# Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region

# Research Paper and Summary Report

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**APEC Sub-Committee on Customs Procedures**

**May 2025**

Asia-Pacific
Economic Cooperation

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Produced by
National Superintendency of Customs and Tax Administration (SUNAT) of Peru

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## EXECUTIVE SUMMARY

This research paper is developed within the framework of the project “Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region”, endorsed by the Sub-Committee on Customs Procedures (SCCP) of the Asia-Pacific Economic Cooperation (APEC). The main objective of the project is to improve the capacities of customs administrations in the region to identify and control illegal trade of goods that have a negative impact on the environment, focusing on compliance with Multilateral Environmental Agreements (MEAs) such as the Basel Species of Wild Fauna and Flora - CITES. The scope of the project also includes species such as timber, fauna and hydrobiological resources that are not protected under CITES but are regulated by domestic regulations that also seek to guarantee their sustainable trade and prevent their illegal exploitation.

The research conducted focuses on the identification and evaluation of technologies applicable to the field of customs to facilitate the monitoring of regulated goods, such as hazardous wastes, ozone-depleting substances, endangered species of wild flora and fauna, and hydrobiological resources. Among the main technological solutions analyzed are: *Transparent Forest, SIGO$_{SFC}$ & SIADO-Region, Wild Cats Parts Identification Guide, the Ultima ID Pro refrigerant analyzer, DNAID-Elasmobranchs, Vanta® XRF, XyloTron and DART-TOFMS*. These versatile tools enable customs administrations to improve efficiency in the control of goods that impact the environment.

For each technology evaluated, the analysis addressed eight key aspects: detection of the need and/or identification of the problem; technical equipment, design and construction process; implementation, conditions and method of use; target goods; evaluation and results; challenges, opportunities for improvement and future projections; cost, maintenance and lifetime; and other additional information of interest. However, the depth of the analysis of each aspect varied according to each technological solution, either due to the prioritization of the most relevant aspects based on their applicability and context, or due to the limited information available at this stage. The latter is due to the fact that some of the scientists involved in the development of these technologies are in related processes, such as indexed scientific publications, which restrict access to certain data.

The conclusions of this paper indicate that the incorporation of these technologies would represent significant advancement for customs administrations in terms of environmental management. However, this paper identifies challenges related to the concerted efforts of the agents involved, compatibility with complex samples, expansion of the database and the need to ensure sustainable financing. Close cooperation between customs, academia, international organizations, NGOs, other APEC fora and the private sector is a valuable component for APEC economies to exchange knowledge and resources, thus achieving more efficient and sustainable customs management.

## INTRODUCTION

As awareness of global environmental issues such as climate change and biodiversity loss increases, it becomes crucial for customs to adopt advanced tools to prevent illegal trade of goods that negatively impact the environment.

Compliance with Multilateral Environmental Agreements (MEAs) such as the Basel Convention, the Montreal Protocol and the Convention on International Trade in Endangered Species - CITES, as well as ensuring the sustainable trade of those species such as timber, fauna and hydrobiological resources, which do not have a degree of protection under CITES but are regulated by domestic regulations, should require customs systems with solid technical capabilities to identify regulated goods.

Customs administrations play a crucial role in implementing these MEAs once an economy has adopted them, not only to facilitate legal trade but also to mitigate illegal trade by confirming that international trade of goods complies with environmental regulations and contributes to global efforts to preserve the environment. However, the adoption of innovative technologies to address the challenges of illegal trade and unsustainable resource exploitation remains limited. This gap highlights the need for a more structured approach that incorporates technological solutions in line with the customs realities of the Asia-Pacific region.

The project “Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region”, endorsed by the APEC Sub-Committee on Customs Procedures (SCCP), seeks to address this need. Led by Peru, and co-sponsored by Australia; Chile; New Zealand; the United States; and Viet Nam, the main objective of this project was to identify, evaluate and globally select available innovative technological solutions that enhance the capabilities of customs administrations in the region to facilitate the identification and control of illegal trade in regulated goods, focusing on first-line controls assisted by customs laboratories. At the same time, the project aimed to promote close cooperation between customs, academia, international organizations, NGOs, other APEC fora and the private sector, within a framework of regional cooperation.

In this context, the innovative technologies selected for this project and reflected in this research paper, although dispersed globally or not yet implemented in the customs field, represent a collaborative effort to integrate tools that meet the criteria of versatility, speed of response and level of accuracy in customs processes. Solutions such as Transparent Forest, which facilitates the traceability of forest products, and advanced tools such as DART-TOFMS, designed for rapid and reliable chemical analysis, stand out for their ability to address specific challenges in the control of goods with environmental impact. These technologies would not only help customs to confirm compliance with MEAs, but also significantly improve efficiency and effectiveness in the identification and control of critical goods.

## METHODOLOGY

The methodology used for the identification and selection of practical and highly accurate technologies applicable in the field of customs followed a mixed and structured approach, combining documentary review and interactions with representative of domestic and international entities. It is important to mention that the research, analysis and drafting of this document was carried out by staff from strategic areas of the National Superintendency of Customs and Tax Administration (SUNAT), ensuring that the work remained fully aligned with the project's objective.

This methodology comprised several phases:

1. **Documentary review and technical training:** An exhaustive analysis of MEAs was carried out, focusing on the Basel Convention, the Montreal Protocol and CITES. This process made it possible to identify the goods regulated by these agreements, as well as others not included in them but regulated by domestic regulations, such as timber, wildlife and hydrobiological resources. In addition, complementary readings and technical training was provided on the challenges associated with these goods.

2. **Open-source research and networking:** Based on the documentary review, the search for innovative technological solutions with characteristics in accordance with the reality of customs administrations began. This stage included consulting open sources as well as a network of local and international contacts.

3. **Consultations with domestic entities and meetings:** Direct consultations and meetings were held with domestic entities in charge of or linked to the target commodities, such as ministries and specialized entities, to obtain local perspectives on control needs and available technologies.

4. **Consultations with international organizations, meetings and interviews:** Direct consultations and meetings were held with the Basel Regional Center for South America, regional project coordinators, as well as NGOs and specialized international organizations, which provided access to technical data and facilitated contact with scientists and/or technology experts, with whom interviews were conducted.

5. **Technical evaluation and prioritization:** With the information gathered, the technologies identified were evaluated considering main criteria such as versatility, speed of response and level of accuracy. This analysis made it possible to prioritize the optimal technological solutions based on their practicality, speed, effectiveness, cost, accessibility and alignment with the project's target commodities.

6. **Construction of the final analysis:** The results obtained were organized and synthesized in this paper, integrating an analysis based on eight key aspects: detection of the need and/or identification of the problem; technical equipment, design and construction process; implementation, conditions and method of use; target goods; evaluation and results; challenges, opportunities for improvement and future projections; cost, maintenance and lifetime; and, other additional information of interest.

   This methodology ensured an analysis aligned with the project's objectives, generating a practical framework for the implementation of technological solutions in customs.

**Technological solutions**

Technological solution : **The Origin Project**

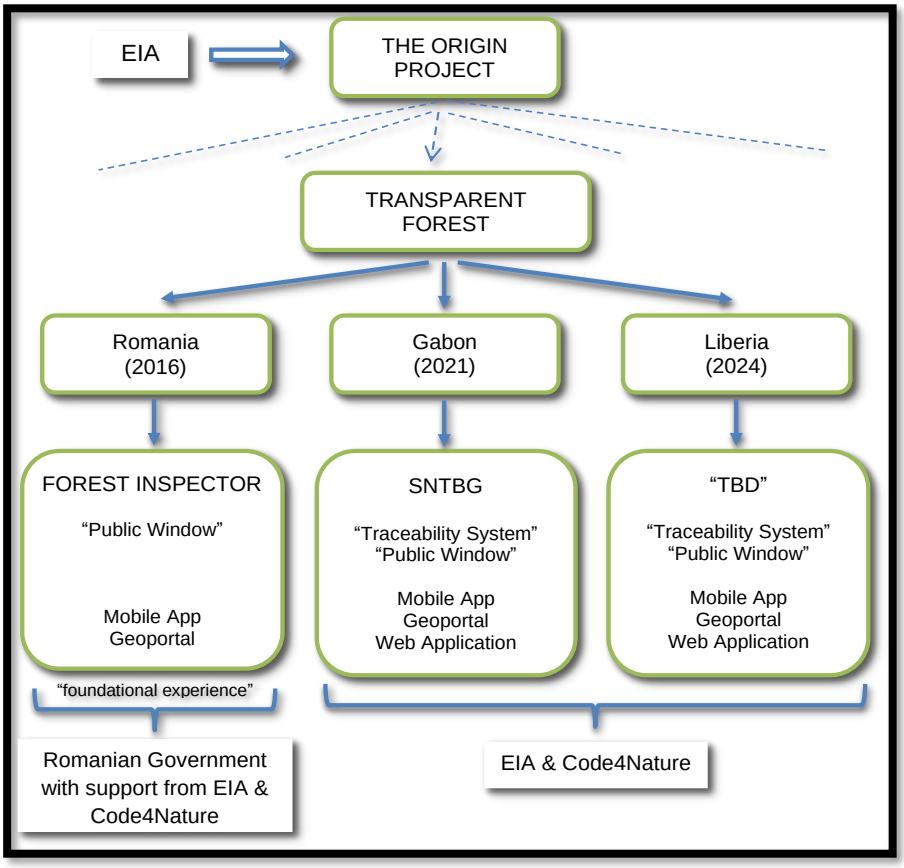
Supplier : **Environmental Investigation Agency (EIA) and Code4Nature (C4N)**[1]

The Origin Project is a global initiative of the Environmental Investigation Agency (EIA) that aims to achieve greater transparency in the supply chain by helping to find or require information on the origin of wood products. This initiative includes various actions designed to ensure that data about the origin of wood products is transparent and publicly accessible.

A fundamental part of this initiative is based on the open-source transparent traceability system called "Transparent Forest", designed and built by EIA and Code4Nature, which is the basis for developing different and unique versions that adapt to the context of each economy (domestic systems). The version for Romania is called "Forest Inspector", which is both a mobile application and a geoportal that serves the function of a "Public Window", which was developed by the Romanian government and from where the foundational experience to adapt the following versions came from.

The version for Gabon is called SNTBG (le Système National de Traçabilité du Bois du Gabon), which is a mobile application, a geoportal and a web application, representing the most complete version to date. EIA and Code4Nature are currently working on a new version that will be adapted to the needs of the Liberian economy. The versions for Gabon and Liberia, in addition to the "Public Window" function, also have the "Traceability System" function, both versions have been built by EIA and Code4Nature.

**Evolution of the technological solution: Transparent Forest**




Source: Prepared by the author

[1] Environmental Investigation Agency (EIA), *The Origin Project: Promoting Transparency in the Wood Supply Chain*, Environmental Investigation Agency, https://www.eia-international.org.

## 1. Detection of the need and/or identification of the problem

This global initiative of the EIA is part of its Forest Campaign, which aims to ensure a future in which the world's forests are managed in a more equitable, transparent and accountable manner, and in which global consumption is no longer an obstacle to this governance, but rather a force for supporting it. Forest-dependent communities in producer economies, forest commodity producers, civil society, and governments must all be empowered to play a key role in managing their resources sustainably.

The lack of accurate digital data across producer-economy commodity supply chains exposes these systems to fraud and criminality and undermines sustainability and forest conservation efforts. The EIA seeks to address this critical gap and empower all stakeholders through the development and implementation of digital systems to bring real-time, transparent forest data to governments, law enforcement, companies, communities and civil society stakeholders.

## 2. Technical team, design and construction process

The *Transparent Forest* system has been designed and built by the EIA and the Romanian non-profit organization C4N.

The most complete version of this system is represented by Gabon's domestic timber traceability system, SNTBG. This domestic system contains a complete set of modules covering the entire timber supply chain, from standing tree inventory, through transport, processing and all the way to export.

An Android mobile application allows government officials and company staff to complete a digital permit for every step along the supply chain. The system can operate without an internet connection when necessary, with digital transfer between users via QR codes and automatic synchronization with the central system when users arrive in an area with cellular or Wi-Fi coverage.

A web application and geoportal allow public administrations, industry, civil society and public users to consult and view the data collected by the system, while protecting the necessary confidentiality of the company. This geoportal is integrated with state-of-the-art satellite remote sensing deforestation alerts generated by Global Forest Watch and Wageningen University, and high-resolution monthly mosaics from Planet Labs. A *"Citizen App"* mobile application allows the Gabonese public to verify the legality of logging trucks and report possible illegalities. The system is designed to be interoperable from the outset, with public APIs (Application Programming Interfaces) allowing data interoperability with other private or public systems.

The overall design goal of the *"*Transparent Forest*"* system is to use relatively simple technologies to accomplish a very complicated task. Therefore, the system has been built as a cloud-native traditional web application, using robust, stable and scalable components such as PHP and PostgreSQL. When developing new versions of the system in new economies, the EIA works closely with local experts and authorities to define the appropriate data model, and then build and implement the system according to local rules and regulations. The cloud infrastructure is also built with this in mind, using more traditional and robust components to host the application and route traffic. In terms of application design, SNTBG is built with a modular architecture, with separation of concerns and containerization, allowing the system to be fragmented and those fragments to have almost immediate utility.

## 3. Implementation, conditions and method of use

The *Transparent Forest* system is designed as open-source code that can be easily adapted to new economies and commodities.

This tool was first developed by the Romanian government as a window of transparency in Romania, under the name of Forest Inspector, which is both a mobile application and a geoportal, which functions only as a "Public Window", providing public access to data from Romania's domestic timber traceability system called SUMAL. Building on this foundational experience, the EIA and C4N collaborated to create the *Transparent Forest* system.

In October 2023, Gabon's Minister of Environment issued an order making the SNTBG mandatory for all timber sector companies operating in Gabon. The EIA is currently supporting the Gabonese government in the domestic implementation of the traceability system.

In 2024, EIA and C4N initiated a pilot project in Liberia, where a new version of *Transparent Forest* was field-tested to record and track the transport of chainsaw-sawn timber.

*Transparent Forest* has been designed to be low-cost to implement because, in the field, it is an Android mobile application that works without the need of an internet connection. Thus, it adds few additional tasks and costs to users, which makes things easier for small business owners. In fact, users get a free digital traceability system to manage their own operations. Businesses and governments also benefit from operational efficiency by using the system as a source of veracity, and administrative users have easy access to their authorized data through the web application and geoportal.

## 4. Target commodities

The *Transparent Forest* system is currently built around timber, but it can be applied to any other risk commodity to fill key traceability gaps in the supply chains of products that drive deforestation, such as palm oil, cacao, coffee or gold.

## 5. Evaluation and results

Within three months of the launch of the Inspector Forestal system in Romania in June 2016, the number of transport permit registrations increased by 60%. This highlights the rapid shift towards legalization of timber transports in the economy, triggered by the new transparency of transport permit data.

EIA and C4N have been field testing the SNTBG in Gabon since April 2021. It has proven its effectiveness and has been accepted as Gabon's domestic timber traceability system. Implementation is ongoing. The SNTBG contains a large database of timber supply chain records that will be used in conjunction with data generated and managed by the domestic forest administration prior to the implementation of the traceability system to evaluate the effectiveness of the system at key intervals.

*Transparent Forest* allows users to easily evaluate the statistics and results of their work, and managers to evaluate the statistics of the system as a whole, by generating automated reports and metrics.

## 6. Challenges, opportunities for improvement and future projections

The *Transparent Forest* system represents a digital transformation of commodity supply chains. This requires the adaptation of paper-based permitting processes to new digital systems, including new legislation and procedures on how transactions are recorded and fees are collected along the supply chain. This is a major transformation that will bring huge efficiency gains in both operations and management, but it also involves a concerted effort by actors across multiple ministries as well as the private sector.

There are infinite ways to improve the system. *Transparent Forest* is designed as a simple but effective and flexible tool. There are many additional modifications and tools that can be added to the system to improve data collection, management and user experience, and the way data is analyzed, such as developing algorithms to identify suspicious behavior.

In the coming years, EIA and C4N plan to continue improving the SNTBG in Gabon, while simultaneously developing new versions of the system in other economies and adapting it to new environments and commodities.

## 7. Cost, maintenance and lifetime

The *Transparent Forest* system has been developed over four years by a team of ten people. Now that it is complete, future systems can be developed cheaper, building on this existing code.

