use and setup Spartan GoCam 4G/LTE.

## SMART Mobile

SMART Mobile is a mobile-based extension of the SMART (Spatial Monitoring And Reporting Tool) System, designed to enhance real-time data collection, reporting, and communication for environmental monitoring and law enforcement. It allows rangers, conservationists, and local communities to report illegal activities, track patrols, and analyze data directly from their smartphones or tablets.

SMART Mobile enhances the efficiency of the SMART Patrol System, making it an essential tool for conservation efforts in areas like Mae Hong Son Province, where remote monitoring is critical for protecting natural resources.

*Task:*

Design SMART Mobile collection data platform on smartphone similar with SMART Patrol Observation Form in SMART desktop, and training.

SMART Mobile

The Smart Connect program window displays the patrols of community forests and forest protection units in Mae Hong Son Province. The image shows each type of patrol station point and each patrol route in real-time.

## SMART Connect

SMART Connect is an advanced data-sharing and communication feature integrated into the SMART System. It enables real-time connectivity between patrol teams, conservation managers, and law enforcement agencies, enhancing the effectiveness of wildlife and forest protection efforts.

In the Mae Hong Son initiative, SMART Connect plays a crucial role in linking field patrols with law enforcement, ensuring rapid response to illegal activities such as poaching, illegal logging, and land encroachment.

*Task:*

Specify and set up Domain + SSL for SMART Connect.

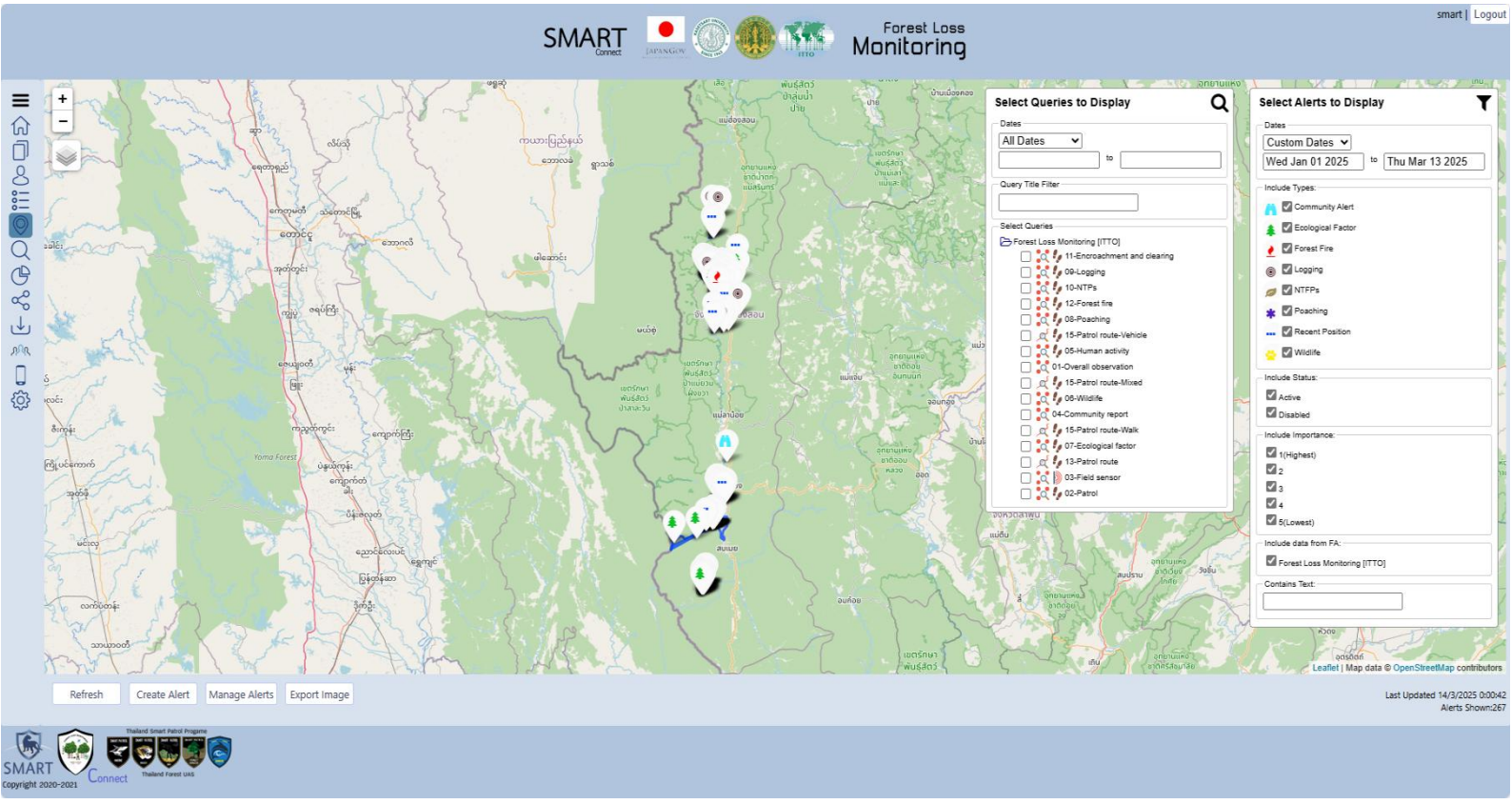
The domain namely: https://itto-forestloss.org/

