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# Technical Survey and Environmental Profile of the Mekong River

## Results of Phase 1

Cambodia GeoSpatial Day 2025

18 November 2025

Institute of Technology of Cambodia, Phnom Penh

# Content

# Who we are

01

*«We are proud to put the immense potential of geographic information at the service of our clients, to help them develop their territories and improve the living conditions of their inhabitants.»*

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# Our background

**The French National Geographic Institute (IGN)** is created. It replaces the Army Geographical Service, created in 1887.

**1940**

Creation of **FIT Conseil**, a firm of surveyors, which will become GEOFIT GROUP in 2017.

**1968**

**IGN France International**, a subsidiary of IGN, is created to carry out the public institution's international activities. At first, it was dedicated to the renovation of cartographic coverage in Africa. It then opened to land management, the environment, agriculture, defence...

**1986**

**GEOFIT GROUP,** a specialist in land surveying in France for 50 years, becomes the majority shareholder in IGN France International (which becomes IGN FI) and entrusts it with the management of its export business.

**2015**

# IGN FI rely on French IGN's expertise

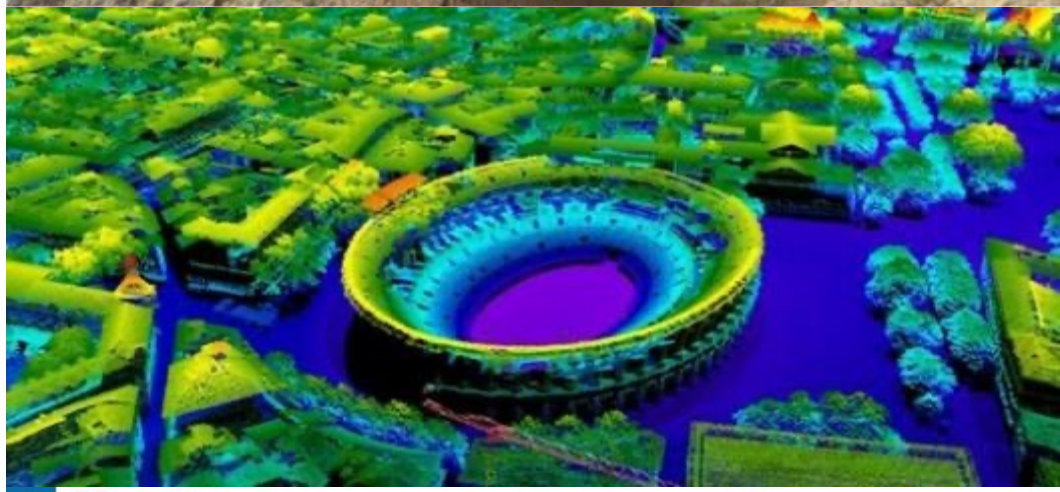
**The IGN, the public service cartographer,** is dedicated to depicting France in every detail, describing its towns, forests and landscapes, and observing its evolution.

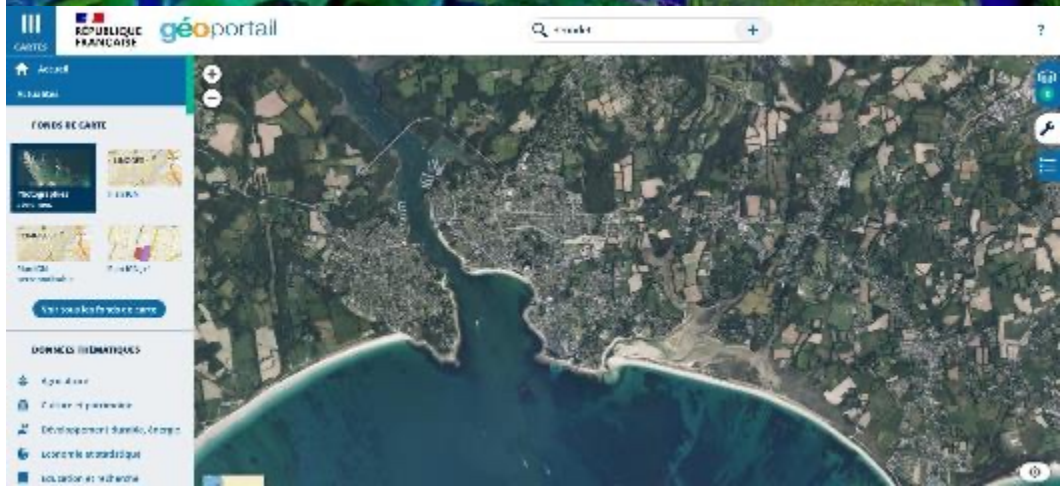
- Under the umbrella of 2 ministries: Ecology/ sustainable development; Forestry/
- 1600 employees including 40 researchers
- 2 imagerie centers (aerial and spatial)
- 1 engineering school (ENSG)
- 3 joint research units

géoportail

- **1.79 million** monthly visits to the Geoportal
- **2.9 million maps** distributed
- **2152 To** served in open data on Géoportail
- **5th most consulted** government services site

**Since 1985, IGN has been calculating the International Terrestrial Reference Frame (ITRF).**



# In brief

≈ **40 years** of experience

**50 employees** at Paris headquarters

Achievements in more than
**+ de 100 countries**

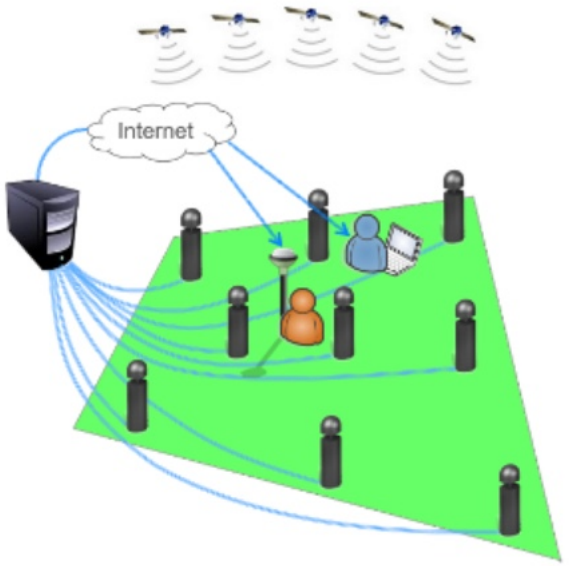
**20 M€** average annual turnover

# Global Footprint

Since 1986, our projects have taken us to over a hundred countries.

Breakdown of 2024 sales (in %)


- Active in more than 100 countries
- A presence on all continents
- 56 on-going projects
- A wide range of projects (from 15k€ to 30M€)




# Geodesy

We deploy **geodetic infrastructures** based on permanent stations and materialized networks :

- Installation of permanent station networks
- Rehabilitation or densification of existing networks
- Creation of a national geodetic reference frame through CORS and a material network

**The rehabilitation or implementation of a country's geodetic network** is fundamental to land management, urban planning, sanitation, transport, border management and national security.

These activities are complemented by **specific services:**

- Accurate geoid model based on measurements, gravimetry if needed, calculations
- Calculation and implementation of boundary lines
- Development of tools for transforming coordinates
- Technology and skills transfer
- Theoretical and practical training



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# Geodesy

- **UGANDA**
  Implementation of the new reference system for land administration • 2017-2020 & 2024-2026
- **SENEGAL**
  Modernization of the national geodetic network (CORS) and rehabilitation of existing networks • 2023-2025
- **BENIN**
  Creation of a national geoid model • 2017-2018
- **SAUDI ARABIA**
  Creation of a national geodetic reference system • 2012-2016
- **UNITED ARAB EMIRATES**
  Harmonization of the geodetic reference frame • 2024-2026
- **LAOS**
  Installation of a national reference system based on permanent geodetic stations (CORS) • 2022-2024
- **COLOMBIA**
  Installation of 13 new permanent stations for the geodetic network • 2021-2023

# Data acquisition

**Geographic data  provides accurate and comprehensive information** that is essential for effective land management, urban planning, sanitation, transport, border management, and national security.