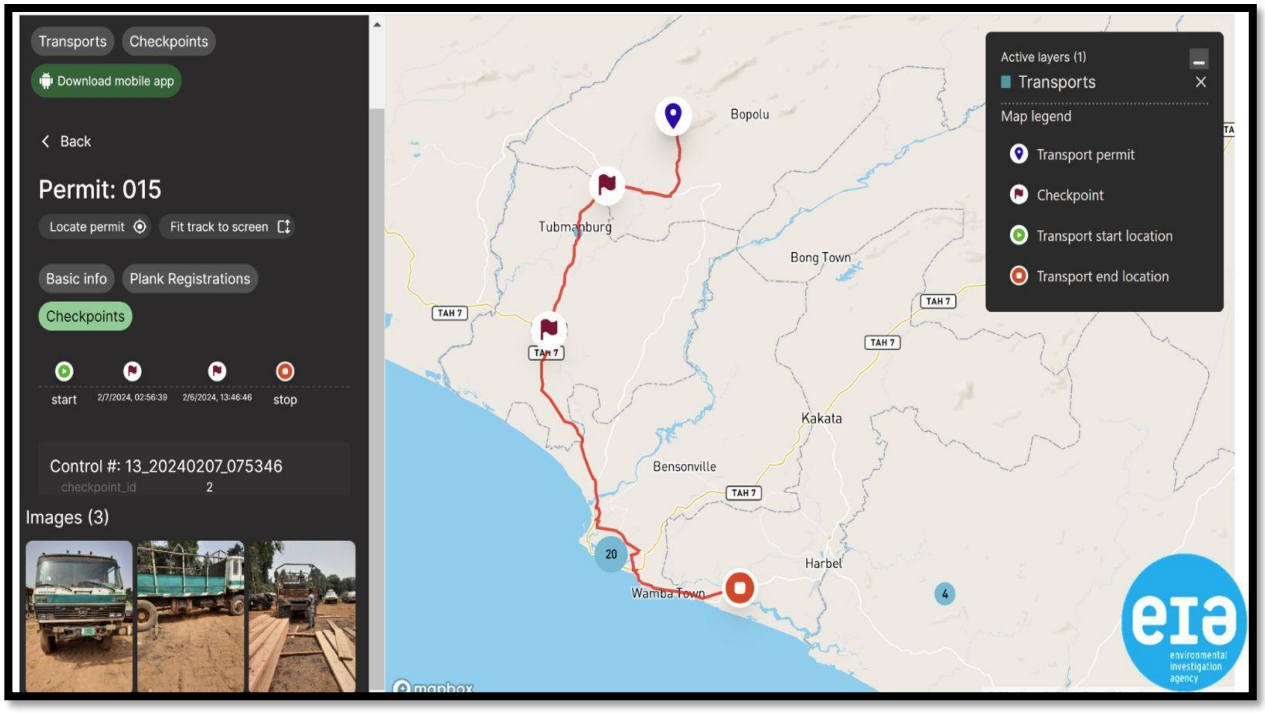
Each version of the system is designed to be delivered entirely to domestic governments, which will have to maintain their own systems going forward, including the cost of their own development team, servers, user support, etc. The EIA and C4N are committed to ensuring the long-term success of the transfer of each system and will continue with maintenance and support for as long as necessary.

As for the core *Transparent Forest* system, the EIA and C4N will need ongoing funding to continue its development to accommodate Android updates; create an iOS version; provide ongoing support to users and operators of the system; and, in addition to the core work of extending the system to new economies and commodities.

## 8. Additional information of interest

Proper authorization of data is a fundamental concern of *Transparent Forest*. Each implementation of the system will exist in a complex context of legislation and regulatory standards, so it must be both flexible and rigorous in its approach to data authorization and ownership. This has been taken into account and built into *Transparent Forest* from the outset through role-based access control, the global standard for data authorization. In addition, system security is an important aspect that they have taken very seriously, conducting continuous audits and penetration tests during the development and implementation periods.

Finally, transparency of as much of the data generated by the system as possible will be essential to ensure its long-term success. This transparency will depend on the governments of each economy that own each system to guarantee access to the data. Transparency of supply chain data will enable international buyers to easily obtain the documentation they need and conduct due diligence on their supply chains; it will enable civil society to play a watchdog role in ensuring compliance with legislation; and it will enable local communities to ensure that they are fully engaged in forest governance and know that they receive full compensation for timber extraction that takes place in or near their communities.




Source: Interface of the technological solution provided by the EIA.

Technological solution : **Management Information System - SIGO$_{SFC}$ & Digitalized Filling System – SIADO Region**

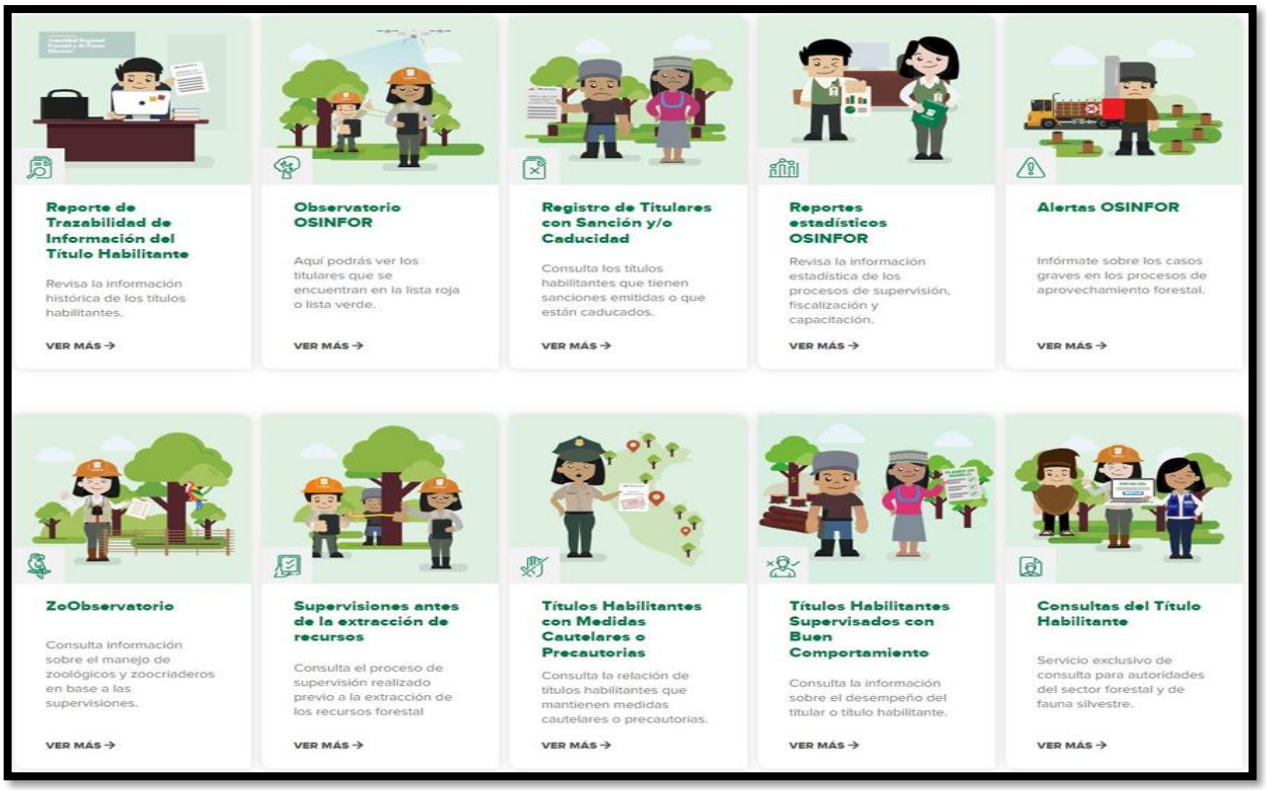
Supplier : **Agency for the Supervision of Forest Resources and Wildlife (OSINFOR)**

The OSINFOR Management Information System (**SIGO$_{SFC}$**) is a system developed by Peru's Agency for the Supervision of Forest Resources and Wildlife (OSINFOR) to improve supervision, control and transparency in the exploitation and commercialization of forest resources. This system is designed to promote transparency and ensure legality in forestry activities.

Key functions of the SIGO$_{SFC}$:

- Registration of forestry operations: Allows operators to register their activities online, including timber extraction, transport and commercialization, which facilitates monitoring by the authorities.
- Real-time monitoring: Allows OSINFOR to track real-time information on forestry activity and ensure compliance with environmental regulations.
- Accountability: Forest operators must report on the amount of resources extracted and sold, which contributes to the traceability of the product from extraction to the final consumer.
- Transparency in the supply chain: Enables greater transparency in the marketing chain of products such as timber and other forest products, helping to prevent illegal or unsustainable practices.


Source: SIGO$_{SFC}$ online system interface, available at https://sigosfc.osinfor.gob.pe/




Source: $SIGO_{SFC}$ online system interface, available at https://sigosfc.osinfor.gob.pe/

OSINFOR's Digitalized Filling System (**SIADO-Region**) is a platform that is also part of OSINFOR's management system. Its main function is to collect structured information to combat illegal domestic and international trafficking of timber products and activities that may generate negative impacts on forests, such as illegal logging, illegal agriculture and other processes that contribute to the loss of forest cover.

Main characteristics of SIADO-Region:

- Structured information: The system uses an architecture to identify the type of document, sub-type and detail of the information, which facilitates its search.

- Transparency in forest management: SIADO-Region centralizes information on the rights granted for forest exploitation, allowing governments, international organizations and other stakeholders to take an interest in the status of forests and make informed decisions on the sustainable management of natural resources.

- Digitized database: The information is digitized, allowing managers and authorities to have real-time, easily accessible information for decision making.

It is important to note that the SIADO-Region system can only be accessed by officials from public entities such as the forestry authority, forestry technical administrations, regional governments, environmental prosecutor's offices and the customs administration.


Source: SIADO-Region online system interface, available at https://siado.osinfor.gob.pe/fema

Both SIGO$_{SFC}$ and SIADO-Region are crucial tools for strengthening the sustainable management of forest resources in Peru, an economy with one of the largest tracts of tropical forests in the world. Both systems complement each other by offering:

- Transparency and traceability of forestry activities.
- Constant monitoring of deforestation and illegal activities.
- Efficient implementation of forest protection policies.

Internationally, these systems serve as a model for other economies with similar challenges in the management of their natural resources. Projects such as these are essential to reduce illegal deforestation, one of the major contributors to climate change and global biodiversity loss.

## 1. Detection of the need and/or identification of the problem

OSINFOR faced several deficiencies in public management, including the lack of an efficient system for supervising and monitoring forestry and wildlife activities, which made it difficult to make informed decisions. Until 2013, information was managed through spreadsheets, which limited the monitoring of processes and the evaluation of results. This scenario negatively impacted productivity, goal compliance and user satisfaction. In addition, the response time for information requests and the resolution of cases as a result of supervision was excessively long (more than thirty months), which generated distrust among citizens.

Additionally, the system encountered a lack of information about logging permits granted by the forestry authority until 2018. The available data was either incomplete or outdated and had to be requested through official letters, even though regulations require the information to be provided within fifteen working days. This situation hindered effective planning and control interventions.

The SIGO$_{SFC}$ and SIADO-Region were developed in response to several problems related to the illegal exploitation of forest resources, deforestation and the lack of transparency in the commercialization of forest products.

## 2. Technical team, design and construction process

The SIGO$_{SFC}$ and the SIADO-Region were designed and implemented by an internal OSINFOR technical team, making use of their in-depth knowledge of the institution's processes and needs. The process began with the mapping of all OSINFOR's operational, administrative and legal

processes, which made it possible to identify the modules needed for the system. The SIGO$_{SFC}$ was built with a single programming language, integrating various modules covering monitoring, control, training and management of forest resources, with a centralized database. This allowed for the integration and optimization of access to information, reducing redundancies and duplication of functions. The SIADO Region has a structured documentation process that identifies the types and subtypes of documents.

It should be noted that the improvements to the SIGO$_{SFC}$ and SIADO-Region systems in Peru have been possible thanks to the technical and financial support of various international organizations, including the United States Agency for International Development (USAID) and the United States Forest Service (US Forest Service).

## 3. Implementation, conditions and method of use

The implementation of SIGOSFC was carried out in several stages, starting with the development of key modules (supervision, auditing, and training) that supported the management of OSINFOR's core functions. Meanwhile, SIADO-Region was developed with a focus on the types of management documents, using a document architecture that allows for their easy identification. These modules were integrated with a single programming language and database, allowing quick and centralized access to information. This system is used in a decentralized manner by OSINFOR's offices in various regions, which facilitates field data collection, optimizes the supervision of forestry activities and allows for greater transparency and efficiency. In addition, the SIGO$_{SFC}$ is accessible to both internal and external users, including exporters, importers and competent authorities.

## 4. Target commodities

The main objective of the SIGO$_{SFC}$ is the management of information on forest operators and the marketing of products derived from forest resources. However, as OSINFOR also oversees wildlife, it is important to note that this system has applications for both timber and wildlife.

SIADO-Region has a more specific focus on querying digital information on approved logging rights that contribute to monitoring deforestation and illegal activities affecting forests. Although its main focus is to share information to forest sector actors to mitigate deforestation, indirectly it is also related to wildlife, as the loss of natural habitats can affect biodiversity and fauna.

So, although timber and other forest products are the most prominent targets, wildlife is also part of the target commodity of these systems, especially in terms of illegal trade and conservation activities.

## 5. Evaluation and results

The impact of the SIGO$_{SFC}$ has been considerably positive.

In the last year, the system has registered more than 60,000 queries from domestic and international users, with fast response times (between one and five minutes). The system has also been a key factor in improving institutional efficiency, as it provides real-time information on the monitoring and control of forestry activities, contributing to decision-making. In addition, the system has enabled more than 6,000 queries of statistical information on the results of supervision and audits. The system's reliability is maintained at a high level thanks to constant updates and integration with other information systems, such as SISFOR and SIADO-Region.

SIGO$_{SFC}$ evaluation indicators:

- ✓ Registered operators: More than 2,000 forest operators formalized.
- ✓ Traceability: 95% reliability in the traceability of forest products in key regions.
- ✓ Legality: 90% of traded products are legal, although 5-10% of illegal trade persists.
- ✓ Data reliability: 85-90% reliability of recorded information.

SIADO-Region evaluation indicators:

- ✓ Digitized information: 70-90% of administrative acts granted by the forestry authority were submitted within the deadline, enabling effective planning and targeted supervision.

Both systems have shown significant progress in legalizing forestry activities and monitoring deforestation, although challenges persist in remote areas. Reliability and positive impact are evident, but monitoring and full implementation in some areas still require improvement.

## 6. Challenges, opportunities for improvement and future projections

One of the current challenges is the constant updating of the modules to adapt to regulatory changes, both internally at OSINFOR and at the governmental level. Also, the implementation of new technologies to improve interoperability with other systems of public entities (such as regional governments) is a challenge in continuous development. Opportunities for improvement include expanding interoperability with more regional and domestic authority systems, optimizing response times for more complex queries, and incorporating new analysis and reporting functionalities. As for future projections, work is underway to migrate to version 3.0 of $SIGO_{SFC}$, which will integrate technological improvements that will optimize the management of resources (human and technological) and improve accessibility to information for the more than 15,000 current domestic and international users.

## 7. Cost, maintenance and lifetime

The $SIGO_{SFC}$ and SIADO-Region were developed by in-house technical staff, which significantly reduced initial implementation costs. The costs associated with operation and maintenance are relatively low, as the system is managed by the same development and maintenance team within OSINFOR. The life span of the system is estimated to be five to ten years before needing a major renewal or upgrade, depending on technology upgrades and infrastructure improvements. Maintenance is performed on an ongoing basis, adapting to the entity's changing needs and technological advances, and includes the incorporation of new versions and functionalities.

Both systems require constant maintenance and sustained funding to ensure their effectiveness and longevity, especially in a context of economic challenges and technological adaptation needs. To ensure their sustainability, both systems should seek additional funding through international cooperation.

## 8. Additional information of interest

The process of building $SIGO_{SFC}$ and SIADO-Region was marked by the internal collaboration of OSINFOR staff, who actively participated in mapping processes and defining system requirements. The result was a system that was highly aligned with the institution's operational needs. One of the key lessons learned was that the use of a centralized database and the integration of modules facilitated a more efficient management that was less prone to redundancies. Over the years, continuous improvements have been implemented in the $SIGO_{SFC}$, with special emphasis on interoperability with other government systems and the optimization of data capture at the regional level. The system's response to the information needs of the different stakeholders (OSINFOR, regional governments, SUNAT, FEMA, among others) has been positive, with a high level of satisfaction from both domestic and international users.

Technological solution : **Wild Cats Parts Identification Guide**[2]

Supplier : **Panthera**

The Wild Cats Parts Identification Guide is a tool created to combat illegal trafficking of wild cats. The correct identification of wild cat species based on their body parts, as well as the products made from them, is key to understanding, characterizing and counteracting the illegal trafficking of these animals and their parts, as well as for the control and legal processes that are carried out in the fight against this crime.

The purpose of this guide is to provide guidelines to wildlife law enforcement officers, so they may identify specimens and products of wild cats that are illegally offered in the domestic and international market, in inspections, operations, searches, among others. It is a clear, visual and didactic guide, designed for any law enforcement agent or official, regardless of their background.

This guide was developed by the global non-profit organization, Panthera, whose objective is to conserve the more than forty species of wild cats that inhabit the world and their ecosystems. Through the use of applied science, education, and work with communities and local authorities, Panthera works to combat threats such as wildlife trafficking, which endanger cat populations and the ecosystems they inhabit.

