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Wood Tracking Systems
System design, technologies and tools

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Regional Workshop on Wood Tracking Systems (WTS) and EU Deforestation Regulation (EUDR) Compliance: Strengthening Forest Governance in Eastern Partnership countries

Yerevan, Armenia, 22-25 October 2025

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Structure of the presentation

- Core components of wood tracking technology
- Core functionalities of WTS
- Services to a NWTS
- Tried and tested WTS tools and technologies
- Innovative IT-based solutions for EUDR due diligence information management
- Emerging technologies in Wood Tracking
- Conclusions and takeaways

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Core components of wood tracking technology (hardware, software, consumables)

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- **Unique IDs**
  - Centralised and controlled *allocation*, to system users, of uniquely-numbered, electronically readable, identifiers of individual wood products (such as barcoded tags, RFIDs), and
  - *monitoring* of their (single) use for product identification, physical marking, and declaration (product entered into database)

- **Field data capture**
  - Personal Digital Assistants (PDAs), portable computers used to aid electronic field data collection and data transfer to central database

Both (unique IDs, PDAs) **can be replaced** by:

- traditional log numbering and paint-marking / hammering, and
- paper-based tally and manual entry into the WTS,

although at the detriment of productivity and reliability
(as multiple recopies allow writing/reading errors, and poor control facilitates fraud such as multiple use of numbers, forged documents, double accounting systems, etc.).

Adding-in these two features can be part of a phased-in development and implementation plan of the system.

- **Central database / cloud platform**, running on servers for local system applications and data backups

- **Integration points:**
  - Field data capture devices and sensors (data, images…)
  - User and partner institutions' ERP systems (Customs, Tax Dept., Banks etc.) and GIS systems
  - Data centre for external data saving and backups

- **Connectivity**, and protocols for data transfer to central database based in system operation unit

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Core functionalities of WTS

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- **User interfaces:** users, stakeholders with different access/use rights
- **Data capture/collection:** methods (manual or electronic entry of declaration/ inspection data, data upload; automated sensors)
- **Analytics and reporting tools**, for (+/-) automatic monitoring and verification processes:
  - data processing and preparation of documents ("reports"), such as declarations, listings etc. at each step in supply chain
  - data cross-checks, for completeness, format, conformity against specified sets of rules, within tolerance levels, and for consistency
  - tracking wood movements, status and stocks ("near real-time")
  - ensuring 3 pillar legality (origin, compliance, taxes)

Functionally, a WTS allows system operators to:

- Register users with different access and use rights
- Register statutory documents pertaining to the users: official titles, forest management plans, permits, tax receipts etc.
- Receive and upload data sets from forest management units: forest inventories, harvesting declarations, way bills etc.
- Process data and conduct data verification checks for regulatory compliance, through systems and documents or in the field
- Reconcile “inspected data” and “declared data” sets

- Highlight non-conformities, and issue reports (“clear of findings”, or discrepancies)
- Send alerts and invite automatic or manual interpretations
- Produce automatic, or support customized reports
- Trigger inspections, corrective action requests
- Validate final data sets
- Conclude on the compliance of an operator or a batch of products, and issue statements etc.

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Services to a National WTS

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- Documentation: System requirement analysis, Functional specifications, Technical specs, Procedures, User manual…
- Software development ("agile" mode), testing and enhancements
- Procurement of hardware, system deployment
- Training of users
- Hosting of central database
- Data management (in-house/contracted out)
- Support and maintenance (in-house/contracted out)
- Hosting of data backups (external data centre)
- Third-party auditing / monitoring / certification

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Tried and tested WTS tools and technologies

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Overview and use cases of:

- Tags/labels, barcode/RFID systems, GPS sensors
- PDAs/smartphones/barcode readers
- GIS: role in mapping and tracking, incl. EUDR geolocation
- EUDR due diligence information management (next)

- **Tags/labels for unique ID of raw wood products:**
  - Plastic tags or printed labels
  - Affixed on trees, stumps, logs, planks etc.
  - Bear alphanumeric or barcoded no. (electronic reading), encrypted (for secure transmission) or not
  - Do not store information, but link each physical product with its associated information in the database
- **PDA/smartphone:**
  - Equipped with barcode-reader and specific SW app
  - Electronic field data collection and downloading / transfer of data, to a desktop computer in office and to central database
  - Increasingly replaced/complemented by smartphones (if 4G)