Depending on the surface area to be covered and the level of precision required, we help organizations acquiring them by using:

- Ground sensors
- Airborne sensors
- Satellite sensors

Types of data acquired:

- Images
- LiDAR

From raw data, data processing techniques can be used to create:

- Thematic databases (raster or vector)
- Digital terrain or elevation models
- Orthophotographs
- 3D Models

# Defence/ boundaries/ civil security

- **DIRECTION MONDIALE DES DOUANES/ AVIATION GENERALE**
  Design and development of a dedicated geoportal• 2020-2022
- **INDONESIA**
  Creation of disaster management centers • 2006-2007
- **SAUDI ARABIA**
  **/ QATAR** • Demarcation and mapping of land and sea boundaries • 2010-2013
  **/ JORDANIA** • Demarcation and mapping of the land border • 2024-2026
- **CONGO**
  Land borders and maritime delimitation: negotiation assistance • 2015-2016
- **SRI LANKA**
  Post-Tsunami: reconstruction aid • 2007-2009

# Environment/ natural risks

- **SENEGAL**
  Integrated flood management project • 2021-2024
- **CEEAC**
  Assessing hazards, vulnerabilities and risks in member states • 2019-2021
- **EUROPE**
  EFFIS • 2022-2028
- **CONGO**
  Analysis of the drivers of biodiversity erosion • 2021
- **WORLD**
  Validation of data produced for the JRC “Hotspot Monitoring” initiative • 2016-2021

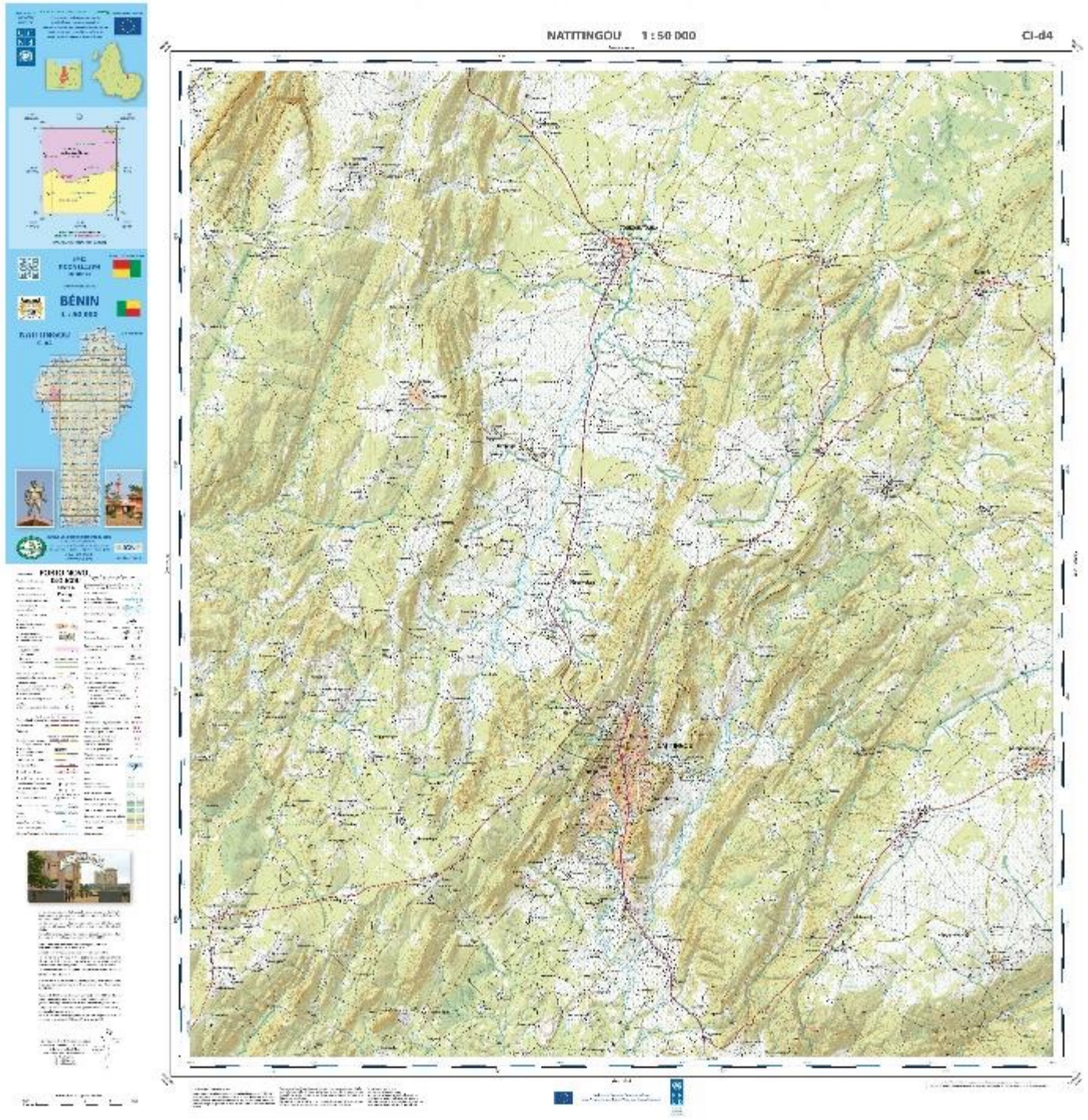
# Agriculture/ forestry

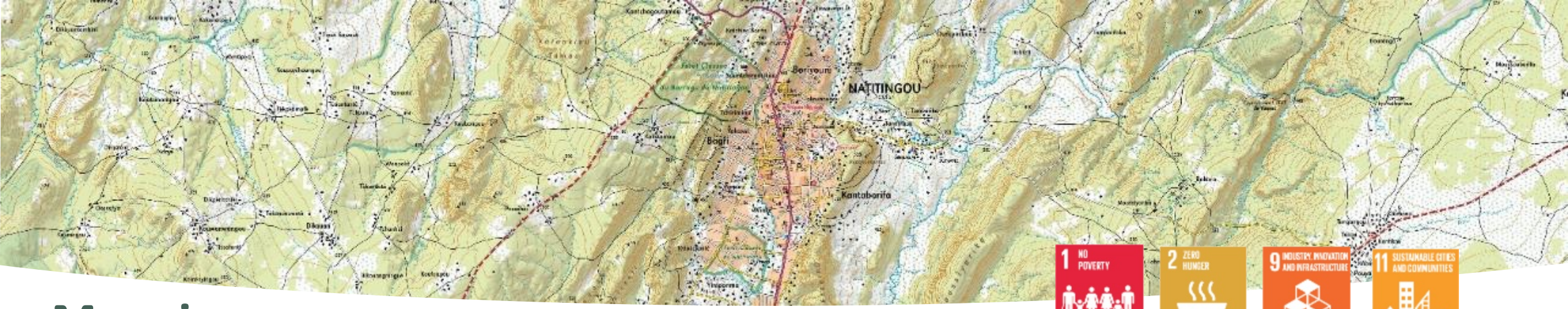
- **EUROPE**
  Validation of the CLC+ Backbone component of the new generation of land use monitoring products
  • 2020-2022
- **CENTRAL AND WESTERN AFRICAN COUNTRIES**
  Monitoring land-use dynamics using satellite images (OSFACO) • 2011-2020
- **GUINEA**
  Agro-ecological zoning project • 2018-2020
- **IVORY COAST**
  National Forest and Wildlife Inventory (IFFN) • 2019-2021
- **EGYPT**
  Crop inventory/ yield study/ water hyacinth control/ diachronic study of arable land evolution • 2006-2015
- **INDONESIA**
  Spatial analysis of land use • 2020-2022

# Mapping

The challenge is to provide our customers with **complete, multi-scale spatial control of their environments**, in both two and three dimensions, in image, vector or cartographic form.

The creation of multi-source, multi-thematic reference databases and the production of physical and digital derived products provide our customers with major tools for decision-making, development assistance and risk management.