**1. Detection of the need and/or identification of the problem**

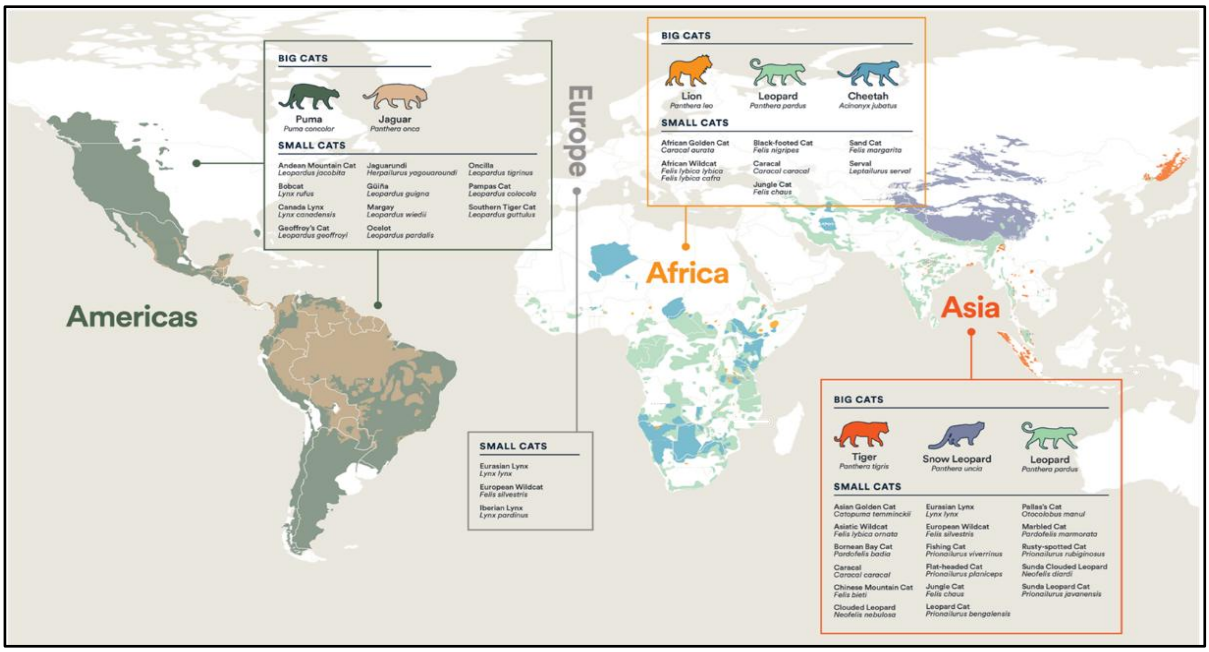
The Wild Cats Parts Identification Guide was born out of a need identified by various allies: to have a simple and visually clear tool to help authorities identify the parts of wild cats seized in operations against illegal wildlife trafficking. This need was expressed mainly in economies where trafficking of species protected under international conventions such as CITES originates, which often lack resources or specific tools for the correct identification of the parts of these animals.

In addition, many of the seizures occur in economies at the intermediate or end of the trafficking routes, where authorities often do not have the specialized training needed to identify wild cat parts in illegal markets or during border controls. This fact highlights the importance of expanding the use of the guide beyond economies of origin to include transit and destination economies, where authorities also face the challenge of combating trafficking in wild cat species and their derivatives.

Thus, the guide not only responds to a specific need in certain economies, but it also has the potential to improve the capacity of authorities along the entire trafficking route, contributing to the early detection and effective interdiction of these crimes at a global level.

[2] Panthera, *Wild Cats Parts Identification Guide*, Panthera, https://www.panthera.org

**Map of the world's wild cats and where they live**




Source: Panthera

## 2. Technical equipment, design and construction process

The Wild Cats Parts Identification Guide has more than five versions adapted in different Latin American economies. The first version was launched in Bolivia in 2021, followed by Peru in 2022, Brazil in 2023, Colombia in 2023, and the Mesoamerica version has just been finalized this year.

For its creation and development, a team of scientists led by Panthera, together with partner organizations including natural science museums with well-preserved collections of wild cat parts, created one of the first versions of this tool. During the process of development, environmental authorities at the domestic and regional levels were also involved in the creation of the regulatory framework according to each economy or specific context, as well as in the validation of its content.

In collaboration with the United Nations Office on Drugs and Crime (UNODC) for the Colombian version of the Guide, some additional chapters were included, such as recommendations to promote coexistence with wild cat species, capture and relocation, and what to do in case of encounters with wild cats in their natural habitat. This was carried out to address, in a single tool, some of the most frequent inquiries formulated by environmental officials who face crimes against wild cats on a daily basis.

## 3. Implementation, conditions and method of use

The guide has been physically disseminated in the economies mentioned above (Bolivia; Peru; Brazil; and Colombia), in collaboration with various local environmental prosecutorial authorities, wildlife police, park rangers and other entities involved in conservation and control of illegal wildlife trafficking. These officials are the main users of the guide, as it allows them to better identify and manage wild cat parts seized during operations, investigations and other related processes.

Additionally, the guide is available online and can be requested by any authority or public or private entity working in wildlife protection, as well as in the fight against organized crime related to animal trafficking. Through this digital access, Panthera seek to ensure that the tool reaches a greater number of law enforcement agents, researchers and conservation professionals in different regions.

Although the guide is mainly used in physical/printed format and in digital format as a PDF or easy-to-navigate online publication, Panthera seeks to continue expanding and adapting it to new contexts, especially with the use of technologies. Therefore, the next step is the development of a

mobile application that will allow law enforcement and other users to access the tool even faster and make it more accessible during field work, regardless of conditions or location.

Although currently available in Spanish, there are also plans to translate the tool into English and other languages in the future, in order to broaden its scope and facilitate its use in more regions of the world, ensuring that a greater number of economies and authorities can benefit from this tool in the fight against wild cats trafficking and the conservation of these species.

**4. Target commodities**

The Wild Cats Parts Identification Guide includes detailed cards for the identification of live wild cat individuals, based on physical characteristics such as size, weight, coat pattern, ear shape and other distinguishing features. These cards are useful for authorities in situations of capture, relocation and control of illegal trafficking, allowing them to recognize and differentiate wild cat species in the field accurately and quickly. In addition, the guide also covers the identification of goods derived from wild cat parts, such as skins, fangs, teeth, claws, skulls and elaborated articles such as jewelry or talismans.

**5. Evaluation and results**

During training conducted on the use of the guide, positive feedback has been received regarding its ease of use and accessibility. Participants have highlighted how intuitive and visually clear the tool is, which facilitates its implementation in field operations and tasks. In addition, several officials have shared cases in which they have expressed that they would have liked to have this tool in previous specific situations, which highlights the importance of having a resource like this for the identification of wild cat parts.

Likewise, the publication of the guide has made it possible to accompany investigative and criminal processes in the fight against criminal networks dedicated to wildlife trafficking. In these cases, the guide has been used as a key expert tool, providing crucial evidence that has contributed to effective convictions against traffickers, strengthening judicial efforts to dismantle illegal structures and guaranteeing the protection of wild cat species.

**6. Challenges, opportunities for improvement and future projections**

Despite the positive reception of the Wild Cats Parts Identification Guide, several challenges have been identified. One of the main challenges is distribution in remote areas, where access to the tool may be limited. Also, it is key to strengthen ongoing training to ensure its effective use by authorities in the field.

In terms of improvements, a great opportunity is seen in the development of a mobile application that allows users to access the guide anytime, anywhere, even offline. In addition, constant updating of the guide to include new species and trafficking cases is critical to maintaining its effectiveness.

Future projections include the translation of the guide into several languages, which will facilitate its use in more economies. Panthera also plan to enhance its presence in interactive online platforms and continue to strengthen its integration in judicial and investigative processes, to consolidate it as a key tool in the fight against illegal trafficking of wild cats and the conservation of these species.

**7. Cost, maintenance and lifetime**

The cost of the Wild Cats Parts Identification Guide varies according to its format (physical or digital). Physical production costs include printing and distribution, whereas the digital version focuses on development and periodic updates. The development of a mobile application will involve an initial cost for programming, design and testing, as well as ongoing maintenance for updates and upgrades, which could require a significant investment.

However, Panthera remains committed to making this tool free to use for authorities and entities involved in wildlife protection, always seeking to optimize resources through partnerships and the use of accessible digital platforms.

In terms of maintenance, the guide needs regular updates to include new species and adapt to legal and identification changes. The lifetime of the tool will depend on its ability to remain relevant through these updates and its integration into new platforms, ensuring its long-term usefulness in the fight against illegal wild cats trafficking.

## 8. Additional information of interest

Illegal wildlife trafficking is one of the most lucrative crimes globally, reaching USD 23 billion annually, making it the fourth largest illicit market controlled by transnational organized crime. Faced with this global threat, it is urgent to have effective tools to support authorities in detecting and eradicating these criminal networks.

The Wild Cats Parts Identification Guide is a key tool to address this challenge. It provides a self-contained, easy-to-use solution that enables law enforcement officers to accurately identify seized wild cat parts, from sea and river ports, to borders and airports. Visual, clear and practical, the guide facilitates field detections and enhances real-time seizures, without the need for advanced specialized training.

This tool not only supports effective seizures, but also strengthens the capacity of law enforcement officers in their daily work, enabling them to correctly identify wild cat parts in various situations. Moreover, as it is free to use, the guide is designed to train authorities around the world, from inspectors and park rangers to border agents, contributing to global capacity building in the fight against wildlife trafficking.

In summary, the guide is not only an effective tool to increase detections, but also provides a vital boost in the ongoing training of agents who are on the front line in the fight against organized crime and the protection of the most vulnerable species.

The guide and contact details can be found at the following link: https://hopp.bio/felidguide

Technological solution : **Refrigerant analyzer in the framework of the implementation under the Montreal Protocol: Ultima ID Pro, model RI-700H HVAC/R**

Supplier : **United Nations Environment Programme (UNEP) and Neutronics Inc.**

The Montreal Protocol[3] is an international environmental agreement that establishes obligations for signatory economies to take measures to protect the ozone layer from chemicals that destroy it, and since 2016, it has established measures to contribute to the mitigation of global warming. To this effect, the Montreal Protocol was amended in October 2015 through the Kigali Amendment (city where the meeting of the parties was held). The Kigali Amendment expands and complements the Montreal Protocol's efforts to address an additional problem: greenhouse gases used as refrigerants, known as HFCs (hydrofluorocarbons).

The ozone layer expands around the globe and acts as a filter for harmful ultraviolet radiation, protecting the Earth and the life on it. Ozone-depleting chemicals (ODS) destroy the ozone in the atmosphere and let in ultraviolet rays that affect life and the environment. The most serious effects are related to diseases such as skin cancer and eye problems, damage to agriculture and forest deterioration, the decline of marine species and the fishing industry, among others. These substances (ODS) are found in products such as: refrigerants, foaming agents, cleaning solvents, fire extinguishers, fumigants, etc.

Within the group of ODS, refrigerants have historically been the substances that have had the greatest impact on the ozone layer, due to their chemical composition and their massive use in a variety of applications. In absolute terms, refrigerants have been primarily responsible for the destruction of the ozone layer since the mid-20th century until the adoption of the Montreal Protocol in 1987, which established a global regulation for their gradual elimination. Today, with the Montreal Protocol and the Kigali Amendment, work is underway to phase these substances out and promote safer alternatives, but the legacy of refrigerants remains one of the greatest environmental challenges in terms of safeguarding the ozone layer and mitigating climate change.

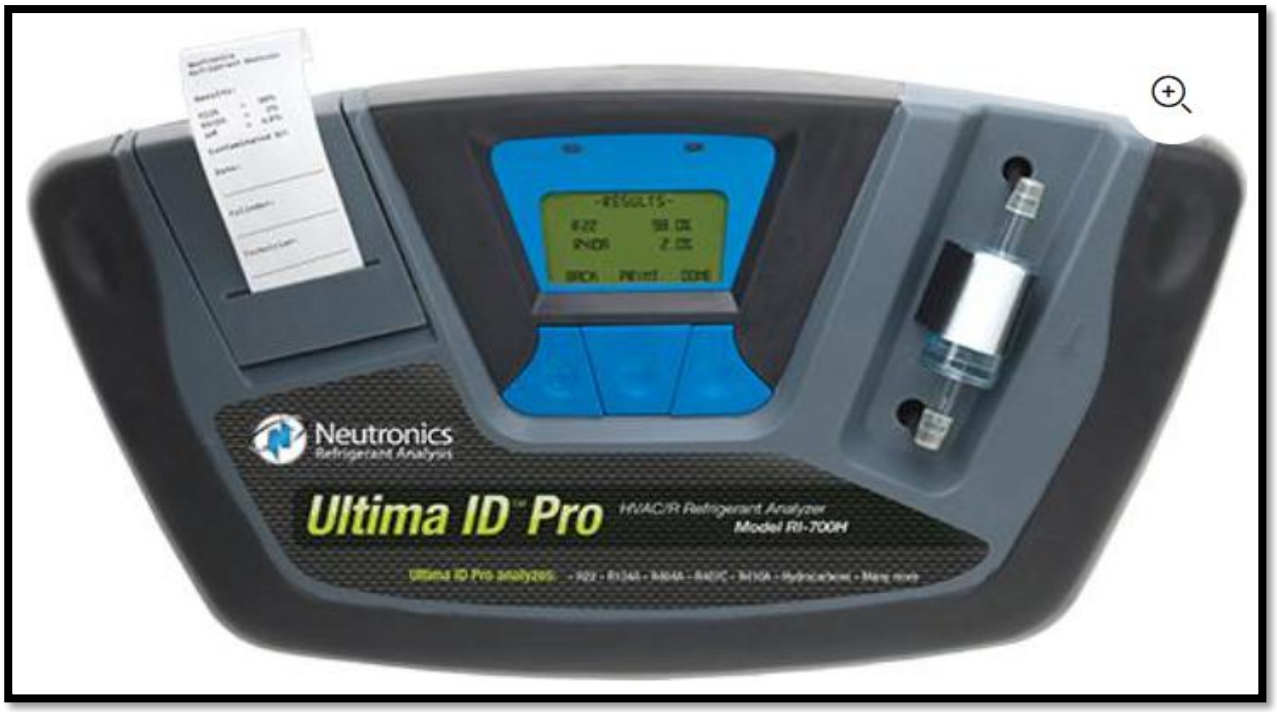
United Nations agencies such as the United Nations Development Programme (UNDP) and the UNEP provide direct and targeted assistance to economies to meet their obligations under the Montreal Protocol as an integral part of international efforts to protect the ozone layer and mitigate the effects of ozone depletion on human health and the environment.

In this context, these agencies support the use of technologies that improve the management and handling of refrigerants, working with governments and private sectors in promoting best practices and the distribution of sustainable technologies for refrigerant management worldwide. Diagnostic tools, such as the Ultima ID Pro Refrigerant Analyzer, model RI-700H HVAC/R, are essential in this context and are recommended in projects supported by the United Nations, especially in the framework of efforts to comply with the Montreal Protocol and the Kigali Amendment.

This analyzer allows precise identification of permitted or prohibited refrigerants, helping to prevent illegal trade. It also allows to monitor the quality and composition of refrigerants entering or leaving an economy, thus ensuring compliance with international regulations, among other benefits.

The following sections will explore important aspects of the Ultima ID Pro Refrigerant Analyzer, model RI-700H HVAC/R, an essential technological solution to ensure compliance with international regulations on refrigerant management.

[3] United Nations Environment Programme (UNEP), *The Montreal Protocol on Substances that Deplete the Ozone Layer*, United Nations Environment Programme, https://www.unep.org/resources/report/montreal-protocol-substances-deplete-ozone-layer




Source: Image obtained from https://www.teledyne-ai.com/en-us

## 1. Detection of the need and/or identification of the problem

The Ultima ID Pro Refrigerant Analyzer, model RI-700H HVAC/R, arose from the need to provide an accurate and effective solution to address multiple challenges related to refrigerant management and compliance with international environmental regulations such as the Montreal Protocol and the Kigali Amendment. From the accurate identification of refrigerants and mixtures to the control of illegal trade and its proper management, this device was developed to facilitate the implementation of environmental policies and promote the safe and responsible use of refrigerants globally.

## 2. Technical equipment, design and construction process

The refrigerant analyzer Ultima ID Pro, model RI-700H HVAC/R, is designed and marketed by the company Neutronics Refrigerant Analysis.

This tool is designed with non-dispersive infrared (NDIR) sensor technology, allowing it to accurately detect the composition of various refrigerants. The oxygen sensor and white filter help detect the presence of air or contaminants within the refrigerant sample. The instrument includes an LCD display with contrast adjustment options and a printout system for instant results.

Its mixture and purity detection capability is due to a factory calibration process and versatile data channels. Its construction ensures durability and ease of use in the field, enabling fast and accurate diagnostics.

Technical specifications:

- WEIGHT: 4.5kg approximately.
- IDENTIFIED REFRIGERANTS: R12, R-22, R32, R-134a, R-404A, R-410A, R-507A, R1234yf, R408A, R417A, R421A, R421B, R422A, R422B, R422C, R427A, hydrocarbons.
- ACCURACY: +/- 2% or greater, of the gases indicated.
- POWER SUPPLY: 12 VDC at 2A through 110/220V AC adapter, 50 - 60Hz
- APPROVALS: CE, UL and CUL.
- USER INTERFACE: Graphical display, function keys, printer
- SAMPLE GAS EXTRACTION: Pressure from bottle or system.
- TEMPERATURE RANGE: 10 - 49°C.
- HUMIDITY: 0 - 95% relative humidity without condensation.

- TEST SAMPLE SIZE: 5g per test.
- PRESSURE: 3.5 to 3.55 bar.
- PART NUMBER: 7-08-1000-71-0

**3. Implementation, conditions and method of use**

This is a portable tool and should be used in controlled conditions to ensure the reliability of the measurements. Optimal working conditions for the equipment include an operating temperature between 10-49°C and a humidity range between 0-95% RH. The tool operates in liquid or vapor samples of refrigerants, without the presence of oil. The process of use is simple: connect the hose to the system or cylinder, run the analysis and the equipment provides instant results, which can be printed using the internal printer. In addition, the device allows modification of the channel data to add refrigerants not detected by default.

**4. Target goods**

Refrigerant gases controlled under the Montreal Protocol.

Contaminated refrigerants:
Includes the ability to detect and analyze the composition of many 400 series refrigerants in addition to R134a, R22 and hydrocarbons (HC).

Pure refrigerants:
Can identify the following refrigerants: R12, R32, R408A, R409A, R417A, R421A, R421B, R422A, R422B, R422C, R427A and HC.

The instrument can also identify and analyze the purity content of R134a, R22, HC, R404A, R407C and R410A.

HC include R600, R600A and R290, but this tool cannot differentiate between them.