Install SMART Connect and develop SMART Mobile to suit specific needs and contexts and connect to personal devices – mobile phone application (e.g., via the App or Play Stores) to assist local authorities, community groups and youth in community forest loss and degradation.

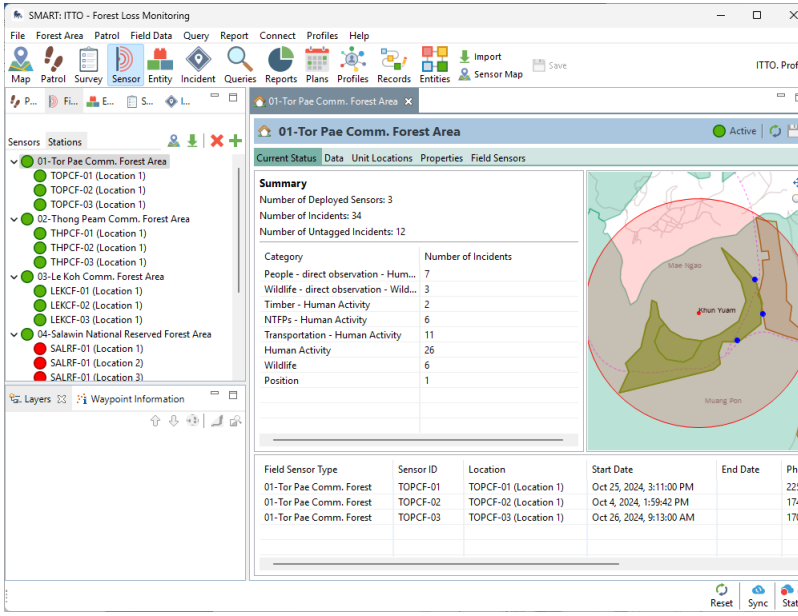
For, SMART Connect website is: https://itto-forestloss.org:8443/server/connect/home

Connecting data NCAP cameras and sharing data with SMART Mobile, SMART PATROL program (SMART Desktop) and reporting on SMART Connect.

SMART Connect



SMART Plugin Option, in this picture, shows the SMART Sensor to collect from the camera trap including; (1) camera locations, (2) mapping location, (3) video, photo, and date time of record in the camera pictures.