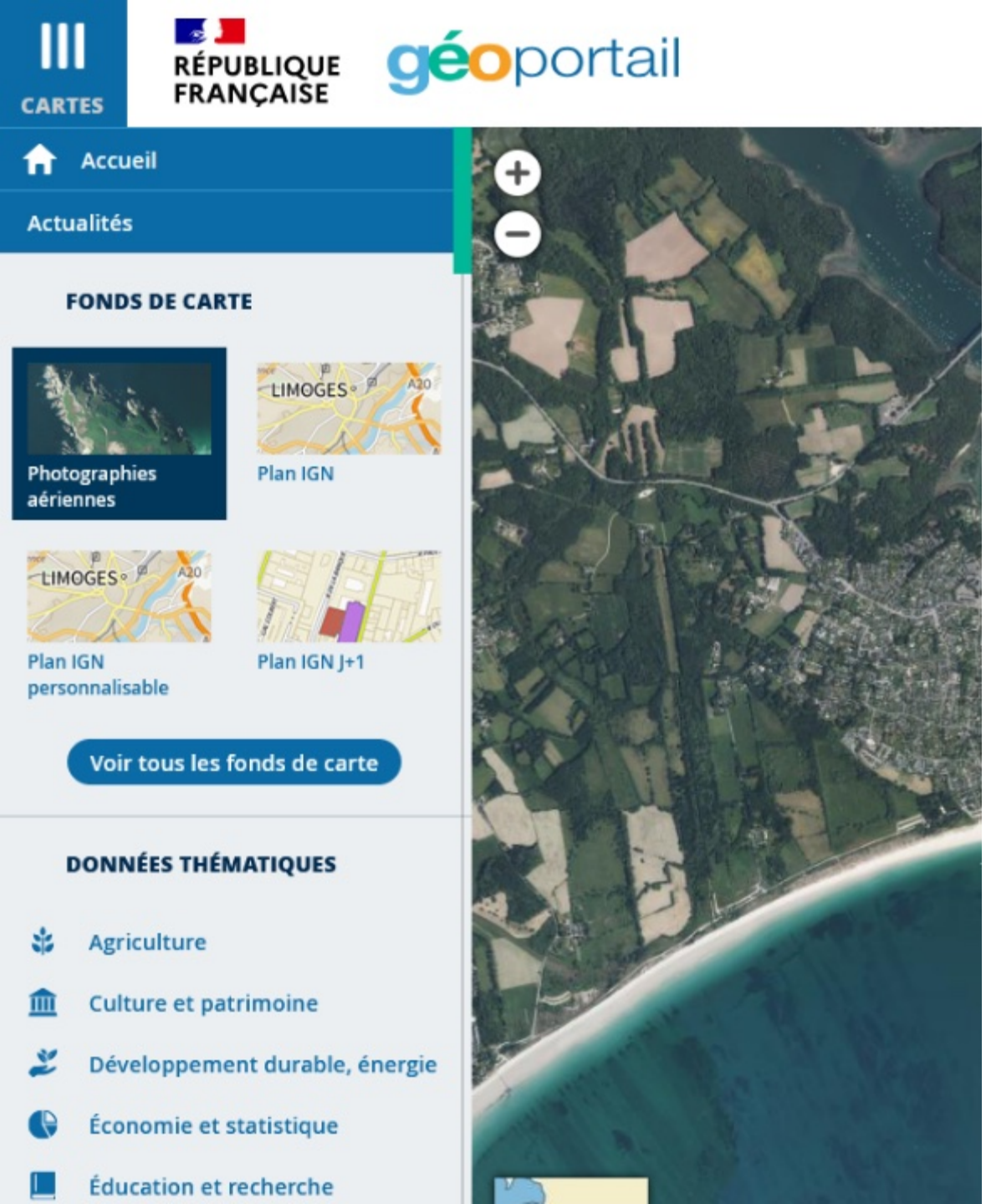





# Mapping

- **BENIN**
  National mapping at a scale of 1:50,000 • 2014-2018
- **CHAD**
  Large-scale spatial data infrastructure for the city of N'Djamena and its surroundings • 2017-2022
- **IVORY COAST**
  Addressing the district of Abidjan and setting up a unique addressing repository • 2021-2024

  Urban database (Ortho photo / MNT / BD Vector) for the Greater Abidjan and Assinie districts, as part of the Integrated Urban Land Management System project• 2021-2024
- **SAUDI ARABIA**
  Quality assurance to produce a national topographic database • 2017-2019
  Multiscale Anglo-Arab mapping of the Jordanian-Saudi border • 2024-2026
- **COLOMBIA**
  Modernization of the cartographic production chain at the national cartographic institute (IGAC) • 2021-2022
- **CONGO Brazzaville**
  Advanced multi-sector GIS training, organized for the Congolese cartography institute • 2022




# Development of spatial data infrastructures and geoportals

We design and implement infrastructures for sharing, exchanging and disseminating geographic data, **making it accessible to different users via a GIS or geo-portal**, according to their specific professions.

Our expertise in creating user-friendly geoportals ensures that geographic data is easily accessible and visualized, enhancing overall usability and impact.

Benefits:

- Enhanced decision-making capabilities
- Improved development assistance
- Effective risk management
- Comprehensive spatial control of environments
- Support for long-term strategic planning



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# Support for land governance

Drawing on its own resources and its network of international experts and partner companies, IGN FI supports **land tenure security in rural and urban areas**, conducts **mass land certifications** and pilot projects, and **contributes to the operationalization of land tenure offices**.

Specifically, we provide:

- Institutional and Legal Support
- Execution or supervision of cadastral survey work
- Rehabilitation and digitization of cadastral plans, titles, and land documentation
- Analysis of existing processes
- Data modeling according to LADM standards


# Design and development of land information systems

The development of LIS is essential for providing comprehensive spatial control of environments, enhancing decision-making capabilities, and supporting long-term strategic planning. By integrating geographic data and ensuring high-quality standards, LIS projects contribute to effective land management and risk management.

Key Activities:

- Institutional and Legal Support
- Development of land information systems (LIS) integrates geographic components and various modules related to land registry management.
- Analysis of existing processes, improvement of existing systems, data modeling according to LADM standards, design, development, deployment.
- Rehabilitation and digitization of cadastral plans, titles, and land documentation.
- Technical assistance, technology transfer, training.
- Change management / awareness campaigns.

# Formalisation / land registration

- **IVORY COAST**
  Implementation of an integrated rural land management system • 2020-2023
- **MOZAMBIQUE**
  Systematic land regularization • 2021-2023
- **MALI**
  Audit of Office du Niger land management and procedures • 2018
- **BURUNDI**
  Support for the land certification of the landscape restoration and resilience project • 2021-2023
- **MADAGASCAR**
  Operation of land certification and support to land offices - Lots n°2 and 3 • 2023-2024


# Land information system and land digitalisation

- **COTE D'IVOIRE**
  Implementation of an integrated urban land management system(SIGFU) • 2021-2024
- **CAMEROUN**
  Modernization of Cadastre and Domains (PAMOCCA) • 2019-2022
- **UGANDA**
  Setting up a nationwide land registration system • 2010-2020 & 2020-2024
- **TRINIDAD AND TOBAGO**
  Design and implementation of the land registration system • 2018-2024
- **TANZANIE**
  Design and implementation of the land management information system • 2016-2019



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# We are committed to empowering our clients by transferring knowledge and technology

Our approach includes:

- **Training Programs**
- **E-Learning Platform**
- **Long-term Support**
- **Customized Solutions**