**5. Evaluation and results**

The analysis results are displayed visually on the screen and can also be printed out. In the case of refrigerant detection, the device offers an evaluation of purity or mixture. The analysis includes the possibility of detecting contaminants or incorrect mixtures and generating detailed reports with the components and their percentage in the mixture. The reliability of the equipment is high, as it is designed with NDIR sensor technology for accurate detection.

**6. Challenges, opportunities for improvement and future projections**

The main challenge is compatibility with new refrigerants, as this market is constantly evolving with the introduction of new compounds. Although the device allows for software updates, the integration of new refrigerants can be a challenge.

Despite its effectiveness in detection and analysis, there are opportunities for improvement, particularly in the ability to identify more complex refrigerant mixtures and expanding their connectivity options. In this sense, a possible future improvement would be the integration of advanced technologies to store and analyze data through mobile or cloud platforms, which would optimize its application in more dynamic work environments.
Also, the future projection of the device includes the constant updating of its refrigerant database and improving the accuracy of measurements, which could be achieved through the development of new sensors and more sophisticated algorithms.

**7. Cost, maintenance and lifetime**

The Ultima ID Pro Refrigerant Analyzer, model RI-700H HVAC/R, is a high-end equipment and its reference price is USD 3,795.00.

The basic unit includes graphic display, an infrared sensor, electrical connections, lithium battery and printing module. These components do not require maintenance; therefore, it is not necessary to replace or repair anything inside the unit. Opening the unit will void the warranty.

Regarding the filter and oxygen sensor, they do require maintenance:

- Filter change: whenever contaminants are detected, especially oil residues. The cost of the filter is affordable, around USD 30 to USD 50.
- Oxygen sensor replacement: When the sensor indicates that it is depleted, it is a component that must be replaced from time to time, with an estimated cost of USD 200 to USD 400.

The lifetime of the device is about 5-7 years, depending on use and maintenance.

## 8. Additional information of interest

Black market and undeclared imports of refrigerants with falsified or incorrect labels are a constant challenge for customs authorities.

The Ultima ID Pro Refrigerant Analyzer, model RI-700H HVAC/R, is lightweight, portable and easy to use, allowing officers to perform field inspections, at storage facilities, ports, airports, or at points of entry without the need for additional equipment. The device has the unique ability to detect refrigerant mixtures that are not easily identified with simple visual inspections or standard documentation. Many times, illegal importers mix unauthorized refrigerants with permitted substances to circumvent regulatory controls. Through its detailed analysis, the equipment can identify the presence of mixtures containing prohibited components, alerting customs personnel to possible violations.

This specialized use of the tool in customs is often underestimated or not sufficiently recognized, but in reality, it is key to helping authorities maintain tight control over imports and exports of refrigerant products and comply with international environmental standards, in addition to preventing fraud and tax evasion associated with illicit trade in refrigerants.

Technological solution : **Molecular techniques for species identification: DNAID-Elasmobranchs**

Supplier : **Florida International University – PhD Diego Cardeñosa**

This technological solution called DNAID-Elasmobranchs is composed of a Mic qPCR kit and the molecular technique developed by scientist Diego Cardeñosa, designed for genetic identification of species applied to elasmobranchs, a group of cartilaginous fish that includes sharks, rays and mantas, known for their skeleton of cartilage instead of bone.

Mic qPCR is an advanced quantitative PCR technology that enables accurate, real-time measurement of genetic material. It can be specially designed to work with small sample quantities or in environments where high precision and efficiency are required.

Source: Image obtained from Bio Molecular Systems' Mic qPCR equipment brochure.

**1. Detection of the need and/or identification of the problem**

The creation of the DNAID-Elasmobranchs technological solution responds to the need to address the difficulty of visually identifying shark products (such as meat, fins, skin and oil) that are subject to international trade. This technological solution for genetic identification allows the rapid and accurate detection of species, outside of a laboratory, facilitating the fight against illegal trade in elasmobranchs.

**2. Technical equipment, design and construction process**

The equipment consists of a real-time thermal cycler, a laptop computer, pipettes, and tubes. Together with reagents and primers, a reaction is generated that can be viewed in real time to determine the species to which the product being tested belongs. The test was designed and validated at Florida International University under strict forensic standards and conditions.

Characteristics of DNAID-Elasmobranchs:

- Applicable for all sharks and rays.
- Price of USD 1.5 per sample
- Mobil: field test
- Fast: results in approximately two hours
- Easy to use
- Only requirement is electricity
- Adaptable to other organisms

**3. Implementation, conditions and method of use**

The test consists of taking a small tissue sample of the product and extracting its DNA through a field-based extraction process. Then, a real-time PCR test is performed, which lasts approximately one and a half hours. The test result consists of species-specific curves, which can be compared with a previously validated standard curve. No prior technical knowledge is required to perform this technique.

**4. Target commodities**

Any product originating from a shark or ray; however, it has the potential to be applied to other species as well.

**5. Evaluation and results**

The evaluation of the DNAID-Elasmobranch technology solution shows that the test is highly reliable, as it does not generate false negatives, which means that it will always correctly identify the elasmobranch species in the analyzed samples. However, the accuracy of the test depends on the quality of the sample. Well-preserved, high-quality samples tend to generate more reliable and consistent results, while degraded or contaminated samples may reduce detection efficiency.

**6. Challenges, opportunities for improvement and future projections**

One of the biggest challenges is to generate genetic profiles for all shark species. Work is being carried out to include as many species as possible to make the test more robust. Mr. Cardeñosa is also looking to develop similar tests for other groups of species.

**7. Cost, maintenance and lifetime**

The cost of running a sample is USD 1.5 per sample. The equipment costs around USD 20,000.00 and does not require calibration or major maintenance according to factory specifications. The lifetime is not specified by the manufacturer.

**8. Additional information of interest**

Mr. Cardeñosa is unable to provide further details at the time of writing as he is in the process of preparing a publication of the test in an indexed scientific journal, so some of the answers are general and not in high detail.

Technological solution : **Screening techniques for the control of transboundary movements under the Basel Convention: Vanta® XRF**

Supplier : **Olympus-Evident**

The Basel Convention regulates transboundary movements of hazardous and other wastes with the aim of preventing its illegal traffic and ensuring proper management thereof. This convention requires the “prior informed consent” of the parties involved for any shipment of wastes, ensuring that the final destination is an economy that is capable of properly managing the materials[4].

Residues or wastes that contain toxic, corrosive, reactive or flammable substances in their chemical composition are classified as hazardous and therefore their residue will also be toxic, corrosive, reactive or flammable, and are subject to strict regulations. The illicit trafficking of hazardous waste is considered a crime, and domestic authorities are responsible for implementing local regulations to prevent this type of trade.

In this context, portable X-ray fluorescence spectrometry (XRF) analysis equipment is a decisive tool for customs authorities and environmental control agents. These devices enable rapid, non-destructive analysis of the chemical composition of materials, such as heavy metals and hazardous substances, without the need for a laboratory. By using portable XRF equipment, authorities can efficiently and accurately verify whether products, wastes or residues being imported or exported comply with the requirements for trade, including the procedures established in the Basel Convention.

This technology contributes to the early detection of hazardous residues or wastes, enabling customs to make quick decisions on compliance with international and domestic legislation, preventing illicit trade in goods; thus, protecting the environment and public health.


Source: Image obtained from Olympus Vanta® XRF equipment brochure.

[4] Retrieved from the text “The Basel Convention at a glance” of the United Nations Environment Programme (UNEP). Available at https://www.basel.int/Portals/4/Basel%20Convention/docs/convention/bc_glance-s.pdf

## 1. Detection of the need and/or identification of the problem

In the global context of hazardous waste management and the prevention of illegal trade, it is crucial to have technological tools to facilitate customs inspections. Transboundary movements of hazardous wastes must be strictly regulated to prevent illegal traffic and to ensure that wastes are managed in accordance with international safety and environmental standards, as set out in the Basel Convention. To this end, customs officials need to have non-destructive, efficient and rapid screening methods that enable them to accurately identify the elements or chemical compounds found in goods and their concentration.

In this regard, portable XRF analysis equipment has established itself as a key technological solution. This equipment enables the non-destructive and rapid identification of chemical elements found in materials, facilitating the detection of heavy metals and other hazardous substances without the need for complex laboratory processes. This ability to perform real-time, on-site analysis is critical at customs checkpoints where resources and time are limited.

XRF technology has undergone significant development in recent years, supported by the implementation of technical regulations and environmental standards in regions such as Europe and the United States, where it has been integrated into industries such as mining, metal production and waste management. Its application in these sectors has proven to be effective for the rapid and reliable determination of chemical elements found in materials, contributing to informed decision-making and quality control.

Thus, the adoption of XRF technologies in the field of customs is presented as a key tool to improve the effectiveness of goods inspection, facilitating compliance with the Basel Convention and other regulatory frameworks, and helping to prevent illegal trade of hazardous waste or residues at a global level. The following points will be addressed with reference to the use of the Olympus Vanta® XRF, a portable, fast and accurate analysis tool that offers a practical solution to perform this type of inspection in the field, ensuring that goods are properly evaluated in accordance with current regulations.

## 2. Technical equipment, design and construction process

The Olympus Vanta® XRF is an XRF analyzer designed to provide rapid, accurate and non-destructive analysis of the elemental composition of a wide range of materials. This equipment has been developed to identify and analyze a variety of elements, from magnesium (Mg) to uranium (U), allowing the detection of heavy metals and other elements in materials such as metals, waste or scrap, industrial products, making it suitable for applications in control, inspection of goods and verification of regulatory compliance.

The Vanta® XRF from Olympus-Evident stands out for its portable and robust design, optimized for field use. Its specifications are as follows:

| **Feature** | **Specifications** |
|---|---|
| Dimensions | 10,4 cm x 29,6 cm x 24,1 cm |
| Weight | 1,9 kg with battery<br>1,67 kg without battery |
| Power supply | Removable lithium-ion batteries or 18-volt AC power adapter unit |
| Display | Color “transflective” touch screen (800 x 480 WVGA) with 16-bit LCD interface, capacitive panel and gesture control. |
| Operating environment | -10 °C to 50 °C (-10 °C to 50 °C) (continuous duty cycle with optional fan)<br>10% to 90% relative humidity without condensation |
| Drop resistance | Military standard 810G, 1.3m drop test |
| Protection Index (IP) rating | IP54: protection against dust and water splash from all directions |
| GPS | Integrated GPS/GLONASS receiver |

| | |
|---|---|
| Operating system | Linux |
| Comunication (interface) USB | Two USB 2.0 type-A ports<br>One miniB-type USB 2.0 port for connection to a computer |
| Wi-Fi® | Support for 802.11 b/g/n (2.4 GHz) standard via optional USB adaptor |
| Focus camera (optional) | CMOS, full VGA |
| Sample camera (optional) | 5-megapixel CMOS with autofocus lens |
| Data storage | 1 GB industrial microSD card installed in the slot for amplified storage |

The Vanta® XRF integrates XRF technology that allows precise analysis of the chemical elements present in a sample without the need to destroy it. Its X-ray-based analysis system works by generating an X-ray beam on the surface of the material to be analyzed. This beam excites the atoms in the material, causing them to emit fluorescence. The device measures this fluorescence to determine the exact elemental composition of the sample.

In addition, its rugged construction is designed to withstand harsh environmental conditions, making it a reliable tool for field inspections. The equipment is designed to be easy to operate, even for personnel without advanced technical experience, with an intuitive interface and touch screen that allows fast results (in less than ten seconds) to be obtained with just one touch.

According to Mathieu Bauer, senior application scientist at Thermofisher[5], one of the most renowned manufacturers of analytical equipment, in the mid-1960s portable XRF instruments appeared, a mobile technology that would become a revolutionary solution for materials analysis. The more compact devices made it possible to take “the lab to the field,” eliminating the need to transport samples and providing on-site results.

According to this manufacturer, although the equipment developed was portable and even handheld, field XRF analyzers of the 1980s still came with at least two parts, a probe containing a radioactive isotope along with the detector and a processing unit, and the analyzers were generally dedicated to a single application.

It was not until 1994 that the first single-unit portable XRF analyzer was developed, which offered real-time digital signal processing and could measure elements as light as titanium. Weighing only 2.5 lb., it offered improved analytical performance at a lower price than previous XRF instruments.

For the latest generation of devices, Bauer notes that a user-friendly interface ensures that users with different levels of experience can easily operate the analyzers and generate high-quality results.

The Vanta® XRF was built by Olympus-Evident, a leader in portable measurement and analysis solutions. The equipment has been designed with versatility, reliability and portability in mind. In addition, it is backed by years of research and development in X-ray spectrometry technology, ensuring accurate and consistent performance. Its construction includes high-quality components, ensuring durability and resistance to extreme working conditions.

## 3. Implementation, conditions and method of use

The Vanta® XRF is a portable and rugged instrument designed specifically for use in field conditions. Its construction allows it to withstand demanding working environments, with the ability to resist high levels of dirt, dust and even accidental drops.

Although the Vanta® XRF is designed to be resistant, its performance and longevity are optimized when used in controlled conditions, so that the equipment can operate with greater accuracy and

[5]Text from “Understanding the Journey from Lab-Based to Handheld XRF Technology”, available at https://www.thermofisher.com/blog/materials/understanding-the-journey-from-lab-based-to-handheld-xrf-technology/

less exposure to extreme conditions that could affect its operation, such as extreme temperatures, high humidity or constant exposure to abrasive materials.

The Vanta® XRF is simple to operate and does not require complex procedures. The instrument is designed for rapid analysis of chemical elements found in materials, such as heavy metals, without the need to destroy samples. The process of use is carried out in just a few steps:

1. Sample preparation: The material to be analyzed is selected and a suitable surface to place the equipment is required. If the sample does not have a smooth surface, it is recommended to cut or sand it to obtain better results.

2. Placement of the device: The operator places the Vanta® XRF device on the surface of the material. The tool has a high-resolution camera that captures the fluorescence of the materials when irradiated by the X-rays emitted by the device.

3. Analysis and results: Once the tool is in place, the operator presses a button to start the analysis. In less than ten seconds, the equipment provides results on the composition of the elements found in the sample. Detailed information about the elements can be seen on the screen, allowing quick decisions to be made.

**Use of Vanta® XRF in an industrial e-waste handling facility**

Source: Image provided by an expert from the United Nations Development Programme.

Vanta® XRF equipment can be implemented at different stages of the customs control process.

Its integration allows officials to perform fast inspections and obtain results efficiently, contributing to compliance with international regulations such as the Basel Convention and the prevention of illegal trade in hazardous waste.

## 4. Target commodities

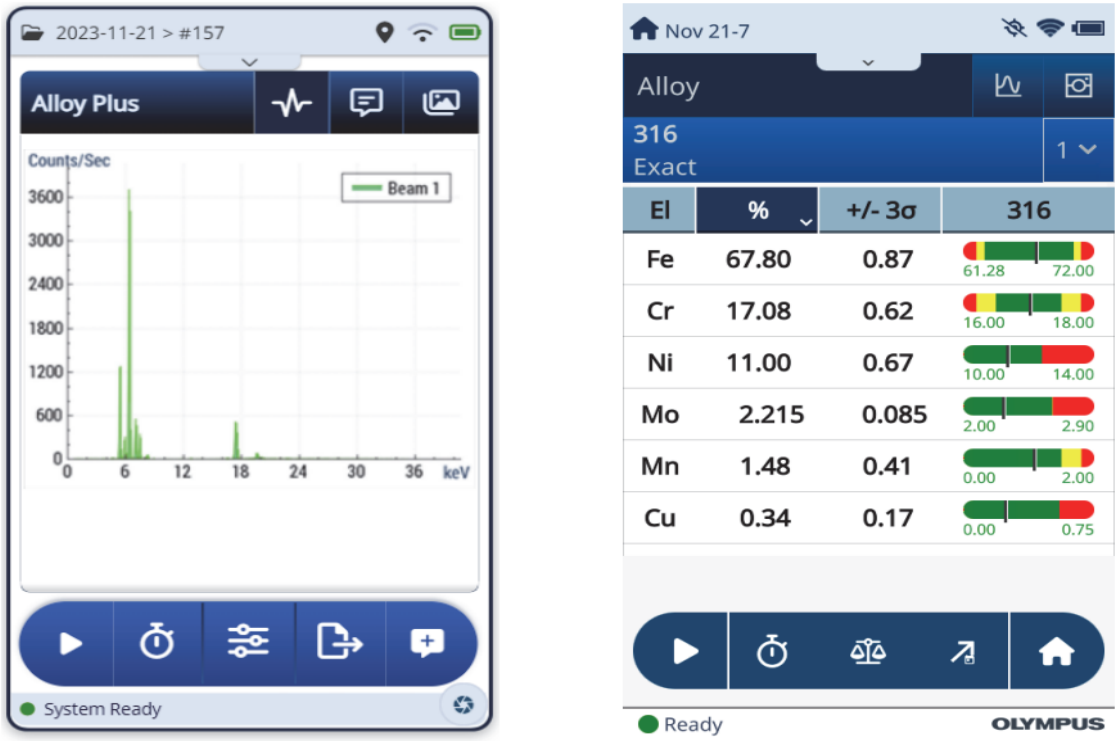
The Vanta® XRF is a versatile tool that can analyze a wide variety of commodities, not only hazardous wastes or residues, but also:

- Metals and alloys: It can identify different types of metal alloys, steels, bronzes, brasses, coppers, aluminums, among others.
- Toys and consumer products: It identifies controlled metals such as mercury, cadmium and lead.
- Plastics: It detects halogens such as bromine found in plastics, which is an indicator of brominated flame retardants that are controlled by the Stockholm Convention.
- Electronic devices: Used to verify the content of elements that are included in technical regulations such as the European RoHS Directive on the content of hazardous substances.