- **Barcode-reader alone:** only supports tally counting (listing)
- **RFID** (Radio Frequency Identification) **tags:**
  - Can be used to identify, track wood products throughout supply chain
  - Store information: product origin, species, processing status etc.
  - Limitations: Electronic device (PDA) required to upload/download data to/from it. Suitable for large saw-logs; but to be tested for wood fuel in bulk (bundles, big bags, truckloads)
- **GPS sensors** (/emitters through satellite data comm. network)**:**
  - Can provide real-time location tracking of entire truckloads of wood, as part of vehicle tracking system (not suitable for itemized products).
  - This can be integrated within NWTS, for a fleet of exclusive, dedicated trucks, equipped for the purpose (examples: pulp and paper industry in Scandinavia, Portugal)

- **Geographical Information Systems (GIS):**
  - Designed to capture, store, analyse, manage, and present spatial or geographic data, in maps or tables of coordinates etc.
  - Enable users to visualize and interpret information in relation to its geographic context

- **Relevance of GIS for mapping, wood tracking, EUDR compliance**
  - GIS can help monitor the supply chain by mapping harvesting sites, log yards, tracks and roads, processing and storage facilities, and distribution routes and sites, enhancing transparency and traceability
  - EUDR requires precise geolocation of wood harvesting sites. GIS can provide detailed maps and data analysis to verify that wood is sourced legally without causing deforestation

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Innovative IT-based solutions for EUDR due diligence information management

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"*The problem is not the [geolocation] data. The problem is how to 'transport' this data*" (System Performance Director, FSC International):

- Issue of sharing sensitive, traditionally confidential, commercial information: revealing sellers and buyers' identity among chain of private sector operators and traders, before and after export

- New solutions exist to transfer geolocation information, without full traceability through every step in the chain

- Examples:
  - FSC is introducing **FSC Blockchain – Transforming Supply Chain Integrity** to support EUDR compliance
  - Others: see blockchain, and next presentation

- Such solutions, designed for implementation within private supply chains, of individual businesses or communities of traders like FSC or PEFC, not for integration into national systems like NWTS

- In contrast, **NWTS** ensures confidentiality of information, held by a trusted third party, avoiding data privacy or security concerns for public / private sector users

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Emerging technologies in Wood Tracking

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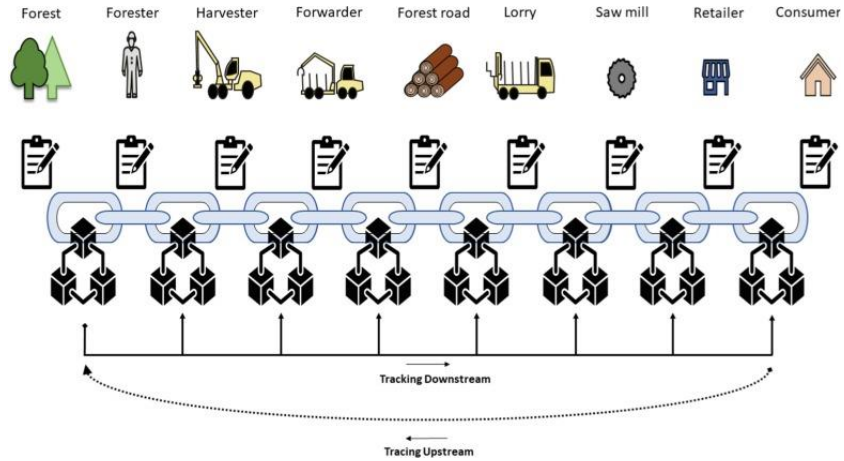
- **Blockchain technology:** secure, tamper-proof tracking of wood provenance, enhancing transparency and trust in wood supply chains
- **Internet of Things (IoT):** real-time data collection and monitoring
- **Artificial Intelligence (AI) & Machine Learning:** predictive analytics for supply chain risk management and automated anomaly detection



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Blockchain technology and relevance for WTS

- **Blockchain definition:** Digital ledger, securely records transactions across supply chain users' computers. Data cannot be altered retroactively
- **Use:** real-time data sharing among stakeholders, and secure storage of compliance documents, to verify transactions and legal sourcing
- **Immutable, verified, auditable records**, have potential to :
  - ensure a permanent, trustworthy history of the wood's journey from forest to consumer and enhance its origin verification and legality
  - deter fraud by making it difficult to falsify documents or misrepresent the product's origin
- **Consumer trust:** By providing verifiable sourcing information, blockchain encourages responsible purchasing decisions; contributing to a more accountable and efficient wood supply chain

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Main limitations of using blockchain tech.