# Methodology on Mekong River survey

02

# Consultancy Services for Environmental & River Profile Survey to Support MRC Monitoring, Forecasting, and Assessment

## Scope of the project

- **Beneficiary :** Mekong River Commission For Sustainable Development

- **Consortium**

IGN FI – Lead, technical & quality management

NP Survey – Field data acquisition & processing

CDG Laos – Local coordination & permits

- **Phase 1:**

Apr 1 – Oct 31, 2025

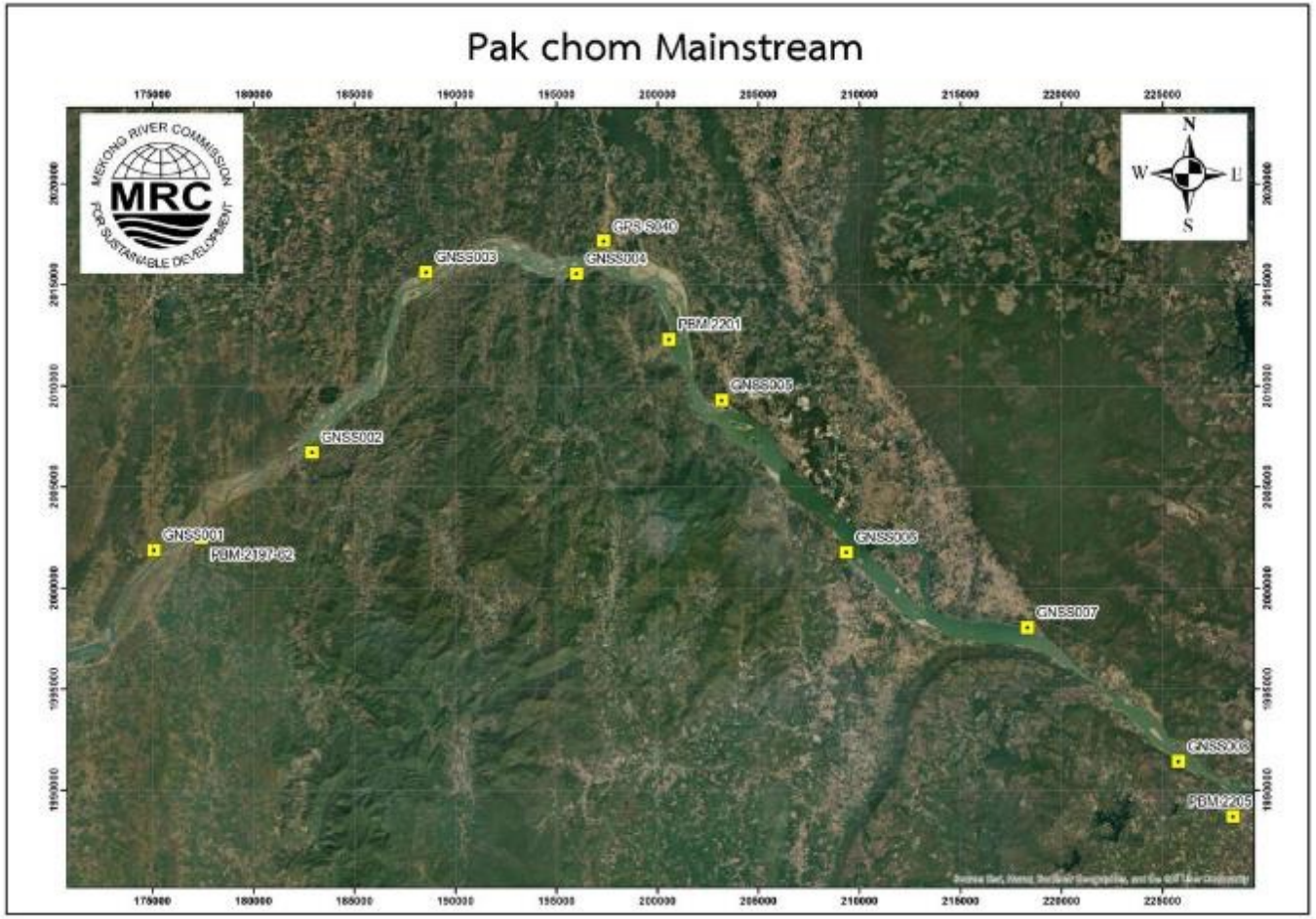
3 Main Streams: Pak Chom, Boun Koum, Phou Ngoy

Lidar & multibeam surveys, sediment sampling, cross-sections

# Methodology: Focus on Pak Chom Mainstream

## Establishment of Geodetic Control Points

- **Geodetic control points set every 10 km along the project area.**
- **Benchmarks established on both Thai and Lao sides, using national geodetic standards.**
- **Used as reference for all subsequent surveys (horizontal and vertical control).**



# LAOS: Installation of permanent stations (CORS)

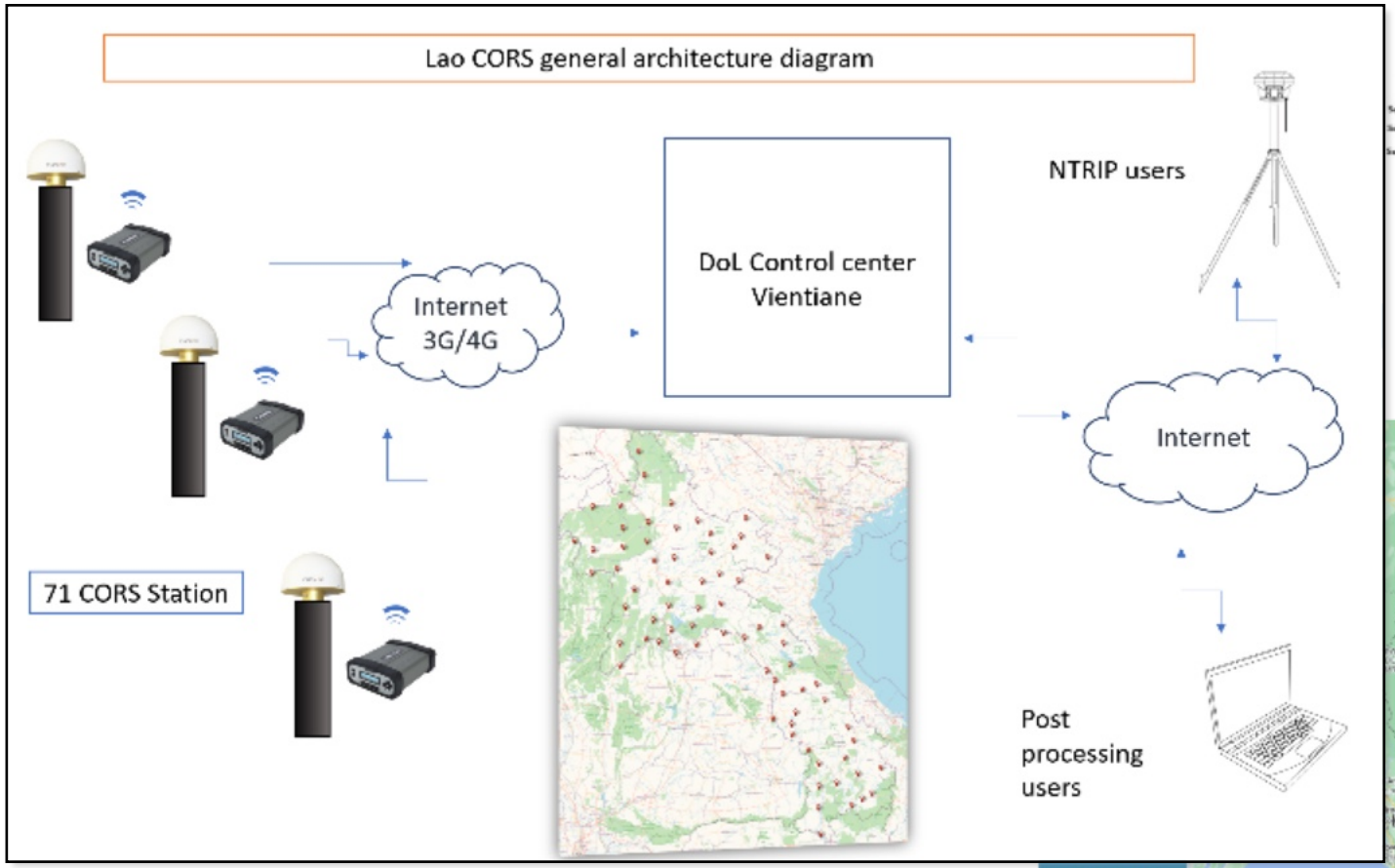
**2022-2024**

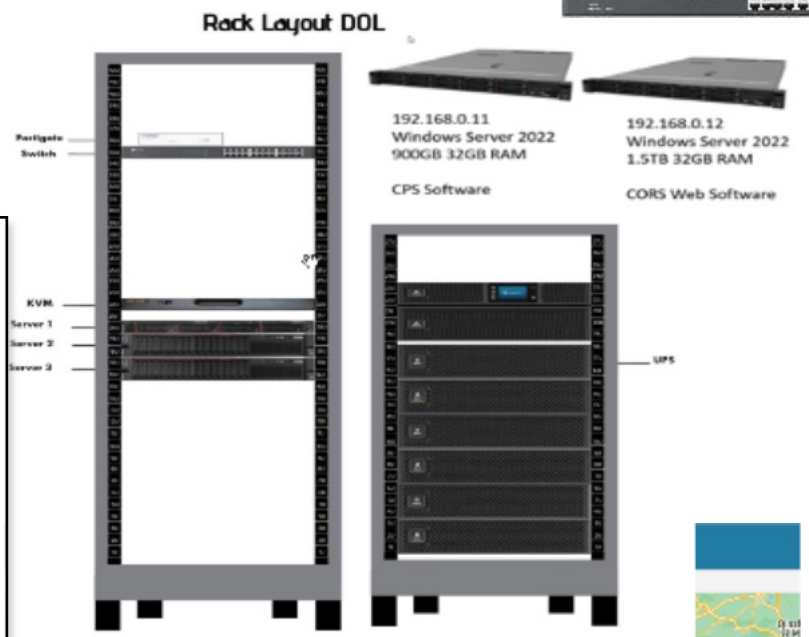
**Project to install permanent CORS stations across the country with the implementation of RTK services.**