## 5. Evaluation and results

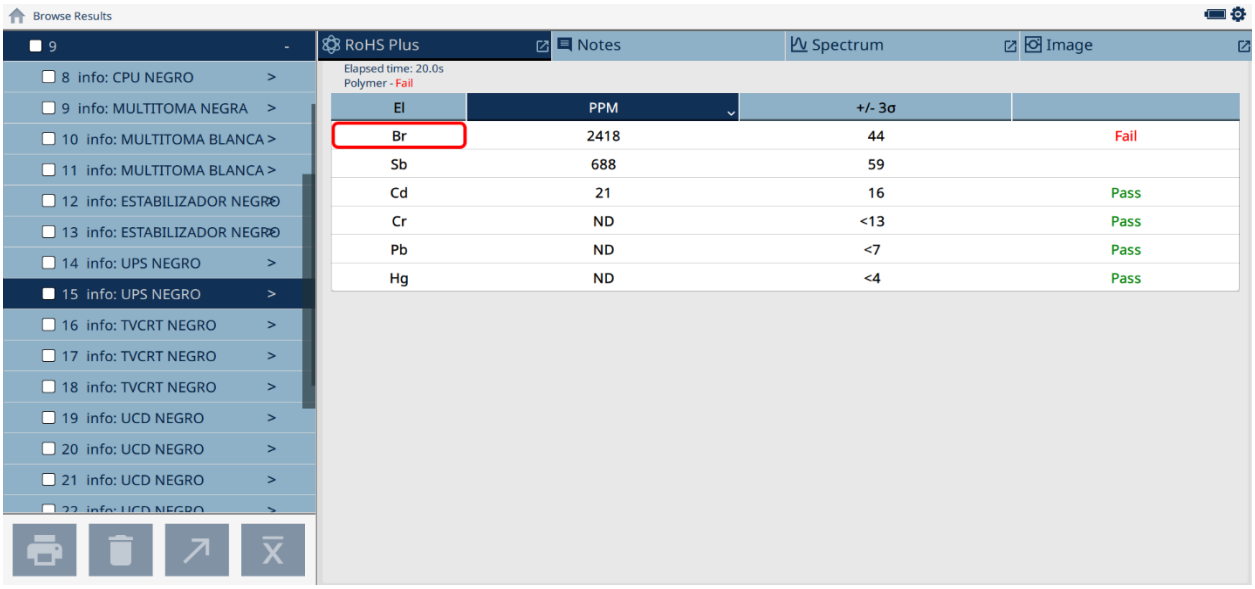
The results of the analysis can be observed in real time, by means of the LCD screen incorporated in the equipment or by using a computer, which can be connected to the equipment through software available for this purpose.

**Analysis results on the Vanta® XRF screen: alloys mode**




Source: Images obtained from Vanta® XRF equipment interfaces.

**Computer interface analysis results: RoHS mode**




Source: Image obtained from the Vanta® XRF computer software interface

The result shows the error in terms of standard deviation for each element and in some cases, according to the user's configuration, allows the user to establish action levels, e.g.: values above which the test result is considered not to comply with the permissible levels, facilitating the user's action and decision making. This can be seen on the right side of Figure “Analysis results on the Vanta® XRF screen: alloys mode”, with green labels indicating compliance or red labels indicating non-compliance.

The detection limits for the most common metallic elements are in the order of 5 mg/kg, for halogens it is between 5 mg/kg and 50 mg/kg. For aluminum, it is 3000 mg/kg.

The equipment is factory calibrated and has verification mechanisms that can be easily implemented by the user. In addition, there are also certified reference materials for various elements and analysis matrices (e.g. plastics, minerals, quartz) that allow adequate controls of the equipment performance.

## 6. Challenges, opportunities for improvement and future projections

The use of screening techniques is highly effective for rapid analysis and selection of samples that can then be confirmed in laboratories. However, there are some limitations. Due to portable XRF analysis being based on the identification of chemical elements, it cannot detect chemical compounds, mixtures of compounds, or physical or chemical properties, which limits its ability to properly classify a commodity.

For example, although it can detect the presence of elements such as bromine or antimony in plastics, the equipment cannot identify whether two samples correspond to different types of polymers unless the chemical additives (usually called fillers) found are different.

XRF technology is expected to evolve to include improvements in the detection of mixtures and complex compounds.

## 7. Cost, maintenance and lifetime

The approximate cost of a portable XRF analysis equipment is USD 30,000.00, including basic accessories such as the charging station, batteries and connection cables.

As for maintenance, it must be performed by the manufacturer or an authorized representative in the economy to ensure optimal performance and durability.

The lifetime of the equipment is not specified in the manufacturer's manual, although it is expected that, with proper maintenance, the device will have a lifetime of more than fifteen years.

## 8. Additional information of interest

The Basel Convention has publications on its website, including reports of joint activities with the World Customs Organization[6] aimed at harmonization between tariff headings and the categories and codes used to classify wastes.

Control of transboundary movements of hazardous wastes, as well as verification of compliance with correct tariff classifications and compliance with technical regulations, is one of the key functions of foreign trade authorities.

Screening techniques make the control of physical inspections much more efficient, as they help the official make faster and more accurate decisions, reducing time for the user and for the laboratory. In this regard, portable XRF equipment represents an opportunity for elemental analysis to identify, in a non-destructive manner, whether or not a good complies with a condition determined by the presence of a particular chemical element and, therefore, it is possible to be more precise in making the decision as to whether or not to take samples to be sent for confirmatory analysis in the customs laboratory.

[6] Information from the website:
https://www.basel.int/Implementation/HarmonizedSystemCodes/Overview/tabid/2390/Default.aspx

Technological solution : **XyloTron**

Supplier : **University of Washington– PhD Jhon Hermanson**

The XyloTron is an innovative field tool that uses a computer vision system for timber species identification. It was developed by PhD John Hermanson, a scientist at the University of Washington, with sponsorship from the U.S. Forest Service and its international program. This technology aims to solve key problems in the forest industry, particularly in the verification and legal marketing of timber products.

Source: Image provided by CITEmadera-Lima

**1. Detection of the need and/or identification of the problem**

Accurate identification of timber species is crucial in the forest chain, as it is the first step in ensuring legal timber trade. Control points where sawn timber transits, such as roads, ports or rivers, are critical places for making quick decisions about timber shipments.

However, these control points present significant challenges for effective identification of timber species, such as the lack of trained and experienced personnel, the great diversity of timber species, high personnel turnover, among others.

In this context, tools such as the XyloTron are presented as a key solution, as they allow for a quick and accurate identification of timber species, facilitating the control and monitoring of shipments at critical transit points.

**2. Technical equipment, design and construction process**

XyloTron combines artificial intelligence (AI) and advanced mathematical algorithms to develop an artificial vision system that allows the automatic and real-time identification of timber species directly in the field (places such as forestry control posts, customs control areas, sawmills, timber warehouses, among others). This tool has a database that currently includes fifty-three Peruvian species, work carried out by the team of the Laboratory of the Center for Productive Innovation and Technological Transfer of Wood in Lima, Peru (CITEmadera-Lima), which belongs to the *Instituto Tecnológico de la Producción* (Technological Institute of Production).

The technology for incorporating species into the database is constantly updated by the CITEmadera-Lima team, which is also responsible for programming and assembling the XyloTron devices based on a strategic alliance with the University of Washington and the U.S. Forest Service.

This ensures that the system is kept up to date with as many timber species as possible, thus improving its effectiveness in the field.

**3. Implementation, conditions and method of use**

XyloTron has been implemented at CITEmadera-Lima, where dissemination and training workshops are being held for authorities and personnel in charge of timber species identification. The tool is designed to be used in the field, allowing quick and accurate decisions on timber identification.

Conditions of use:

- The wood sample to be identified must be in the XyloTron system database.
- A quick preparation of the cross-sectional surface of the sample is necessary, which is achieved by sanding or cutting, in order to facilitate image capture and subsequent accurate identification.

The method of use is simple:

1. The wood sample to be identified is selected.
2. A cut or sanding is performed in the cross section of the sample.
3. The Xyloscope (a portable device containing a high-resolution camera) is placed over the cut or sanded cross-section.
4. A button is pressed so that the system captures a photograph of the specimen.
5. In less than ten seconds, the system analyzes the image and provides the species identification result.

**4. Target commodities**

The XyloTron targets lumber in various dimensions (such as quarters and boards) as well as lumber processed in sawmills and finished products destined for export. This facilitates the traceability of wood from its origin to its final destination.

**5. Evaluation and results**

The machine vision technology used by the XyloTron allows rapid and accurate identification of timber genus/species in the field, with a reliability rate of over 90%. This system is especially useful for rapid decision-making, such as identification of endangered species or verification of timber legality.

**6. Challenges, opportunities for improvement and future projections**

One of the main challenges is to expand the database to include more timber species, which will improve the accuracy and efficiency of the tool. In addition, the technology is being optimized for use in more extreme field conditions and in areas with less access to technological infrastructure.

Opportunities for improvement include:

- Expand coverage of additional species globally.
- Develop improved versions of XyloTron to identify more types of samples or processed materials.
- Integrate the system with forest management platforms to improve traceability and control of international timber trade.

In the future, the XyloTron is expected to continue to evolve into a new, even more advanced version; the ArborTron. This new and improved device will incorporate several key features such as an expanded database, improved accuracy and increased robustness. The ArborTron aims not only to increase the efficiency of species identification, but also to further contribute to the fight against illegal logging and illegal timber trade by strengthening the capacity of customs control services and forestry companies to ensure the sustainability of the timber trade.

## 7. Cost, maintenance and lifetime

Cost of each XyloTron: USD 1,800.00

Maintenance: This device requires basic maintenance to ensure proper functioning of the electronic components and periodic updating of the species database. Each time the XyloTron is used, it should be verified that all lights are on, as well as a calibration and adjustment of these using a standard template that comes with the equipment. It is recommended that system upgrades be performed at least once a year or as required.

Lifetime: It depends mainly on the conditions and intensity of use, as well as proper maintenance. However, a lifetime of at least seven years is estimated.

## 8. Additional information of interest

The XyloTron is presented as a low-cost and highly efficient solution for forestry authorities and companies that need to perform rapid field verifications of timber species.

The use of this system could transform the forestry industry, making the control and verification of timber legality in the global market more efficient, especially in economies where illegal trade is a major challenge.

Technological solution : **DART-TOFMS**

Supplier : **Wood Identification and Screening Center and National Fish and Wildlife Forensic Laboratory, Ashland, Oregon, USA**

DART-TOFMS (Direct Analysis in Real Time-Time of Flight Mass Spectrometry) is an advanced technology that combines direct ionization in real time (DART) with time-of-flight mass spectrometry (TOFMS), enabling accurate identification of chemical and biological substances. This method creates unique molecular profiles that facilitate detailed analysis of complex samples[7]. Although DART-TOFMS is not designed for direct field use, its application in specialized laboratories has proven to be highly efficient for the identification of various commodities, including timber, wildlife and their by-products. Unlike field tools, which can provide fast results but limited information, DART-TOFMS provides a much more accurate and reliable analysis, allowing precise molecular identification of the species found in the samples.

DART-TOFMS has established itself as a fundamental tool for species identification in specialized laboratories, thanks to its ability to generate fast and highly reliable results without requiring complex sample preparations. This method not only allows accurate identification of wood species, wildlife and their derived products, but also provides detailed information on the molecular characteristics of the samples, such as their chemical composition. These advantages make it an invaluable tool for detecting illegal products or those that do not comply with international regulations. In addition, the high resolution and sensitivity of DART-TOFMS makes it possible to detect even small amounts of compounds found in fragmented or altered samples, such as processed timber products and wildlife derivatives in illegal trade. By comparing the profiles obtained with specific databases, this technology facilitates rapid identification, which contributes to more efficient and accurate decision-making in commodity control and monitoring processes.

The development and implementation of DART-TOFMS has benefited from the accumulated experience of specialized laboratories such as the Wood Identification and Screening Center (WISC) and the National Fish and Wildlife Forensic Laboratory (NFWFL), both located in Ashland, Oregon, USA. These centers have pioneered the use of advanced technologies, including mass spectrometry, for the forensic identification of timber species, wildlife and their derivatives. In particular, WISC has led the way in the implementation of molecular analysis for the accurate identification of timber species and their derivatives, while NFWFL has employed similar techniques for the analysis of wildlife species and their derivatives, contributing to key investigations in the fight against illegal trade.

Source: Image provided by the National Fish and Wildlife Forensic Laboratory.

[7] DART-TOFMS: Direct Analysis in Real Time-Time of Flight Mass Spectrometry," *American Society for Mass Spectrometry (ASMS)*, https://www.asms.org

## 1. Detection of the need and/or identification of the problem

The need to accurately identify timber species, wildlife and their products has increased considerably due to the illegal trade in these natural resources, which is a threat to global biodiversity. Difficulty in species identification, especially when products are processed, altered or fragmented, has generated the need for more accurate and efficient methods. Traditional field identification techniques, such as visual inspection or the use of dichotomous keys, can be insufficient, as they depend on experience and can provide erroneous results due to species variability or sample conditions.

It is in this context that the need arises for tools such as DART-TOFMS, which allow accurate and rapid molecular identification, even when samples are complex or have been altered. This type of advanced technology is crucial not only for biodiversity monitoring, but also for ensuring compliance with international regulations and combating illegal species trafficking.

## 2. Technical equipment, design and construction process

The DART-TOFMS technology was initially developed by Dr. R. Graham Cooks and his team at Purdue University, and its first applications focused on the analysis of chemical and biological substances. Over the years, they and other scientists have explored and expanded the applications of this technology, bringing it to a variety of commodities and research areas.

The technical team behind the development of DART-TOFMS includes experts in mass spectrometry, analytical chemistry and molecular biology, who have worked to optimize the system for high sensitivity, speed and accuracy of identification. This team has collaborated in the creation of specific molecular databases, which further enhances the tool's effectiveness in species identification.

Scientists PhD. Edgard Espinoza and Ms. Erin McClure-Price of the National Fish and Wildlife Forensic Laboratory and the Wood Identification and Screening Center, located in Ashland, Oregon, USA respectively, have expanded the application of DART-TOFMS for use in the identification, including forensic, of timber species, wildlife and their derived products from the volatile chemical components that characterize each species.

DART-TOFMS combines two technologies: direct ionization in real time (DART) and time-of-flight mass spectrometry (TOFMS). The system design is based on the creation of molecular profiles of samples without the need for additional preparation, which simplifies the analysis process. The process of building the tool involves the integration of a DART device, which ionizes the molecules in the samples by an electrical discharge in a gas, and a TOF mass spectrometer, which separates the ions according to their mass-to-charge ratio, allowing the detection of the different compounds present.

Reasons for choosing DART-TOFMS for mass spectrometry in difficult tissues:

- ✓ Accurate
- ✓ Reproducible
- ✓ No solvents required
- ✓ Fast
- ✓ Low consumable cost
- ✓ Spectrum is not solvent biased
- ✓ Can obtain information on positive (e.g. most drugs of abuse) and negative (e.g. fatty acids) ions.

## 3. Implementation, conditions and method of use

For the analysis, only a small sample of wood, wildlife or their derived products, of approximately 1 cm in size, is required. The sample does not require prior preparation for analysis, which makes the process efficient and fast. Subsequently, the sample is placed in the measuring zone of the DART device, where it is ionized and then analyzed by the TOF mass spectrometer. This process takes approximately eight seconds, during which time a mass spectrum, known as a chemical fingerprint,

is obtained, showing the profile of the volatile components found in the sample. Thanks to the high sensitivity of the instrument, even small amounts of these compounds can be accurately identified.

The spectrum obtained is compared with the spectra of reference samples from a worldwide database, such as ForeST (Forensic Spectra of Trees) for wood. From this comparison, a list of the species with the highest chemical coincidence with the spectrum of the analyzed sample is generated. Subsequently, a statistical analysis is performed and a validated mathematical model is generated to classify the species to which the sample corresponds. The conditions for the use of the equipment include a controlled environment in the laboratory, with stable temperature and humidity, which ensures the accuracy and reliability of the process. The implementation of DART-TOFMS is carried out in specialized laboratories that have the necessary equipment for its operation, which allows obtaining high quality results in a relatively short time, facilitating fast and accurate decisions in the control of goods.

## 4. Target commodities

DART-TOFMS has been implemented at the NFWFL and the WISC in Ashland, Oregon, USA, for the identification, including forensic, of timber, wildlife and derived products.

Target commodities based on advancements made at these laboratories include, among others:

- Timber species: WISC has used DART-TOFMS to identify timber species and their derivatives, including in processed or altered products.
- Wildlife and wildlife products: The NFWFL applies this technology to identify wildlife products, facilitating the detection of illegal trade in protected or endangered species under regulations such as CITES.
- Manufactured products: DART-TOFMS is also used to analyze processed products containing wood or wildlife parts, such as musical instruments, luxury goods and pharmaceuticals.
- Extracts and chemicals derived from plants and animals: Such as oils, resins, and natural dyes that may be subject to illegal trade.

## 5. Evaluation and results

The DART-TOFMS has proven to be a highly reliable tool for species identification, with an accuracy exceeding 95% compared to other identification methods. The statistics and reports generated by the system include detailed molecular profiles that can be compared with specific timber and wildlife species databases.

Laboratories using this technology have reported a significant improvement in the ability to detect illegal products. In addition, the rapid turnaround time (usually within minutes) allows informed decisions to be made almost instantaneously, improving the efficiency of control procedures at commodity transit points.