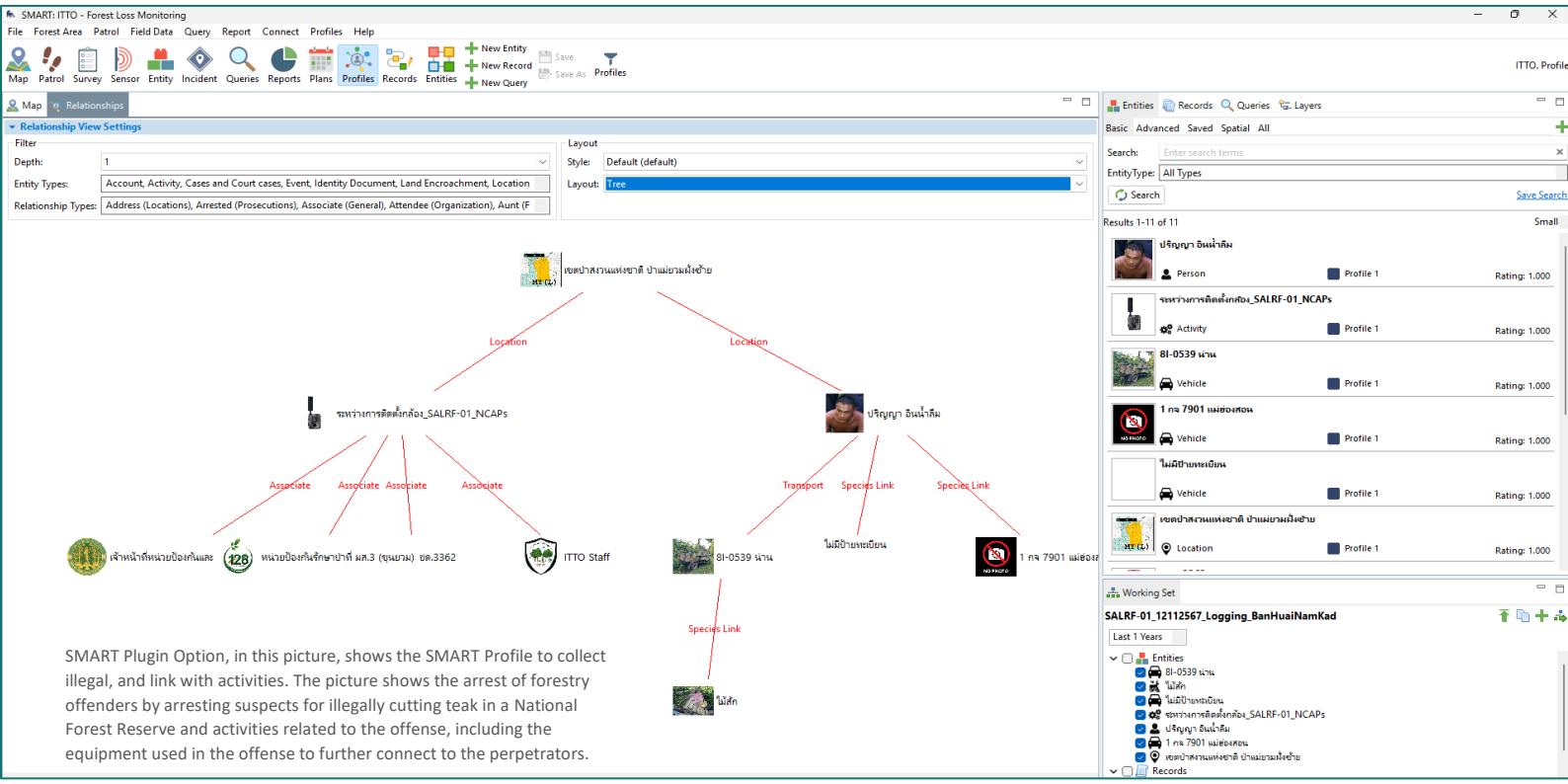

## SMART Plugin Option

**SMART Sensor** is an advanced component of the SMART System, designed to enhance surveillance and monitoring through the integration of automated technologies. It includes various sensor-based tools such as camera traps, drones, and GPS trackers to collect real-time environmental data and detect illegal activities more efficiently.
In Mae Hong Son Province, SMART Sensor technology plays a crucial role in strengthening patrol efforts, reducing illegal logging, and supporting community-led conservation initiatives. By integrating these tools, authorities and local communities can enhance their ability to monitor and protect natural resources effectively.

*Task:*

Setup SMART Sensor on SMART Desktop to support NCAPs (Spartan GoCam 4G/LTE camera trap).