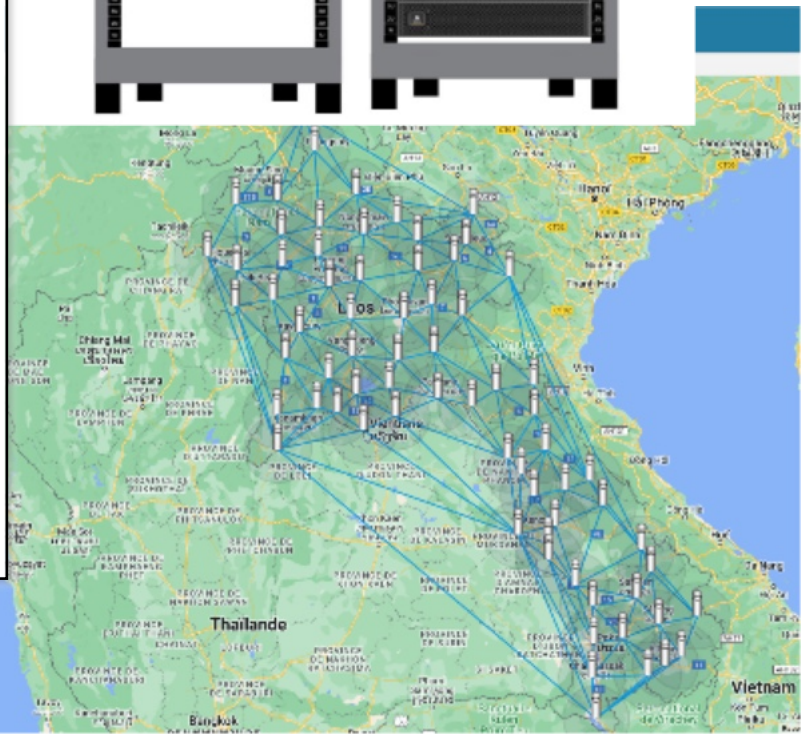
The Department of Land (DoL) already had 21 permanent operational stations and a centralized computing and management center, mainly located around Vientiane and some other urbanized areas.

# LAOS: Installation of permanent stations (CORS)

- Installation of a control center




CORS network architecture diagram in Laos

# THAILAND

Royal Thai Survey Department Reference Benchmark, Pin Number PBM.2197-62

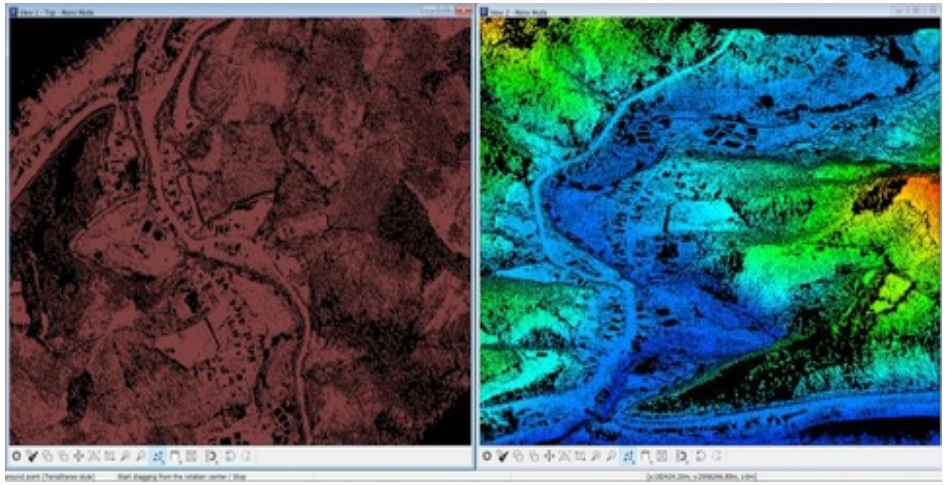
Royal Thai Survey Department Reference Benchmark, Pin Number PBM.2201


Royal Thai Survey Department Reference Benchmark, Pin Number PBM.2205

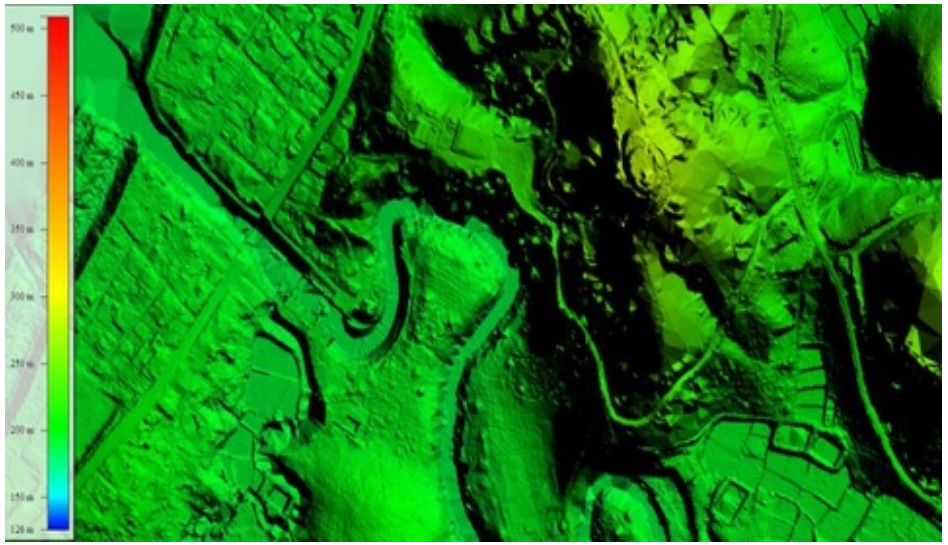
# Methodology: Focus on Pak Chom Mainstream

## Lidar Mapping

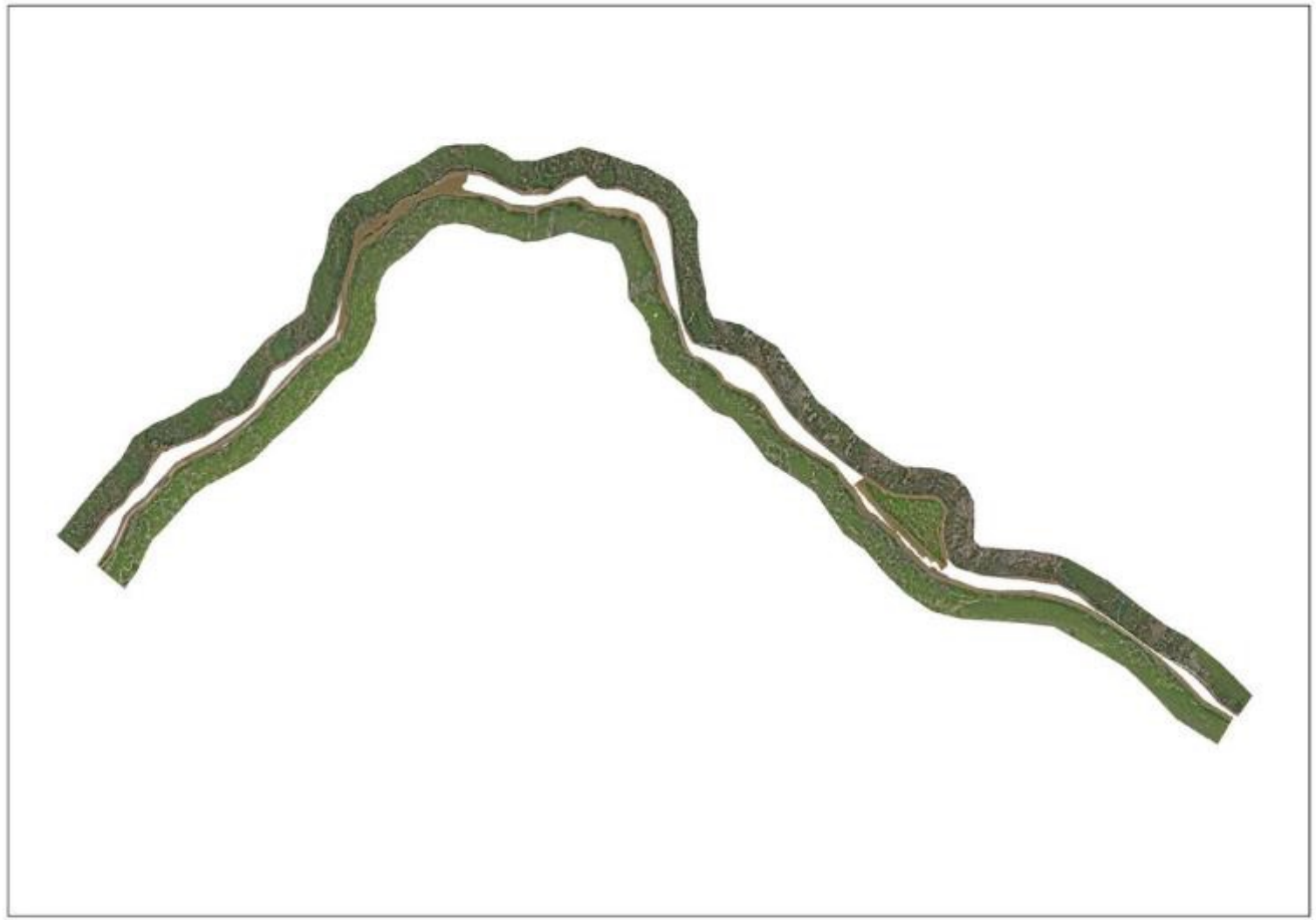
- **UAV-based Lidar survey for high-resolution topography.**
- **Flight height: 238 m; point density: ≥10 points/m².**
- **Data processed into digital elevation models (DEM) and orthophotos.**
- **Ground control points and checkpoints established for accuracy.**