## 6. Challenges, opportunities for Improvement and future projections

Despite its high accuracy, DART-TOFMS faces several challenges, among them:

- Accessibility: Its use is restricted to specialized laboratories due to the costs and complexity of the equipment.
- Limited databases: Although databases for timber and wildlife species are expanding, they still need to be further developed to cover all relevant species.
- Interference in complex samples: In some cases, highly contaminated samples or samples with multiple compounds can generate ambiguous results that require expert interpretation.

Opportunities for improvement include the expansion of databases and the creation of more accessible and portable versions of the equipment. In the future, further integration of the tool with real-time monitoring systems and shared global databases is planned, which would further optimize decision-making.

## 7. Cost, maintenance and lifetime

The acquisition cost of a DART-TOFMS system is relatively high, given that it is a state-of-the-art technology in mass spectrometry. Prices range from USD 100,000 to USD 250,000, depending on the configuration and specific features of the equipment. Furthermore, additional costs include regular maintenance of the device, which is essential to maintaining accuracy and optimal performance. The annual maintenance cost can range from USD 10,000 to USD 20,000, depending on usage and operating conditions.

The lifetime of the tool is approximately ten to fifteen years, with the need for periodic recalibrations and replacement of components, such as ionization sources and mass detectors, ensuring the longevity of the equipment.

### Identification service cost per sample

If a DART-TOFMS system is not available in-house, many specialized laboratories offer the service of analysis using this technology. The cost per sample for identification through DART-TOFMS is approximately USD 70 per sample, depending on the complexity of the analysis and the volume of the sample sent. These laboratories have the necessary infrastructure, which eliminates the need to purchase the equipment and allows access to advanced mass spectrometry technology without incurring the costs of purchasing and maintaining the system.

## 8. Additional information of interest

One of the additional advantages of the DART-TOFMS is its ability to perform rapid analysis without the need for chemical reagents, making it a more environmentally friendly and cost-effective option in terms of resources. In addition, the system is easily integrated with other analytical equipment and computer systems, which facilitates its adoption in existing laboratories.

The DART-TOFMS development process has been based on years of research in mass spectrometry and molecular analysis. Advances in the miniaturization of DART devices and improvements in the sensitivity of mass spectrometers have been instrumental in making this technology a practical and accessible tool for laboratories.

## Conclusions

The analysis carried out in this research paper leads to the conclusion that the incorporation of technological solutions would represent a significant advancement in improving the effectiveness of customs administrations in the Asia-Pacific region in the control of goods that have an environmental impact. Technologies such as the Transparent Forest System for the traceability of forest products, the Ultima ID Pro Refrigerant Analyzer equipment to identify ozone-depleting substances or the DART-TOFMS technology to detect products derived from wildlife such as oils, have proven to be tools that would reduce illegal trade in goods regulated by the Basel Convention, the Montreal Protocol, the Convention on International Trade in Endangered Species of Wild Fauna and Flora – CITES, as well as species such as timber, wildlife and hydrobiological resources, which do not have a degree of protection under CITES but are regulated by domestic regulations.

The methodological approach based on eight key aspects, which included the identification of the problem addressed by the technological solutions to future projections, allowed for a comprehensive evaluation of each one. Although the depth of the analysis of each aspect varied by technology, either due to the prioritization of the most relevant aspects based on their applicability and context, or due to the limited access to certain data by scientists linked to the development of these technologies who are in the process of making indexed scientific publications, this study provides a robust framework for understanding their applicability in diverse customs contexts. This approach highlights the importance of prioritizing those tools that, in addition to being practical and highly accurate, can be efficiently integrated into the existing processes of customs administrations.

The main technologies identified in this research paper have the potential to be replicated in other economies in the Asia-Pacific region, adapting to the regulatory and operational characteristics of each economy. In addition to providing a framework for improving the identification and control of goods, these solutions offer opportunities for the creation of regional and international cooperation networks, facilitating the exchange of best practices and technical assistance between economies. The implementation of these systems not only favors transparency and compliance with international regulations, but also promotes the creation of more sustainable supply chains, aligned with the environmental protection and social responsibility objectives of APEC economies.

Collaboration between customs and other public and private sector actors is valuable to maximize the impact of these technologies, improving effectiveness and sustainability of the control and management of goods with environmental risks. However, challenges were identified related to the concerted efforts of the agents involved, compatibility with complex samples, expansion of the database and the need to ensure sustainable financing. In this regard, the strengthening of partnerships and continuous innovation in the adoption of new technological tools will be key factors for customs in the Asia-Pacific region to continue moving towards a vision that balances the needs of trade and environmental protection.

### Comments by Customs of the Philippines

The Environmental Protection and Compliance Division (EPCD) within the Customs of the Philippines regularly faces challenges related to declarations from importers about the non-hazardous nature of their goods or about their exemption from environmental regulations. These declarations require validation by the Department of Environment and Natural Resources (DENR), the domestic environmental authority, whose response is often lengthy, delaying the clearance of goods.

The adoption of technologies such as those proposed in this research paper (e.g., DNAID-Elasmobranchs, Vanta XRF, the XyloTron, and DART-TOFMS) would significantly improve

EPCD's capacity to analyze environmental goods and enforce the law, reducing dependence on DENR confirmation reports. Currently, EPCD uses tools such as Ultima ID Pro (refrigerant gas analyzer) and RadSeeker (nuclear/radiation detector), but recognizes the need to expand its capacity to address issues related to scrap metal, wood (Agarwood) and hydrobiological products (shark fins).

In this regard, Customs of the Philippines recommends the adoption and acquisition of the technological solutions mentioned in this research paper, with the objective of strengthening its operational and environmental compliance capabilities.

# Annex I

**LIST OF EXPERTS CONSULTED**

Forum: Sub-Committee on Customs Procedures (SCCP)
Project: "Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region" (SCCP 201 2023T)
Output: Research Paper - Annex 1

| No. | Name of Non-Member | Organisation | Job Title |
|---|---|---|---|
| 1 | Mr. Alfredo Rodriguez | World Forest ID | Collections Lead |
| 2 | Mr. Carlos Candia | Agency for the Supervision of Forest Resources and Wildlife (OSINFOR) | Executive |
| 3 | Mr. Richard Ayllas | Agency for the Supervision of Forest Resources and Wildlife (OSINFOR) | Specialist in Forest Information Management |
| 4 | Mr. Sergio Yepez | International Criminal Police Organization (INTERPOL) | Criminal Intelligence Officer, Environmental Security |
| 5 | Ms. Julia Urrunaga | Environmental Investigation Agency (EIA) | Peru Programs Director |
| 6 | Mr. David Gehl | Environmental Investigation Agency (EIA) | Senior Manager for Transparency, Traceability and Technologies |
| 7 | Ms. Alicia Kuroiwa | Independent Consultant | Biologist |
| 8 | Ms. Jessica Gálvez-Durand | Food and Agriculture Organization of the United Nations (FAO) | ECTAD Project Coordinator for Peru |
| 9 | Ms. Pamela Pastor | Panthera | Project Coordinator, Counter Wildlife Trafficking |
| 10 | Ms. Yina Serna | Panthera | Coexistence and Anti-Trafficking Coordinator |
| 11 | Mr. Jiabin Qin | World Customs Organization (WCO) | Technical Attache |
| 12 | Mr. Johan Leon | Ministry of Production of Peru (PRODUCE) | Environmental Management Specialist |
| 13 | Mr. Leonardo Pollach | United Nations Environment Programme (UNEP) | International Consultant |
| 14 | Mrs. Rosa Vento | Wildlife Conservation Society (WCS) | Co - Director of Species Iniciative |
| 15 | Mr. Jorge Luis Martínez | Wildlife Conservation Society (WCS) | Co - Director of Species Iniciative |
| 16 | Mr. Diego Cardeñosa | Florida International University | Postdoctoral Associate |
| 17 | Mr. Carlos Hernández | United Nations Industrial Development Organization | Regional Coordinator - Latin American E-Waste Project |
| 18 | Ms. Leila Devia | Basel Regional Center for Training and Technology Transfer for South America (CRBAS) | Head of Department for the Implementation of the Basel Convention |
| 19 | Ms. Hildaura Acosta | *Centro de Investigación e Información de Medicamentos y Toxicos* (CIIMET), an inter-faculty institution under Panama University | Director |
| 20 | Ms. Marisa Quiñones | Ministry of Environment of Peru (MINAM) | National Coordinator of Project on Waste Electrical and Electronic Equipment (WEEE) |
| 21 | Mr. Edwin Camelo Martínez | United Nations Development Programme (UNDP) | Project Analyst for Persistent Organic Pollutants |
| 22 | Ms. Cristina Quispe | Ceyesa | Product Manager - Non Destructive Testing Business Unit |
| 23 | Mr. Edgardo Jimenez | Evident | Senior Sales and Marketing Manager - Analytical Instruments (XRF) |
| 24 | Mr. Alek Arora | United Nations Office on Drugs and Crime (UNODC) | Project Coordinator |
| 25 | Mr. John Hermanson | University of Washington | Research Scientist |
| 26 | Mr. José Ugarte | Center for Productive Innovation and Wood Technology Transfer (CITEmadera Lima) | Materials and Supplies Laboratory Specialist |
| 27 | Mr. Eric Rosenfield | U.S. Forest Service | Regional Manager for Illegal Logging and Associated Trade Program |
| 28 | Mr. Victor Miyakawa | U.S. Forest Service | Manager for Illegal Logging and Associated Trade Program - Peru |
| 29 | Mr. Edgard Espinoza | National Fish and Wildlife Forensic Laboratory, Ashland, Oregon, USA | Criminalistics Section Chief |
| 30 | Ms. Erin McClure-Price | Wood Identification and Screening Center, Ashland, Oregon, USA | Forensic Chemist |

**Annex II**

# WORKSHOP SUMMARY REPORT

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## EXECUTIVE SUMMARY

This report summarizes the activities and results of the in-person workshop held in August 2024 as part of the project “Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region” (SCCP 201 2023T), endorsed by the Sub-Committee on Customs Procedures (SCCP) of the Asia-Pacific Economic Cooperation (APEC). The main objective of this project is to improve the capacities of customs administrations in the region to identify and control illegal trade in goods with a negative impact on the environment, focusing on compliance with Multilateral Environmental Agreements (MEAs), such as the Basel Convention, the Montreal Protocol, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES. The scope of the project also includes species such as timber, fauna and hydrobiological resources that are not protected under CITES, but are regulated by domestic regulations that also seek to ensure their sustainable trade and prevent their illegal exploitation.

The workshop was organized by the National Superintendency of Customs and Tax Administration (SUNAT) of Peru, with the participation of fourteen APEC economies, in addition to international experts, and had a wide variety of sessions designed to comprehensively address the project's objectives. The workshop included exposure to several innovative technological solutions that were designed to improve the processes of traceability, identification and control of goods regulated by MEAs, as well as domestic regulations. Among the technologies highlighted were:

- **Digital traceability systems** such as The Origin Project, which provide transparent, real-time data on supply chains.
- **Tools** such as the Wild Cats Parts Identification Guide, developed to improve the capacity of frontline officers to identify protected species.
- **Portable and field tools** such as XyloTron and Vanta® XRF, that enable non-destructive identification of timber species and contaminant materials.
- **Advanced laboratory technologies** such as DART-TOFMS, used for high-precision chemical analysis of wood, fauna and flora.

Each technology was previously analyzed and consolidated in a research paper under key criteria including their justification, design, implementation, target commodity, results obtained, challenges and cost. The report highlights how these tools can optimize customs capabilities in the identification and control of regulated goods, as well as promote sustainability in trade operations.

The workshop also promoted inter-agency and international cooperation through plenary sessions, practical activities, working tables and the exchange of knowledge with representatives from various economies, and scientists and/or experts on technological solutions and tools. These dynamics made it possible to identify common needs, explore innovative strategies and establish recommendations for strengthening the customs framework in the Asia-Pacific region.

The workshop concluded with a consensus on the importance of international cooperation and the possibility of integrating these technologies into customs operations to ensure traceability, transparency and compliance. The resulting recommendations aim to guide APEC economies towards the implementation of greener and more sustainable customs.

## INTRODUCTION

Illegal trade of goods with a negative impact on the environment represents one of the greatest challenges for customs administrations worldwide. This problem includes activities such as trafficking in wildlife species, hydrobiological resources, illegal logging, trade of hazardous waste, and ozone depleting substances. These activities not only undermine global environmental conservation efforts, but also generate significant economic losses, foster corruption, and weaken domestic regulatory systems. Their consequences are particularly serious for biodiversity and ecosystems, compromising not only the integrity of the environment, but also the objectives of sustainable development, and the well-being of the communities that depend on these natural resources.

In this context, the project “Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region” was designed to strengthen the capacity of the region's customs to implement innovative technologies to identify and control these goods more efficiently. The project also promoted cooperation between economies, academia, international organizations, and the private sector, consolidating joint efforts to comply with MEAs such as the Basel Convention, the Montreal Protocol and CITES. The project also considered the importance of domestic regulations in each participating economy, recognizing that many species and resources not protected by international agreements require effective domestic measures to ensure sustainable trade and prevent illegal exploitation.

The workshop, held in August 2024 in Lima, Peru, gathered representatives from various APEC economies, international experts, academics, and private sector stakeholders, fostering a space for technical and strategic exchange. Structured in nine sessions, the first session provided a contextual framework on MEAs, the presentation of the Green Trade Strategy promoted by U.S. Customs and Border Protection (CBP) and the best customs practices implemented by the Australian Border Force (ABF), laying the groundwork for subsequent discussions.

Sessions 2 and 3 included plenary sessions that highlighted the importance of networking and strategic alliances to achieve common objectives, both domestically and internationally. Subsequently, sessions 4, 5 and 6 were led by scientists and experts, who presented innovative technological solutions. These included advanced systems for traceability and legality verification in supply chains, field identification tools, and laboratory technologies.

The second day of the workshop focused on practical activities designed to reinforce the technical knowledge acquired during the initial sessions. These activities included a technology showcase, where participants interacted with advanced equipment and tools; working tables that facilitated joint analysis; and, a visit to the Peruvian Customs Laboratory. These activities offered participants the opportunity to explore innovative technologies, evaluate their applicability to customs processes and discuss strategies for overcoming the challenges associated with their implementation.

This report details the results of the workshop, highlighting the technologies presented, lessons learned and recommendations arising from the discussions, with the aim of guiding APEC economies towards more efficient and environmentally responsible customs management.

## METHODOLOGY

The methodology used to prepare this Project Summary Report focused on the compilation, systematization and analysis of the information generated during the "Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region". This approach sought to ensure that the results of the report accurately reflect the activities carried out, the technologies presented, the discussions among participants and the recommendations that emerged from the event.

The methodology was structured in the following phases:

1. **Workshop planning and definition of objectives:** The organization of the workshop was based on the objectives established in the framework of the project, with a focus on strengthening customs capacities through the implementation of innovative technologies for the control of goods with environmental impact. During this stage, the main topics, technologies to be presented and dynamics of interaction among participants were defined.

2. **Workshop development:** The workshop, held in August 2024 in Lima, Peru, was structured in nine sessions that included presentations, plenary sessions, participatory dynamics and practical activities. The information gathered during the event came from the following sources:

   - **Technical presentations:** Presentations by scientists, experts and representatives of APEC economies on technological solutions, customs strategies and international best practices.
   - **Participatory dynamics:** Activities such as the technology showcase, working tables and the visit to the Peruvian Customs Laboratory, which allowed exploring the applicability of technologies and discussing the challenges associated with their implementation.
   - **Exchange of experiences:** Plenary and roundtable discussions that fostered inter-agency and international cooperation.

3. **Information gathering:** During the workshop, a systematic approach was used to gather relevant information by means of:

   - **Technical notes:** Record of presentations and key discussions held during the sessions.
   - **Results of working groups:** Systematization of the agreements and conclusions generated by the participants.
   - **Informal interactions:** Observation of exchanges between participants during breaks, which enriched the analysis with additional perspectives.

4. **Analysis and synthesis of results:** The information collected was analyzed and organized for this document, with a focus on providing a comprehensive view of the workshop's achievements.

   This methodology reflects the activities and information gathering process specific to the workshop, connecting it to the project objectives and its impact on the Asia-Pacific region.

## WORKSHOP

The workshop began with opening remarks by Gerardo Arturo Lopez Gonzales, National Superintendent of Customs and Tax Administration of Peru, followed by welcoming remarks by Raquel Hilianova Soto Torres, Deputy Minister of the Ministry of Environment (MINAM) of Peru.

Then, the master of ceremonies invited all participants to join for a group photo before starting the first of the six sessions scheduled for the first day of the workshop.

Group photo of the participants at the beginning of the workshop.


Source: Workshop team

## SESSION 1: THE ROLE OF CUSTOMS IN THE IDENTIFICATION AND CONTROL OF GOODS THAT NEGATIVELY IMPACT THE ENVIRONMENT

The first session established the basis of the workshop, highlighting the fundamental role of customs administrations in protecting our planet through the identification and control of goods that negatively impact the environment. In addition, green initiatives and best practices implemented by other customs administrations in the region were shared. The following is a summary of the most relevant aspects of the session.

### 1.1. Contextual Framework: Multilateral Environmental Agreements (MEAs)

**SUNAT** presented on the Green Customs Initiative and its scope, which seeks to generate environmental benefits through digitalization, the implementation of trade facilitation measures for environmentally friendly goods, the implementation of green strategies and/or action plans for Customs, as well as monitoring and enforcing the implementation of MEAs.
The crucial role of customs administrations in ensuring compliance with border legislation, specifically with respect to goods covered by MEAs, was highlighted, thus facilitating legitimate trade in environmentally sensitive goods while preventing their illicit trade.