SMART Field Sensor




SMART Plugin Option, in this picture, shows the SMART Profile to collect illegal, and link with activities. The picture shows the arrest of forestry offenders by arresting suspects for illegally cutting teak in a National Forest Reserve and activities related to the offense, including the equipment used in the offense to further connect to the perpetrators.

**SMART Profile** is a customized user interface within the SMART System that allows conservation managers, rangers, and law enforcement agencies to tailor the platform to their specific needs. It enables users to set up monitoring parameters, track patrol performance, and analyze data more efficiently.
In the Mae Hong Son initiative, SMART Profile plays a critical role in helping authorities and community members organize and analyze conservation data, ensuring a more targeted and effective response to environmental threats.

*Task:*

Setup SMART Profile to support illegal activity and link target data (the SMART Profile same with i2BASE)

SMART Profiles Manual

## Result

**SMART System Design:**

- One data model database design for SMART Desktop to support four Community Forests and National Reserve Forests.
- Two language support: Thai/English on SMART Desktop, SMART Mobile, and SMART Connect.
- Three program software and two plugins: (1) SMART Desktop, (2) SMART Mobile, (3) SMART Connect, and two plugins including the sensor and profile.
- Six documents and manuals: (1) Using NCAPs and GPS Tracker, (2) SMART Desktop Manual, (3) SMART Connect Manual, (4) SMART Mobile Manual, (5) SMART Sensor Manual, and (6) SMART Profile Manual for community and officer operations of RFD.
- Query and report automatic design: 34 queries and 6 reports were created.
- SMART online website database:
  - ITTO website; https://itto-forestloss.org, and
  - SMART Connect; https://itto-forestloss.org:8443/server

Photos taken by NCAPs using the Spartan GoCam 4G/LTE camera trap that describe activities captured in the images. This photo shows the community's use of non-timber forest products (NTFPs), such as bamboo, in the Ban Tor Pae Community Forest.

**NCAPs:**

- Data model structure for SMART Sensor on SMART Desktop for collecting and linking NCAPs camera trap data.
- The summary report, based on pictures captured from 25 October 2024 to 28 February 2025 (126 days), shows the following results:
  - Found **4 types of domestic animals**: goats (n=10/time), dogs (n=6/time), buffaloes (n=8/time), and cows (n=9/time) in the target areas.


  - Found **5 types of wildlife**: barking deer, leopard cats, birds, foxes, and wild boars.
  - **Four types of vehicles** observed: motorcycles, tractors, trucks, and cars.
  - **Seven types of non-timber forest products (NTFPs)** such as bamboo, logs or wood, bananas, vegetables, herbs, bamboo shoots, and unclassified.
  - **Six types of equipment** found: lawnmowers, saws, hoes, harpoons, knives, and guns.
  - One time of **poacher** involving a wild boar.

**SMART Patrol and SMART Mobile:**

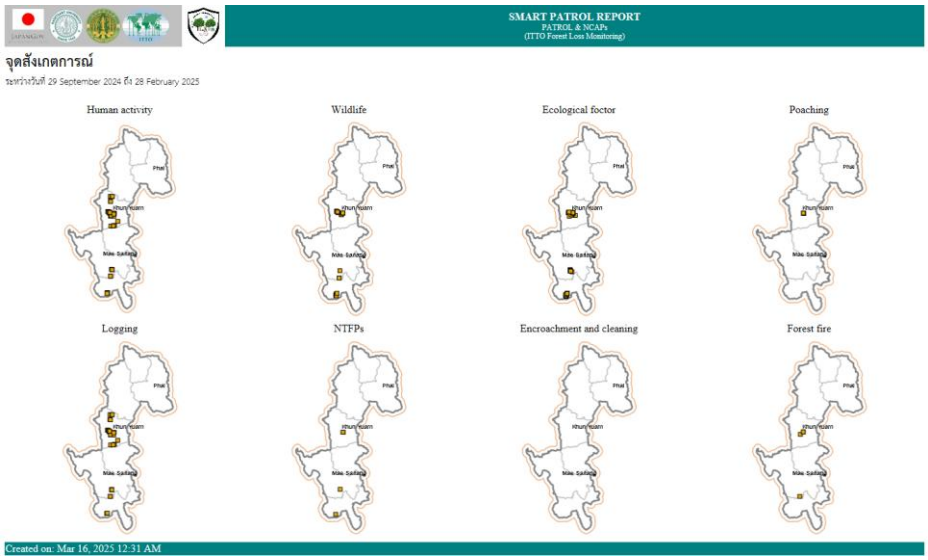
- Two-time survey and check signal location for NCAPs and SMART Mobile application test at the Community Forest.
- Six SMART Mobile devices were used to collect data in each target area.
- Real-time data was sent to the SMART Connect website.
- Four Community Forests and two National Reserve Forests (Forest Protection Unit Officers, M.S. 3 and 9) set up SMART Patrol planning for 4-6 patrols per day/month. The data summary results from January to February 2025 are shown in the table below.