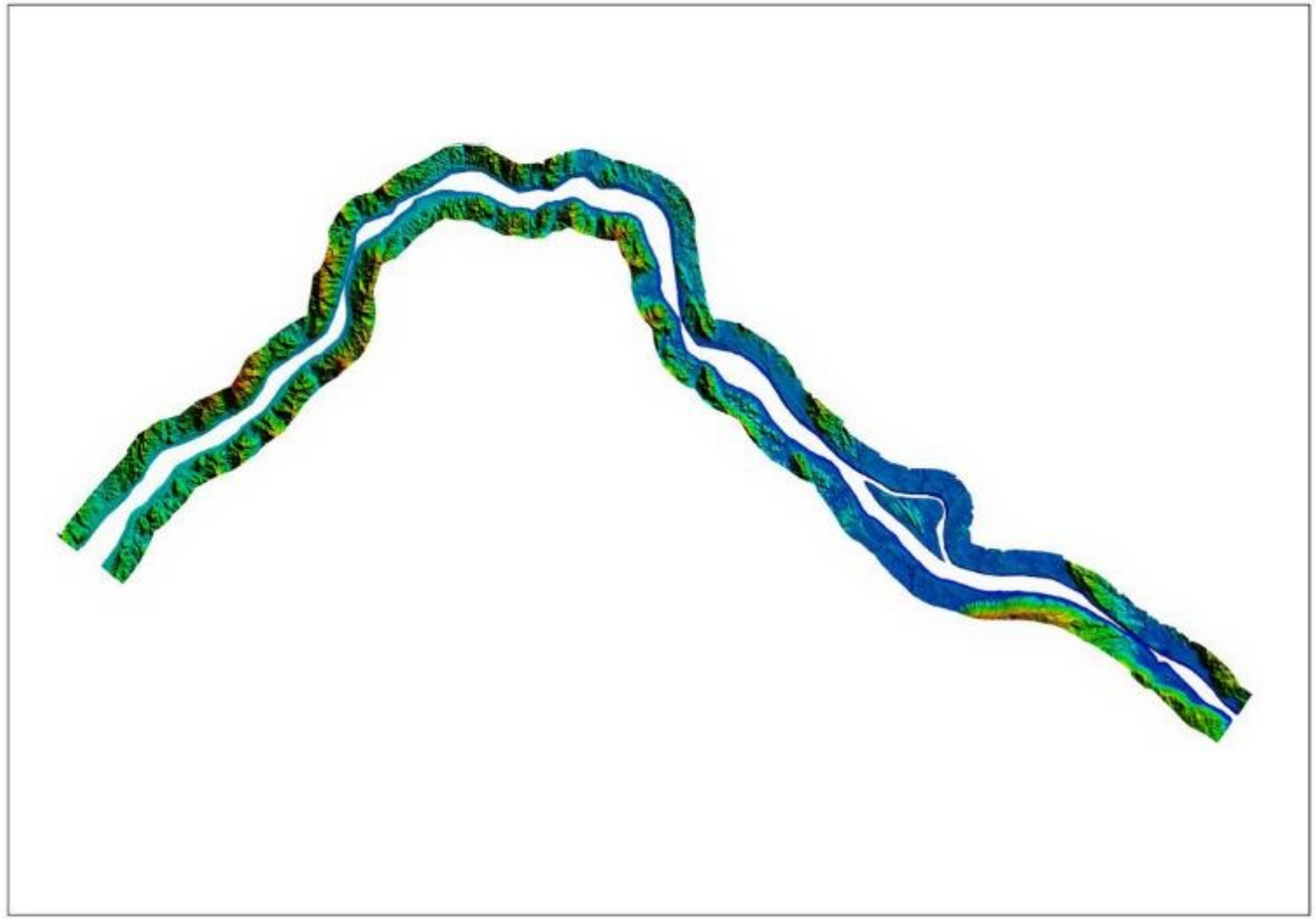


Showing Elevation calculation data from Ground Point



Digital Elevation Model :DEM), Post Processing

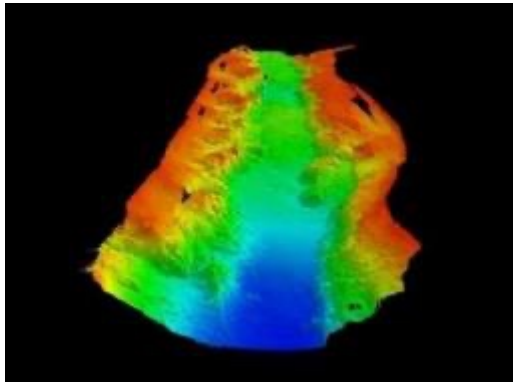


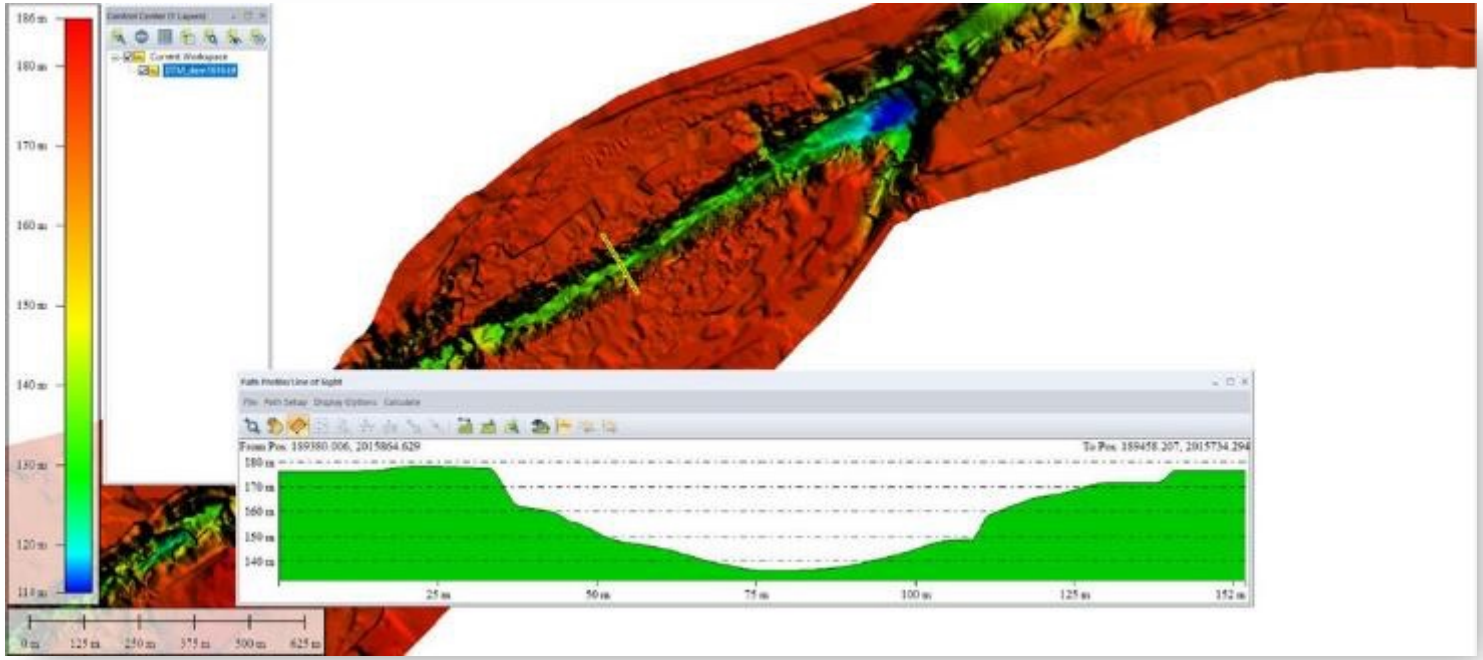


# Methodology: Focus on Pak Chom Mainstream

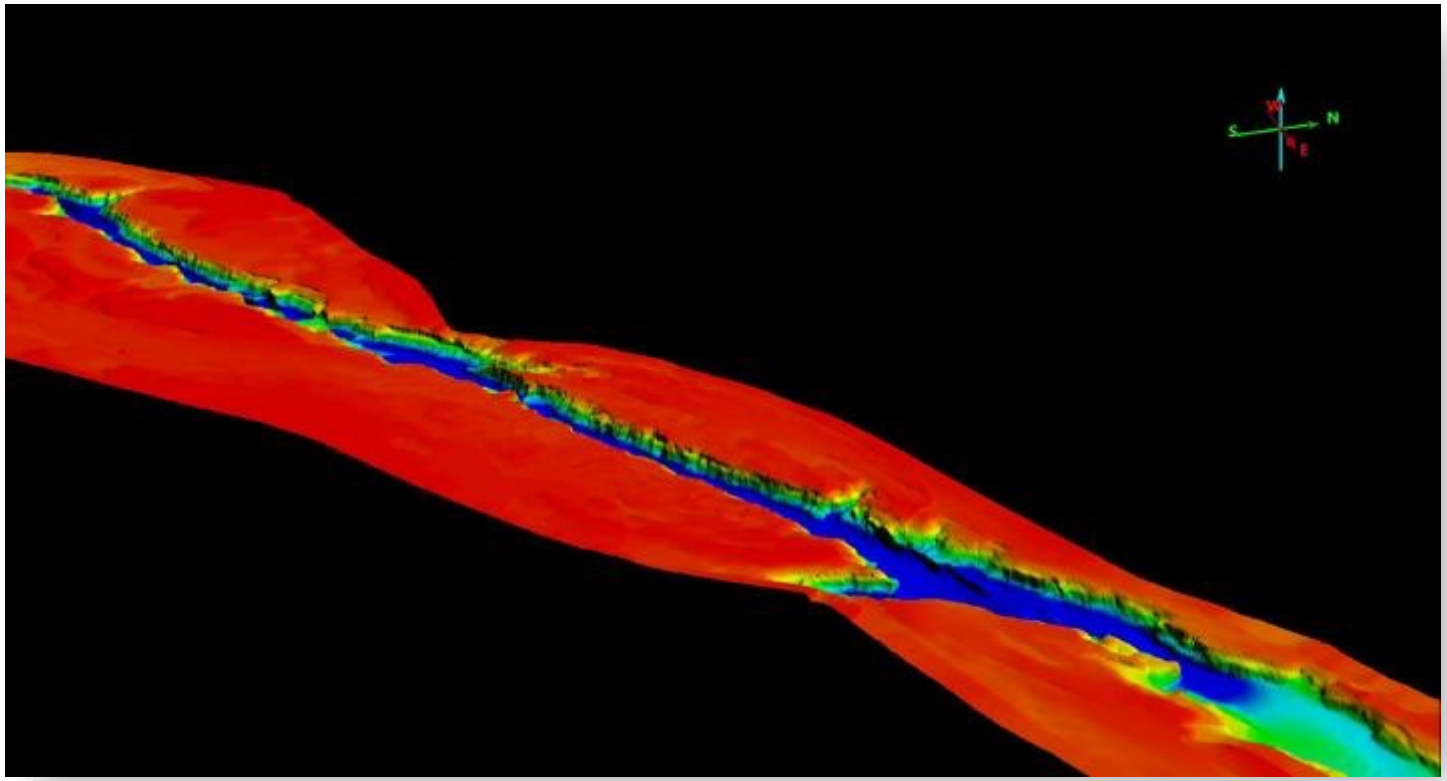
## Multibeam Bathymetry

- **High-frequency multibeam echo sounder used to map riverbed.**
- **Survey covers riverbank to riverbed along the Mekong.**
- **Data synchronized with GNSS for precise depth and position.**
- **Results processed and corrected for tides**





# DEM




3D model

# Methodology: Focus on Pak Chom Mainstream

## Cross-Section Survey (Every 1 km)

- River cross-sections surveyed every 1 km, perpendicular to river centerline.
- Data collected on river shape, slope, and underwater features.
- Used GNSS/RTK and echo sounder for both shallow and deep water.
- High-angle images recorded for verification.

# Methodology: Focus on Pak Chom Mainstream

## Sediment Composition (Every 5 km)

- **Sediment samples collected at cross-sections every 5 km.**
- **Three samples per section: riverbed, left bank, right bank.**
- **Laboratory analysis for particle size and classification (USCS standard).**
- **Results summarized in technical report.**

**Grab Sampler**

**Hand Auger Instrument**

| Test | Standard | Test Quantity (Sample) |
|---|---|---|
| Sieve Analysis | ASTM D6913 | 45 |
| Hydrometer Analysis | ASTM D7928 | 23 |