Two complementary guides published in December 2021 were highlighted, designed to support frontline customs officers, who have a great challenge in implementing MEAs as their scope of application is diverse and technical in nature:

- Frontline Customs Officers' Guide to Key Multilateral Environmental Agreements
- Green Customs Guide to Multilateral Environmental Agreements

It was also noted that, in addition to these guides, there are other support resources provided by the World Customs Organization (WCO) and its strategic partners, such as training, materials, reports, among others. However, technological support was identified as a key resource that would be addressed during the workshop.

### 1.2. CBP Green Trade Strategy

The U.S. representative presented the Green Trade Strategy of the **U.S. Customs and Border Protection (CBP)** and the efforts they are making in its implementation.

CBP's Green Trade Strategy was launched in 2022 at the WCO headquarters in Brussels and was developed with the goal of combating climate change and environmental degradation as they relate to trade and commerce. When creating this strategy, they applied the following guiding principles: leadership, education, collaboration, commitment, investment.

Their strategy is composed of four goals to achieve their green trade vision:

- Incentivize green trade
- Strengthen environmental enforcement
- Accelerate green innovation
- Improving climate resilience and resource efficiency

It was mentioned that environmental crimes generate between USD 85 billion and USD 265 billion in revenues, which are often used to finance criminal activities.

The representative also highlighted the strategy's priority areas of application, such as illegal logging and timber trafficking; illegal mining focused on gold and diamonds; illegal, unreported and unregulated fishing; and wildlife trafficking.

### 1.3. Australia Customs Best Practices

The representative of the **Australian Border Force (ABF)** provided an overview of how they enforce environmental controls at their borders, noting that environmental border control is not the responsibility of a single agency, but that Australia takes a multi-agency approach to the development, management, implementation and enforcement of environmental laws at the border. In this approach, several government departments play a leadership role, which include the following:

Australian government departments:
- Department of Climate Change, Energy, Environment and Water
- Department of Agriculture, Fisheries and Forestry
- Department of Health and Aged Care
- Department of Employment and Workplace Relations

Border agencies:
- Australian Border Force (ABF)
- Department of Agriculture, Fisheries and Forestry

She explained that the ABF is moving forward with the implementation of specific border controls for environmental goods subject to MEAs. Although Australia is party to six MEAs, the presentations focus was on four agreements: endangered wildlife, ozone depleting substances and synthetic greenhouse gases, hazardous waste and mercury.

In addition, it was mentioned that the Green Customs survey, circulated in APEC and promoted by Australia, also included the presentation of the ABF Green Customs Framework which was developed by the ABF in 2022. This framework was presented as an inventory of existing green policies and practices within the agency, and it was explained that it has provided the ABF with a platform to explore and collaborate with other government agencies, trading partners and industry groups. It was noted that the goal is to implement and continuously improve sustainable green trade and green customs practices. It was also highlighted that one of the main pillars of this Framework is the enforcement of environmental regulations and MEAs.

Session 1 concluded with a brief round of questions and answers.

Panelists at the inaugural session of the workshop


Source: Workshop team

General view of the opening session

Source: Workshop team

**SESSION 2: STRENGTHENING THE NETWORK OF CONTACTS IN GOODS CONTROL THROUGH INTERACTION MECHANISMS – PART I (DOMESTIC FOCUS)**

The objective of this session was to promote coordination and cooperation between agencies to strengthen control mechanisms for goods that have a negative impact on the environment, through a robust and coordinated network of contacts.

The session was moderated by a representative of the **Ministry of Production (PRODUCE).**

**2.1. PLENARY: Coordinated interinstitutional work**

The moderator of this session provided the panelists with an overview and introduction to the topic of “Coordinated Interinstitutional Work”.

The moderator emphasized that effective coordination among government entities is fundamental to achieving sustainable and integrated development. He pointed out that, in order to regulate international trade, coordination is essential, which can be defined as the process through which synergies are generated among the actions and resources involved in a specific field of public management. This process also makes it possible to build a system of rules of the game in which the participating actors find incentives to cooperate beyond their particular interests.

Among the coordination mechanisms, the moderator mentioned the following: agreements and conventions, joint meetings, joint plans and programs, information and communication systems, training and institutional strengthening, as well as joint evaluation and monitoring.

PRODUCE, in its work to control CITES hydrobiological resources, works closely with SUNAT, the Specialized Environmental Prosecutor's Offices (FEMA), the Peruvian National Police (PNP) specialized in environmental issues and MINAM.

The moderator then posed the following questions to the panelists:

- What are the agencies with which you act in a coordinated manner to control goods that negatively impact the environment, and what are the main challenges you face in inter-agency coordination?

- What are the specific strategies that your agencies have implemented to obtain support in accessing technological solutions linked to the control of environmentally sensitive goods?

In response to the first question, the Director of the **Center for Productive Innovation and Wood Technology Transfer (CITEmadera Lima)** said that even though there is a line of work to develop the competitiveness of companies in the timber sector, there is also a line of strong coordination with allied agencies such as the National Forestry and Wildlife Service (SERFOR), the Agency for the Supervision of Forests Resources and Wildlife (OSINFOR), SUNAT and the Public Prosecutor's Office. He emphasized that, being a technical agency, they can actively collaborate in identifying solutions to improve control systems, which would reduce the possibility of mismanagement during timber marketing.

The Director indicated that, in recent years, there has been a greater openness among domestic agencies to share information, generating synergies that allow them to work together. He also mentioned that they are establishing cooperation agreements with the aforementioned entities to provide technological tools to facilitate the identification of timber goods.

The Director of the Directorate of Forest and Wildlife Heritage Management Control of **SERFOR** said that, as the CITES management authority in Peru, they play a key role in the control of international trade that does not only include CITES species. She indicated that they are constantly coordinating with SUNAT and other agencies, such as the PNP and the Public Prosecutor's Office. She emphasized that wildlife trafficking, which qualifies as organized crime, motivates greater coordination, not only with the specialized environmental prosecutors' offices but also with the specialized organized crime prosecutors' offices.

It was mentioned that coordination is already established at the regulatory level, but the challenge for the authorities is to identify new mechanisms to detect modalities and routes used to evade and elude control.

The representative of **Customs of Viet Nam** explained the role of the customs in the control of scrap metal and environmentally harmful substances in order to prevent the illegal import of scrap metal into Viet Nam. She explained that customs verifies the quality of scrap imports with the customs declaration, risk information and the corresponding certification (Certificate of Eligibility) for environmental protection. This implies that the authorities carry out a proper physical inspection during the goods clearance process in order to release them for customs clearance. It was noted that these control activities require prior investigations and the generation of policies that can be carried out in coordination with other actors.

In relation to the second question, the Director of CITEmadera Lima mentioned that Peru has a great diversity of timber species, which are increasing every year, currently reaching around 5,000 species. This diversity makes identification difficult, even for trained specialists. Therefore, in alliance with the U.S. Forest Service, they are working on the implementation of identification tools based on artificial intelligence to facilitate species recognition. These tools will enable CITEmadera Lima to create a database that does not currently exist, providing control entities with a complementary tool to promote clearer and fairer trade.

The Director also mentioned the remote sensing systems they use, as well as the adoption of chemical species identification equipment, which will enable them to become a forensic identification center, supporting public and private sector entities in the validation of timber species, or guaranteeing the security of operations. Through an articulated work with UNODC, this knowledge is being taken to the entities in the regions, thus creating a coordinated ecosystem among the entities working in the development of the timber sector.

The Director of the Directorate for the Control of Forest and Wildlife Heritage Management of SERFOR emphasized that as main strategies, legal provisions have been issued that require the implementation of forestry and wildlife information systems. These systems currently provide them with useful information for the management and traceability of products.

She also stressed the importance of inter-institutional efforts and international cooperation as a key strategy for receiving technical assistance support. She stressed that without cooperation and the use of technology, it would not be possible to effectively address illegality, adding that IT tools have become essential to optimize the control and surveillance actions of the institutions.

Finally, the representative of Customs of Viet Nam spoke about risk analysis in import and export operations to detect smuggling. She mentioned that Customs of Viet Nam has deployed smart customs, investing in new equipment and technologies to monitor and report on the intervention of goods.

To finish the session, the moderator concluded that the coordinated work between state entities is crucial for an effective control of wildlife. He also highlighted the importance of the use of digital technology in the daily work to streamline and make more transparent the work of the entities in charge of control, in order to facilitate the trade of goods.

Panelists of session 2


Source: Workshop team

## SESSION 3: STRENGTHENING THE NETWORK OF CONTACTS IN GOODS CONTROL THROUGH INTERACTION MECHANISMS – PART II (INTERNATIONAL FOCUS)

The third session focused on the work promoted by international organizations to contribute to environmental protection efforts, while building a strong network to facilitate the exchange of information, best practices and technological solutions for effective control of goods.

The moderator was the representative of the non-governmental organization **OCEANA.**

### 3.1. PLENARY: The work promoted by international organizations to contribute efforts to protect the environment

The moderator of the session began with an introduction to the topic, highlighting that international wildlife crime is a complex problem, involving the illegal exploitation of flora and fauna, and that it is linked to other illicit activities, such as trafficking in illegal substances, people, forced labor and displacement of indigenous groups. These activities share the same criminal networks, actors, routes and means of moving goods across borders. In this context, the involvement of international organizations is crucial to combat these global problems. In addition, he noted that the illegal wildlife trade has a significant market value, ranging from USD 7 to USD 20 million annually.

The moderator then posed the following questions to the panelists for further discussion:

- In which regions of the world is your collaboration most active, and what are the main challenges facing international organizations, such as the one you represent, in coordinating global efforts to control goods that pose environmental risks?

- What technological solutions are you promoting to strengthen global efforts to control goods that have adverse effects on the environment?

The representative of the **United Nations Office on Drugs and Crime (UNODC)** mentioned that UNODC is active in more than 86 economies. Its most successful interventions have been carried out in regions such as Southeast Asia, Sub-Saharan Africa and the Amazon Basin, areas rich in natural resources, where wildlife trafficking, illegal timber and gold trafficking, illegal fishing, among other crimes against the environment are detected. As an international organization, UNODC promotes cooperation through technical assistance and capacity building initiatives to combat these environmental crimes. However, UNODC faces several challenges in its coordination efforts:

- Financial and human resources limitations: Despite the availability of resources in some developed economies, in general, limitations persist in terms of funding and human resources dedicated to combating environmental crime.
- Insufficient access to technology: Some regions lack the technological resources necessary for effective monitoring and enforcement against environmental crime, which presents an opportunity for UNODC to support in this area, which is, in fact, part of the work they are doing.
- Corruption: Corruption remains a major obstacle, hampering efforts to effectively enforce laws and regulations.

In terms of technological solutions, UNODC promotes various tools designed to improve global efforts to control goods that negatively affect the environment, such as:

- **Capacity building tools:** Initiatives such as the Consortium on Combating Wildlife Crime Toolkit and a framework of indicators help assess economies' progress in combating environmental crime.
- **Legislative support tools:** Tools are provided to assist in the development of legislative frameworks that strengthen environmental protection.
- **Forensic identification tools:** Techniques such as forensic markers linked to seized items are crucial for investigating and prosecuting wildlife crime.
- **X-ray technology:** Used by front-line officers to identify illegal timber trafficking.
- **Satellite tracking:** Technologies are being implemented for real-time detection of illegal activities.
- **Aerial surveillance:** This method is used to monitor inaccessible areas and profile cargo.
- **Passenger and cargo control programs:** These programs enhance the ability to monitor and control the movement of goods that may pose environmental risks.

Through these initiatives and technological advances, UNODC seeks to strengthen global efforts to effectively combat environmental crime.

The representative of the **International Criminal Police Organization (INTERPOL)** stressed that INTERPOL is the world's largest international police organization, with 196 member economies, and that they have a unique mandate to exchange criminal information between law enforcement agencies, including customs authorities. INTERPOL works on five continents, although some projects focus on specific economies. Since 2010, the Environmental Security Program was created, covering five specialized areas: logging, illegal mining, wildlife, pollution and illegal fishing. INTERPOL operates 24/7 from several centers, including in Buenos Aires, Singapore and Lyon, and provides specialized support to different projects while facing new challenges.

The virtual space has become a new battleground for INTERPOL as it works with prosecutors' offices to raise awareness of emerging environmental crime. To strengthen global efforts, INTERPOL is promoting the following technological solutions:

- **Secure Communication System:** A network that connects all member economies for the secure exchange of information.
- **Blue notices:** Used to exchange modus operandi information with all member economies.
- **Shared databases:** Access to databases, such as fingerprints, to assist in investigations.
- **Data mining and forensic analysis:** Evidence analysis techniques, including wood sampling and general forensic analysis, using a variety of applications to detect potential criminal activity.

INTERPOL addresses cross-cutting environmental crimes, such as illegal mining and pollution, using satellite intelligence. Member economies can request INTERPOL's support in these areas.

For her part, the representative of the **Wildlife Conservation Society (WCS)** spoke about its science-based conservation and education actions, working closely with governments, indigenous communities, civil society and the private sector to combat environmental crime around the world. WCS operates in more than 32 economies in Latin America, Africa and Asia, addressing transnational and transcontinental crimes through essential cooperation. To effectively combat these crimes, it is critical to understand how business chain works in order to plan operations. WCS plays an important behind-the-scenes role in facilitating international contacts and technical consultation, but stressed the need for increased government capacity and commitment to address these challenges.

In terms of technological solutions, WCS emphasizes that combating environmental crime is impossible without leveraging technology. They use tools such as:

- **Drones and artificial intelligence:** These tools enhance surveillance and monitoring capabilities.
- **Identification apps:** These apps help identify species, facilitating the detection of illegal activities.
- **GPS and online search tools:** These technologies help track and monitor wildlife and their habitats.
- **Forensic tools:** WCS is actively discussing the use of various forensic techniques, including genetic identification for species verification.

In collaboration with academia, WCS applies molecular identification techniques in coordination with local governments, using these methods as evidence to prosecute illegal activities. Support from the private sector and academia is crucial to WCS's missions around the world, enhancing its ability to effectively combat environmental crime.

This session highlighted the importance of collaboration and communication between international organizations and other stakeholders involved in the control of goods that negatively impact the environment, as well as the need to strengthen the global framework for customs operations, ensuring that authorities are well equipped to deal with the complexities of modern trade while safeguarding the environment.

Panelists of session 3


Source: Workshop team

## SESSION 4: TECHNOLOGICAL SOLUTIONS FOR TRACEABILITY AND LEGALITY VERIFICATION

The fourth session focused on sharing best practices in the development and use of technological solutions to ensure the traceability and legality of goods, under the moderation of the representative of **Customs of Chile**. On this occasion, two speakers presented their experiences and points of view:

### 4.1. The Origin Project

The representative of the **Environmental Investigation Agency (EIA)** presented the Transparent Traceability System for commodities causing deforestation.

He began his presentation by talking about APEC's objectives in terms of forest governance, noting that the forum seeks to promote environmentally sustainable and resilient growth, while responsibly managing forest resources. He also highlighted the importance of combating illegal logging and associated trade, exchanging best practices, and promoting economic policies and capacity building programs.

The speaker highlighted the relevance of forest governance, mentioning essential elements for effective management, such as stakeholder participation, accountability, law enforcement and transparency. He stressed that people have the right to know what is happening in their forests and how they are managed.

The EIA representative explained the open-source timber traceability system, detailing five key principles for an effective domestic commodity traceability system: a seamless supply chain, traceability to source, direct digital inputs, offline functionality, and transparent and open data.

He then presented the Gabon Domestic Timber Traceability System, SNTBG *(le Système National de Traçabilité du Bois du Gabon)*, developed by Code4Nature in collaboration with EIA. This system has three main components: a mobile application for data entry, a central database, and a web application and geoportal for accessing data, statistics and reports. Differentiated access to the web application and geoportal was provided according to permission level, allowing government administrators, general government users, businesses and the public to access relevant data.

Furthermore, the system allows for tracking of goods and also incorporates a satellite alert system. He highlighted the benefits of the system, such as generating alerts, improving operations management, obtaining traceability data, verifying compliance with non-deforestation, sustainability and legality requirements, among others.

Finally, the EIA representative highlighted the features that make this system unique, including direct digital inputs, digital inventories of each tree, transport with GPS tracking and photos, real-time access to data and offline functions.

### 4.2. Management Information System - $SIGO_{SFC}$ & Digitalized Filling System – SIADO Region

The **OSINFOR** representative presented the Management Information System ($SIGO_{SFC}$) and the Digitalized Filing System (SIADO Region).

He explained that OSINFOR's institutional policy focuses on promoting the development of technologies that facilitate the implementation of digital government policies, including the promotion, prevention and control of risks.

He further discussed information management within OSINFOR, highlighting the transition from physical to virtual management through the use of structured data and “shapefiles”. This system has more than 34 million records, which facilitate the monitoring, inspection and training of licensees. The SIGOSFC, according to the representative, has been key to fostering the competitiveness of the forestry sector.

Over the past five years, the platform has received more than 230,000 visits and has been used by 52 economies. Among the outstanding benefits of the system are the traceability report of the Enabling Title Information, the registration of holders with sanctions or expiration, the downloading of statistical reports on monitoring, supervision and training processes, and the possibility of generating alerts on serious cases in forest harvesting processes.

The speaker also mentioned that this platform facilitates the improvement of information management, contributing to compliance with regulations and promoting transparency both internally and towards the public.