| | 01/2025 | 01/2025 | 01/2025 | 01/2025 | 02/2025 | 02/2025 | 02/2025 | 02/2025 |
|---|---|---|---|---|---|---|---|---|
| | Number of Patrols | Distance (km) | Number of Patrol Hours (All) | Count Observations | Number of Patrols | Distance (km) | Number of Patrol Hours (All) | Count Observations |
| Le Koh | | | | | 3.0 | 18.00757598876953 | 15.87055555553 | 35.0 |
| M.S.3 | 6.0 | 81.16636657714844 | 14.47055555549 | 15.0 | 6.0 | 99.21823120117188 | 15.60694444439 | 5.0 |
| M.S.9 | 1.0 | 27.641624450683594 | 1.66 | 1.0 | 1.0 | 0.06603509187698364 | 0.42916666666 | 4.0 |
| Pra Tu Mueang | 5.0 | 7.138610363006592 | 13.36249999998 | 14.0 | | | | |
| Thung Paem | | | | | 3.0 | 18.1551456451416 | 11.08027777776 | 8.0 |
| Tor Pae | 4.0 | 25.405553817749023 | 20.83138888887 | 14.0 | | | | |

- Animal in the area, 12 species found from SMART Patrol including; Barking Deer (*เก้ง, Muntiacus muntjak*), Asiatic Brush-tailed Porcupine (*เม่นหางพวง, Atherurus macrourus*), Red junglefowl (*ไก่ป่า, Gallus gallus*), Bear sp. (*หมี*), Barn swallow (*นกนางแอ่นบ้าน, Hirundo rustica*), Chinese edible frog (*กบนา, Hoplobatrachus rugulosus*), Brown boobook (*นกเค้าเหยี่ยว, Ninox scutulata*), Banded palm civet (*อีเห็นลายเสือโคร่ง, Hemigalus derbyanus*), Brahminy kite (เหยี่ยวแดง, Haliastur Indus), Canis aureus (หมาจิ้งจอก,

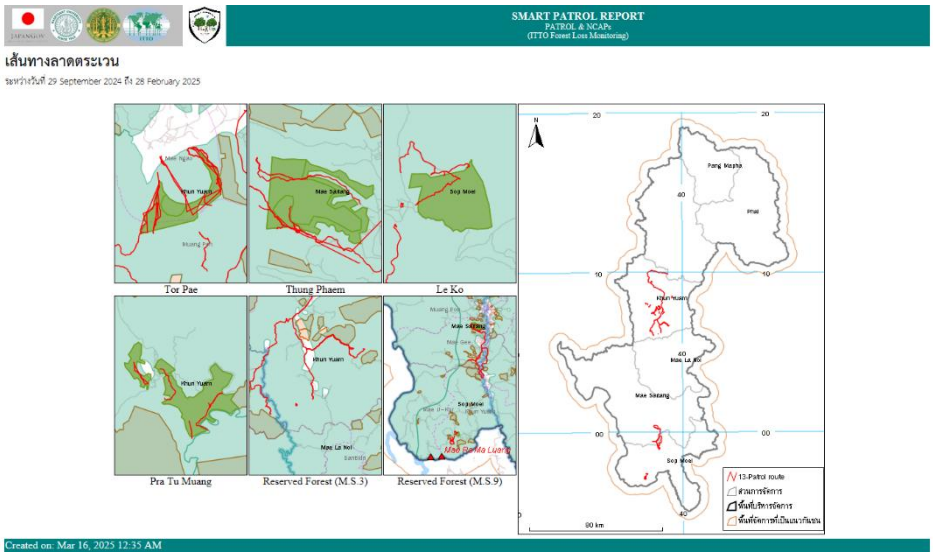
Asiatic Jackal), Banded Linsang (ชะมด, *Prionodon linsang*), and Cannomys badius (ตุ่น หรือ อ้นเล็ก, *Lesser bamboo rat*).