- **Adoption:** must be by all stakeholders in the supply chain
- **Integration:** Connecting diverse systems and processes (suppliers, agencies, transporters), adds complexity, requires training
- **Costs:** Initial setup and ongoing maintenance, especially for smaller businesses
- **Scalability & Data Volume:** Tracking large quantities of timber involves massive amounts of data. Blockchain networks may be too slow or costly for frequent timber updates
- **Data Reliability:** Inaccurate or fraudulent information recorded cannot be changed. Physical verification (sensors, audits) still needed to prevent fraud

- **Physical-digital gap:** Blockchain tracks only digital records. In itself, it does not provide itemised traceability in the absence of individual product numbering
- **Data privacy concerns:** balancing transparency with sharing sensitive business information (as with EUDR DD information)
- **Solutions:** restricted access rights, data encryption, selective disclosure, empty statement truthing, etc.
- **Interoperability:** Multiple blockchains also hard to integrate; cross-chain communication limited
- **Relevance:** only for long but simple, international, private supply chains? Won't replace all NTWS' functionalities at home.

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The Internet of Things (IoT)

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- **Definition**: A network of physical objects embedded with sensors, software, and other technologies that enable them to connect and exchange data over the Internet
- **Connectivity:** allows for real-time monitoring and control of devices and systems (e.g., stocks on a supermarket shelves)
- **Range of IoT sensors:**

  - **RFID tags , GPS sensors:** already discussed (not really "emerging" tech.)

  - GPS sensors: not suitable for tracking individual wood products

  - **Camera systems:** example of SUMAL system in Romania

  - Other types: monitor parameters (moisture, temperature, vibration, environment), not relevant for wood tracking

  - **Only RFID tags are potentially relevant sensors** for individual wood product tracking

IoT + Blockchain work well together

- **Blockchain** = Immutable record of all supply chain events
- **IoT** = Reliable, (semi-) automated tracking data transfer (using RFID tags), as tag moves with wood products being transported between two places
- **Together: close the physical - digital gap** (build itemized traceability, with unique IDs), making fraud, substitution, or mislabeling harder
- **Limitations to keep in mind:**

  - RFID technology, to be adapted for wood fuel products in bulk (fitting)

  - Cost: IoT devices (sensors, tags) can be expensive for small suppliers

  - **Integration:** Requires standardization across forestry agencies, transporters, and retailers

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Artificial Intelligence (AI)

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- **Definition:** AI algorithms simulate human intelligence in machines, and programmed to learn, including capabilities like reasoning, problem-solving, understanding natural language, and recognizing patterns
- **AI can enhance WTS:**
  - **Data Analysis, Predictive Analytics:** vast amounts of data from various sources, to identify trends and patterns in wood supply chains, and helping to make predictions
  - **Example:** Monitoring, assessment of illegal logging risks, based on historical data and environmental/social factors, and analysis of stakeholder reports, *very interesting to guide risk-based data verification and field inspections and so maximise cost-efficiency of enforcement efforts.*

- **Automated Reporting:**
  - Generating real-time compliance reports
  - Sending alerts to stakeholders
  - Note: like WTS can also do…

- **Other examples of applications:**
  - Wood species identification (image recognition)
  - Remote sensing and change detection
  - Regulatory compliance checks: analysing legal documents and regulations, to ensure stakeholders understand and implement the latest requirements

By automating these processes : AI improves the efficiency and accuracy of monitoring and enhances the ability of organizations and governments to enforce regulations, promote sustainable practices, and protect ecosystems

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Conclusion, Key takeaways

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National WTS are critical for legal, traceable timber trade:

- NWTS best option for efficient national forest sector monitoring while addressing data privacy concern

Future trends: increased adoption of blockchain, IoT and AI in a NWTS, but will not replace it

Points of attention for NWTS:

- Respective merits of different product marking/tagging systems to ensure real traceability (unique IDs transferred across transactions)
- Importance of effective data management and field checks

- Importance of a reliable final “certificate of compliance”
- Contracting out option of system operation vs. third-party auditing / monitoring of system
- Cost of deployment and operation, imposing pragmatism in system design and implementation
- Need for training, capacity building, and empowerment for adoption and promotion of integrity
- Opportunity to use, or reuse, and adapt an existing generic platform, where suitable (Romania’s SUMAL, Ukraine system, VPAs, others?) to develop different versions of the same NWTS in several EaP countries

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