**Quantities of Laboratory Tests on Sediment Samples**

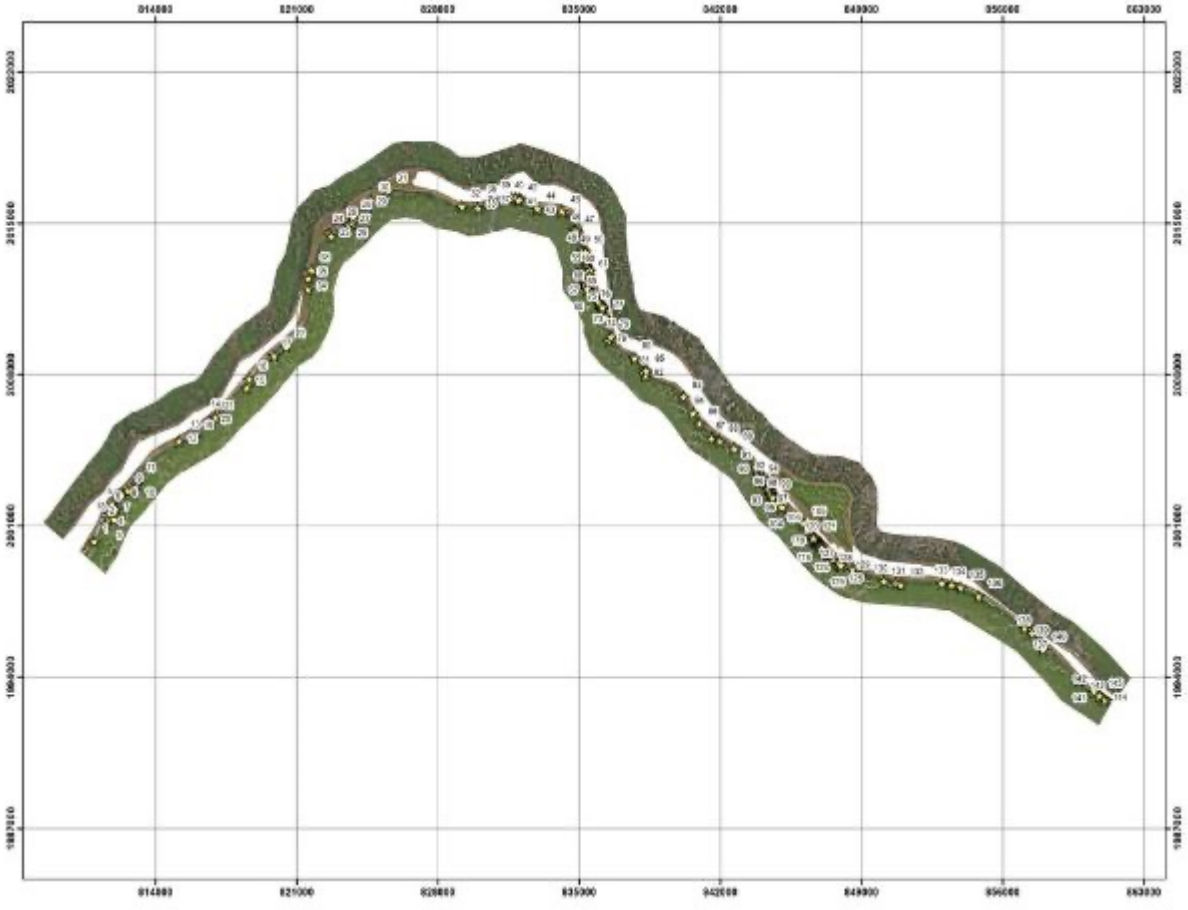
| Target Area | Soil Group USCS | Quantity (%) |
|---|---|---|
| Pak Chom Mainstream<br>15 Sections<br>45 Samples | **SAND**, including:<br>- Well Graded SAND (SW);<br>- Silty SAND/Silty SAND with Gravel (SM);<br>- Poorly Graded SAND (SP); and<br>- Poorly Graded SAND with Silt (SP-SM). | 48.9 |
| | **SILT/CLAY**, including:<br>- SILT/SILT with Sand/Sandy SILT (ML); and<br>- Sandy Lean CLAY (CL). | 51.1 |

**Summary of Sediment Types of Pak Chom Mainstream**

# Methodology: Focus on Pak Chom Mainstream

## Cross-Section Survey (Every 1 km)

- **Survey of human activities along riverbank/littoral zone.**
- **Data includes photos, coordinates, and descriptions of activities (gardens, aquaculture, sand mining, eco-tourism, etc.).**
- **145 positions surveyed, with details on community and SME dependencies.**










**Collect details of anthropological activities 001**








## Collect details of anthropological activities 002

# Methodology: Focus on Pak Chom Mainstream

## Conclusion

**Successfully surveyed 3 main Mekong streams: Pak Chom, Boun Koum, Phou Ngoy**

**Collected comprehensive data:**

- 210 km of riverbank activities, Lidar, and multibeam surveys
- 420 cross-sections, 135 sediment samples
- Technical reports delivered for each location
- Enhanced understanding of river morphology and anthropogenic impacts

**Next steps:**

- Continue the project on remaining locations (end in August 2026)
- Improve methodology and logistics based on experience of phase 1
- Enhance understanding of river morphology and anthropogenic impacts

# Potential of data produced and next steps of monitoring

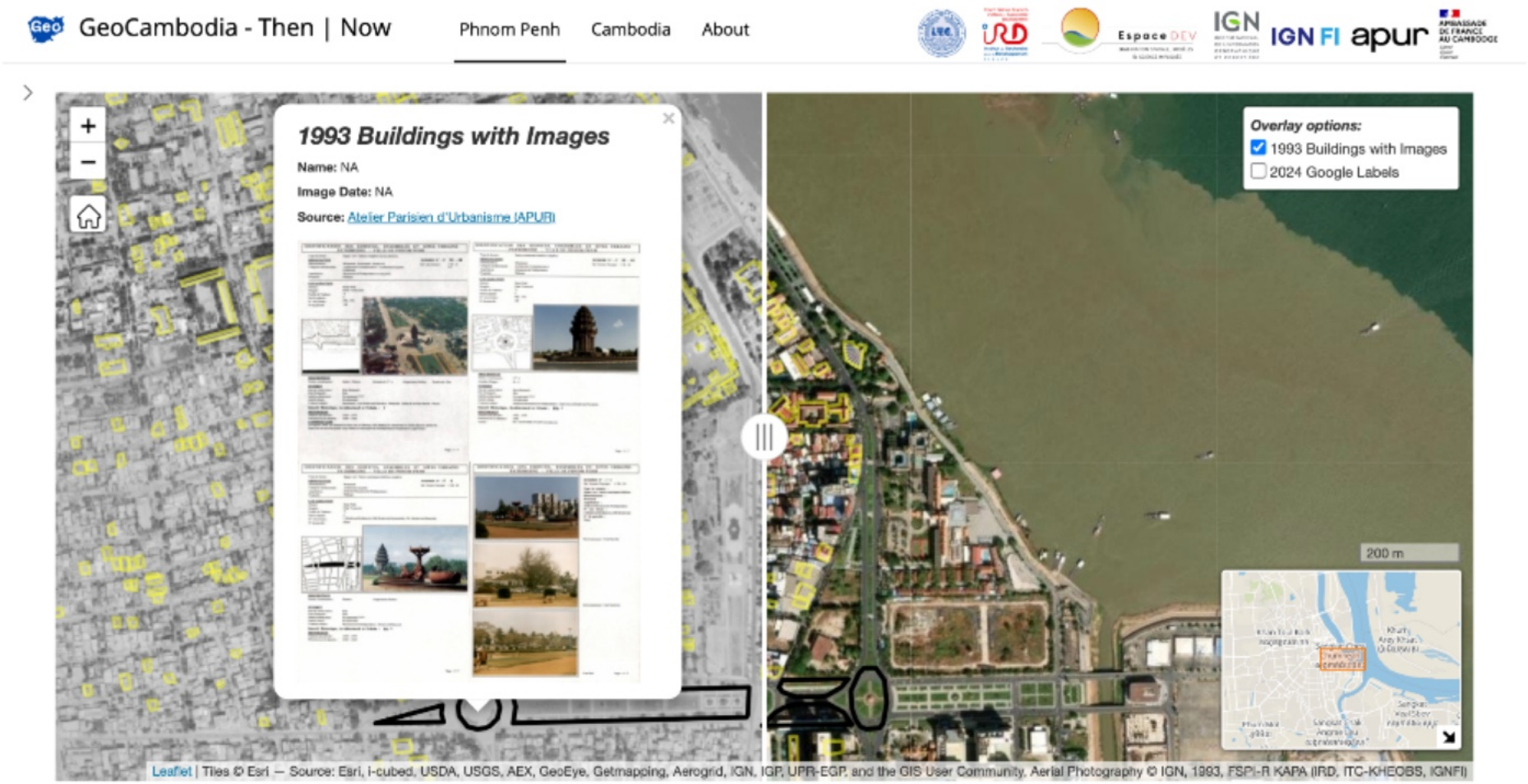
## Building on Project Success

### Advanced Environmental Monitoring

- **Integrate Satellite & Historical Data:** Combine newly acquired field data (Lidar, multibeam, sediment) with satellite time series (Sentinel, SPOT, Landsat) and archival aerial imagery to enable long-term trend analysis of river morphology, sediment transport, and flood/drought patterns.

# Potential of data produced and next steps of monitoring

## Building on Project Success



# Potential of data produced and next steps of monitoring

## Building on Project Success

**Automated Change Detection:** Use AI and time series analytics to detect changes in riverbanks, land use, and anthropogenic pressures, supporting early warning systems for environmental risks. Build a model based on data

**Key Applications:**

- **Urban Growth & Infrastructure:** Track urban expansion and critical infrastructure development along the Mekong
- **Hydropower & Infrastructure Impact Studies:** Use the data to assess cumulative impacts of dams and infrastructure on sediment flow, river health, and ecosystem services.
- **Climate Change Adaptation:** Support studies on climate resilience, flood risk mapping, and drought monitoring using the integrated datasets.
- **Agriculture & Fisheries:** Apply river and floodplain data to optimize agricultural planning, fisheries management, and food security strategies.
- **Disaster Risk Reduction:** Enhance preparedness and response strategies for floods, erosion, and other natural hazards using predictive analytics.

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# Thanks for listening!

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