- ❖ Patrol route, 35 trails were recording on automatic sent data from SMART Mobile to SMART




Summary of Types of Patrol Observations (8 Types Displayed on the Map).

Summary of patrol route, six target areas show in the report query map.




**Illegal activity:**

- ❖ One time, the Forest Protection Unit Officers, M.S.3 team, and ITTO field staff successfully arrested one perpetrator involved in illegal teak logging (6 pieces of teak).
- ❖ Three cases of land clearing were observed.
- ❖ Multiple observed locations where tree cutting resulted in trees dying while still standing in the National Reserve Forests.

The picture shows teak boards seized during the arrest of the perpetrators.

Detection of processed timber during smart patrol from report Forest Protection Unit Officers, M.S. 3.

The nature of the encroachment or land clearing on the National Reserve Forests, obtained from the patrol survey, provides information that can be used to track down the offenders.

The tree cutting makes the tree die as a standing tree.

**Training Participants:**

- Two staff members were trained:
  - SMART Desktop Program Training for ITTO field staff and one officer from the Forest Protection Unit, M.S. 3 and M.S. 9, Royal Forest Department (RFD), Mae Hong Son Province.
  - SMART Mobile – training on how to create and modify the platform design and upload to use on mobile devices.
  - SMART Connect Administrator training.

## Conclusion and Recommendations

### Strengthening SMART technologies and Its Integration with SMART and NCAP Surveillance Systems

Group photo show the camera trap training in Ban Thung Paem.

Illegal activities such as logging, poaching, and land encroachment continue to threaten forests in Mae Hong Son. The integration of SMART Mobile with the SMART and NCAP Surveillance Systems enhances real-time monitoring, enforcement, and community engagement, leading to improved forest management and protection.

- Strengthen the effectiveness of surveillance and monitoring through mobile-based real-time reporting.
- Improve collaboration between rangers, law enforcement, and local communities in preventing illegal activities.
- Optimize the use of AI-driven analytics and automated alerts from camera traps for rapid response.
- The deployment of SMART technologies such as SMART Mobile in project area increased efficiency in patrol reporting, and reducing response time to illegal activities.
- NCAP camera traps have provided crucial evidence for prosecutions, strengthening legal action against offenders.
- Community engagement in SMART reporting has resulted in a higher detection rate of unauthorized forest activities.
- Institutionalize SMART technologies as a core tool in Thailand's conservation policies.
- Strengthen legal frameworks to support the use of SMART and NCAP data in environmental law enforcement.
- Provide training programs for local communities and law enforcement.
- Secure sustainable funding for system maintenance, expansion, and technological upgrades.
- Expand real-time surveillance systems, integrating drones, AI-powered analytics, and remote sensing technologies.

*By fostering continuous innovation, supporting policies, and facilitating collaboration across different sectors, both SMART and NCAP have the potential to be key instruments in protecting biodiversity, preserving ecosystems, and ensuring a sustainable future for both people and nature.*

The advancement of the SMART and NCAP Surveillance and Monitoring System in Mae Hong Son Province is a pioneering move in combining technology, community involvement, and conservation efforts to address illegal activities and safeguard natural resources. With the integration of real-time data collection, citizen science, and strategic partnerships, this initiative has bolstered enforcement capabilities, empowered local communities, and encouraged a more sustainable approach to forest and wildlife preservation.

DEVELOP SMART PATROL

AND SMART SYSTEM (SMART MOBILE SYSTEM)

ITTO Project PD-A/60-369

*Address: ITTO-FOREST LOSS MONITORING PROJECT*

*50 Ngamwongwan Road, Lat Yao Subdistrict,*
*Chatuchak District, Bangkok 10900*