Speakers of session 4


Source: Workshop team

## SESSION 5: TECHNOLOGICAL SOLUTIONS AND TOOLS FOR FIELD IDENTIFICATION

The objective of this session was to present advanced technologies to improve the accurate identification of goods and species in the field, enabling stakeholders to effectively combat illegal activities such as trafficking in wildlife, hydrobiological resources, pollution and illegal logging.

The moderator was the Customs of the United States representative.

### 5.1. Wild Cats Parts Identification

The representative of **Panthera**, a global non-governmental organization founded in 2006, operates in the Americas, Africa and Europe with the objective of conserving the world's 40 wild cat species and the ecosystems they inhabit. Its mission includes scientific research, strategic species recovery, habitat restoration and collaboration with communities and partners. During the presentation, it was highlighted how the identification of wild cat parts faces several critical challenges: lack of prioritization among authorities, fragmentation of information due to decentralized systems, and legislative inconsistencies between economies, which hinder international efforts. In response, Panthera developed a Wild Cats Parts Identification Guide, a key tool to deter illegal trafficking of these animals and improve the effectiveness of controls.

The speaker indicated that a digital version of this guide is currently being developed, which will make it possible to take advantage of the technological advantages for faster and more efficient access.

### 5.2. Refrigerant Analyzer in the framework of the implementation under the Montreal Protocol

The representative of the **General Directorate of Environmental Affairs of the Industry of PRODUCE** presented the progress in the implementation of the Montreal Protocol in Peru, highlighting its importance in addressing global environmental problems such as damage to the ozone layer and global warming. The speaker explained how refrigerant gases, such as HCFCs and HFCs used in refrigeration equipment, freezing and air conditioning systems, contribute significantly to these problems. To mitigate their impact, the use of environmentally friendly refrigerants derived from hydrocarbons, more efficient refrigeration technologies and good practices in the recovery and recycling of refrigerants is promoted. In addition, he stressed the importance of training technicians and sensitize traders and citizens on the proper management of these substances.

The representative mentioned the ongoing projects in Peru, as the Management Plan for the Elimination of Hydrochlorofluorocarbons (HCFCs) Phase II and the Institutional Strengthening Project for the Implementation of the Montreal Protocol - Phase IV, implemented with the support of UNDP. He also highlighted the collaboration between PRODUCE and Peruvian Customs in the classification and identification of these substances, strengthening the management and monitoring capacity to prevent illegal trade in products that damage the ozone layer.

Speakers of the first part of session 5


Source: Workshop team

### 5.3. Molecular techniques for species identification

The representative from **Florida International University** presented the use of molecular techniques, specifically DNA analysis, as a tool to verify the origin of goods, specifically with reference to hydrobiological resources. The speaker emphasized how the increase in commercialized species and associated illegal activities underscores the need to strengthen controls. He mentioned specific cases, such as the detection of containers with shark fins, seahorses and European eels in international control operations. In one case, the Agriculture, Fisheries and Conservation Department of Hong Kong, China requested to corroborate the identity of European eel species, and in Colombia, analyses were carried out to determine the origin of live turtles that were seized.

The speaker highlighted the advantages of using a PCR machine, which allows DNA extraction and analysis in a reliable, economical and real-time manner, identifying up to 70 species. This system has been key to improving the identification of species protected under CITES regulations, strengthening the capacities of several economies and adapting chemical procedures for more in-depth analysis.

### 5.4. Screening techniques for the control of transboundary movements under the Basel Convention

The representative of the **United Nations Development Program (UNDP)** presented the objective of the Basel Convention: to protect human health and the environment from the adverse effects of hazardous waste. This convention covers wastes classified as hazardous according to their origin and characteristics, as well as other wastes such as household waste and incinerator ash. He stressed the importance of treating and disposing of waste as close as possible to its place of generation, promoting sustainable practices and the development of local capacities for its management.

The speaker explained the requirements for the transboundary shipment of waste, such as prior notification to the corresponding authorities and compliance with specific criteria to avoid illegal traffic. He also highlighted the use of technologies such as portable X-ray fluorescence (XRF) to classify and differentiate plastic waste and other materials, facilitating their inspection in the field. Initial findings indicated that a tiered approach, combining visual inspections and more advanced tests such as XRF, which is a non-destructive and non-intrusive method, is essential to improve controls and ensure compliance with the Convention.

### 5.5. XyloTron: Computer Vision System for Wood Species ID

The representative of **CITEmadera Lima** presented the XyloTron, an artificial vision system designed for the identification of timber species in the field, facilitating compliance with timber regulations in Peru. This portable system uses artificial intelligence to identify timber in real time, providing reliable, unbiased results backed by a global database.

The speaker described the identification process, which begins with obtaining reference samples and photographs, which are analyzed using mathematical models to determine the species. He also commented on the evaluation of the effectiveness of the XyloTron in four regions of Peru, achieving accurate identification of species to genus level. This system represents a significant advance in the control of the timber trade, promoting greater transparency and regulatory compliance in the sector.

Speakers of the second part of session 5


Source: Workshop team

## SESSION 6: TECHNOLOGICAL SOLUTIONS FOR LABORATORY IDENTIFICATION

The objective of this session was to demonstrate how advanced technologies in laboratory environments can improve accuracy and efficiency in the identification of species, commodities and environmental samples. These tools contribute to forensic analysis, biodiversity assessment and detection of illegal activities related to wildlife trafficking and environmental crime.

### 6.1. Mass Spectrometry Analysis in a Flora and Fauna Laboratory

The representative of the **National Fish and Wildlife Forensic Laboratory** presented the capabilities of the DART-TOF-MS (Direct Analysis in Real Time - Time of Flight - Mass Spectrometer) instrument, highlighting its usefulness in sample preparation, measurement of molecules and recording of measurements. The technique is especially valuable for complex tissues due to its many advantages:

- Accuracy and reproducibility of results.
- Elimination of the use of solvents, simplifying sample preparation.
- Speed and low cost of consumables.
- Ability to acquire spectra of positive ions (e.g., drugs of abuse) and negative ions (e.g., fatty acids).

Examples tested included sea turtle oil, harp seal oil, South American camelid wool and frankincense, highlighting the ability of DART-TOF-MS to identify chemical compounds with clarity.

### 6.2. Mass Spectrometry DART-TOFMS Analysis of Timber

The representative of the **Wood Identification and Screening Center** highlighted the use of mass spectrometry to answer key questions, such as species, “country of origin” or the specific source of the wood (forest plot or stump). The methods combine:

- DNA: Species identification and geographic provenance.
- Traditional anatomy: Image-based methods, such as Xylotron, mobile applications and dendrochronology.
- Chemistry: Chemical fingerprinting and isotope analysis.

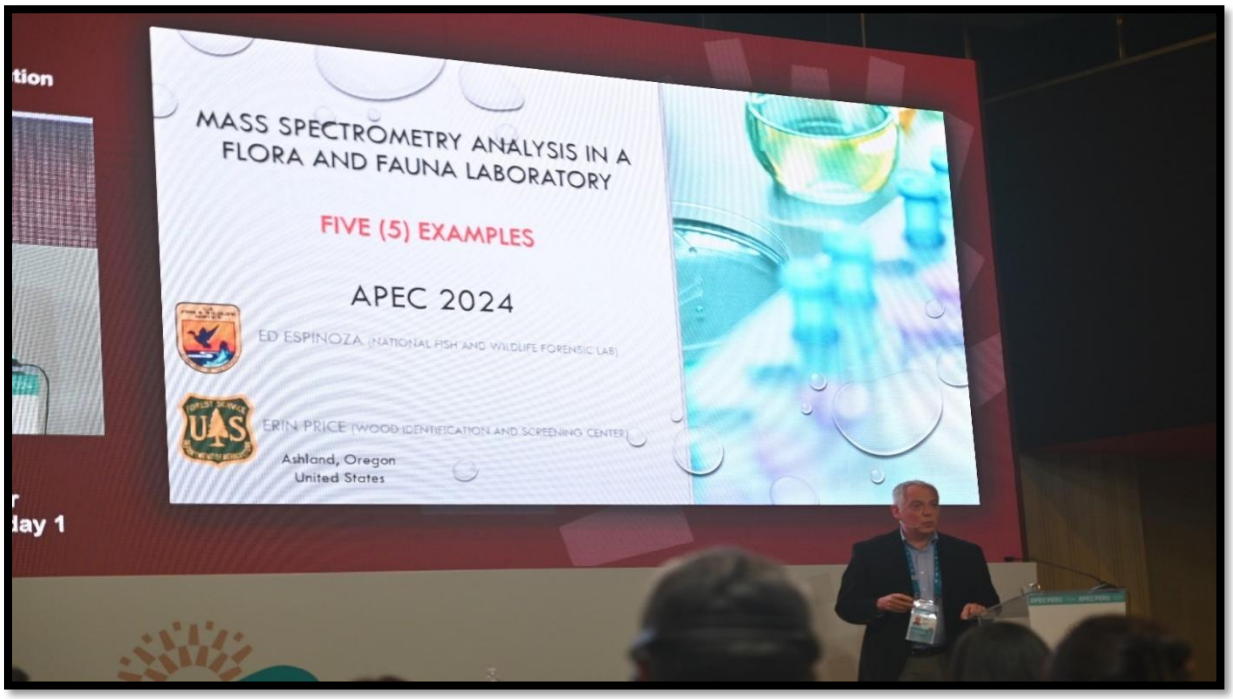
She highlighted the development of a robust forest database that includes:

- 1,600 species, covering most CITES-listed and commonly traded legal timber.
- More than 20,000 spectra, facilitating the identification and analysis of timber species.

Among the cases analyzed are Araucaria, Wollemia Nobilis, Pericopsis Elata and Palisandro, reinforcing the relevance of these tools in compliance with international trade regulations.

This last session, dedicated to technological solutions for laboratory identification, concluded the first day of the workshop. The second day of the workshop would continue with practical activities, discussions and a technical visit, consolidating learning through a participatory and interactive approach.

Speakers of session 6




Source: Workshop team

## SESSION 7: TECHNOLOGY SHOWCASE AND Q&A

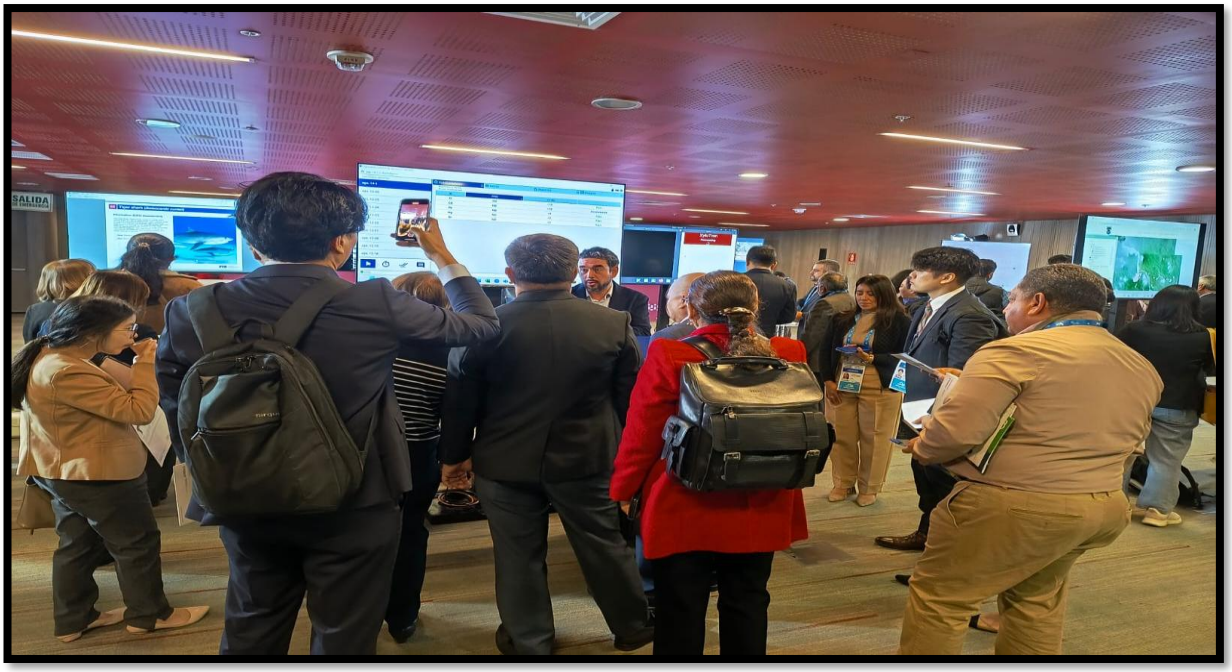
Session 7 offered an interactive and hands-on experience through a technology showcase, where participants had the opportunity to interact directly with the scientists and/or experts who presented their technological solutions and tools.

During this activity, various technological solutions and tools applied to the identification, control and monitoring of restricted species/commodities were exhibited, allowing attendees to learn first-hand about the functionalities, uses and applications of each technology and tool. Participants were able to manipulate the equipment, observe real-time demonstrations and learn more about the technical operation of the tools previously presented during the workshop.

One of the highlights of this session was the direct communication between the attendees and the scientists and/or experts, which provided a space to answer all questions and concerns. This dynamic made it possible to clarify specific doubts, explore practical cases and receive precise guidance on the use of these technologies in their respective work contexts.

The technology showcase consolidated the knowledge acquired in the previous sessions, providing an enriching experience focused on practical learning.

Overview of the technology showcase




Source: Workshop team

Interaction of the participants with the scientists and/or experts of the technologies

.Source: Workshop team

**SESSION 8: ROUNDTABLE**

During this session, working groups were organized with seven members each, who brought diverse perspectives based on their specialties and experiences. Participants discussed two key questions, with the objective of identifying challenges and needs, as well as exploring strategies and solutions related to the implementation of Multilateral Environmental Agreements (MEAs). The roundtable methodology encourages open and collaborative discussion, allowing each member of the roundtable to contribute their knowledge and experience, favoring the exchange of ideas and the construction of collective solutions. Each table designated a representative to present the conclusions to all workshop attendees.

- **Question 1: What are the main problems or needs faced by your customs administration in relation to the implementation of MEAs?**

One of the tables classified the problems and needs into three categories, which facilitated the organization of the ideas discussed by all tables:

Problems or needs linked to <u>people:</u>

- Lack of capacity building.
- Lack of public awareness.
- Cross-cutting presence of corruption, both in the public and private sectors.
- Increase in illicit trafficking of restricted species and goods that escape customs controls and those of other competent entities.

Problems or needs related to <u>resources</u>:

- Lack of inter-institutional coordination and cooperation.
- Limited information exchange.
- Lack of access to advanced technology and data systematization tools.
- Insufficient equipment and infrastructure.
- Limited financial resources.
- Lack of knowledge on traceability and movement of restricted species and goods.

Problems or needs related to <u>legal frameworks</u>:

- Difficulties in establishing agreements between economy-level, bilateral, regional and multilateral actors due to complex legal frameworks that limit case tracking and cooperation between partners.
- Lack of political will and state commitment.
- Need to catalyze the transition to Green Customs to comply with environmental commitments.
- Lack of regulatory changes to facilitate administrative simplification for greater operational efficiency.
- Lack of updated regulatory frameworks that reflect operational realities.

- **Question 2: What strategies have your agencies developed to access technological solutions to improve the control of goods that have a negative impact on the environment? Do you think that any of the technologies presented could be useful for your needs, and what other solutions not mentioned would you recommend considering?**

Participants identified several strategies and solutions implemented by their administrations:

- Project financing.
- Improved risk management criteria and the development of customs-tax risk profiles.
- Increased investment and research in innovative technologies.
- Creation of environmental frameworks for businesses.
- Promotion of technical cooperation among APEC institutions and economies for the transfer of knowledge and technologies.
- Use of platforms such as single windows for the clearance of goods and permits, in addition to the management of databases such as CITES.
- Implementation of technological tools such as geoservers, scanners, artificial intelligence (AI) and SMART selectivity.
- Conduct surveys and reports to determine viable approaches to MEA implementation.
- Promote information exchange through international organizations.
- Develop partnerships with private entities that have advanced technologies to improve the control of goods.

Participants highlighted that all the technologies presented during the workshop were highly relevant to improve the control of goods with environmental impact, although they recognized that their implementation would be a challenge due to the specific capabilities and competencies of each entity. In addition, the potential of artificial intelligence as a key tool for combating illicit activities related to the environment was emphasized.

Participants at their discussion tables during the roundtable session

Source: Workshop team

**SESSION 9: FIELD VISIT TO CUSTOMS LABORATORY**

The last session of the workshop was held at the Peru Customs Laboratory. In its auditorium, participants attended two presentations prior to the tour of the facilities.

The first presentation, entitled **"The Role of the Peruvian Customs Laboratory in the Identification of Goods"**, was given by the head of the Peruvian Customs Laboratory. The key functions of the laboratory in the identification of goods were discussed, highlighting its

role in customs control and ensuring the legality of international trade, with special emphasis on the use of technologies.

The second presentation, **"Wildlife Forensic Science of Flora and Fauna"** was given by the Chief of the Criminalistics Section of the National Fish and Wildlife Forensic Laboratory in Ashland, Oregon, USA. The presentation discussed forensic techniques applied to species identification and combating illegal trafficking in flora and fauna, providing a detailed overview of the scientific methods used to protect biodiversity.

The participants then toured the laboratory facilities in groups, guided by specialized personnel, who provided detailed information on the processes and technologies used in the analysis of goods.

With this activity and the closing speech by the Project Overseer, the program for the two-day workshop was concluded, marking the end of a fruitful space for the exchange of knowledge and experiences on technological solutions applied to customs control and environmental protection.

Workshop participants during their visit to the Peruvian Customs Laboratory

Source: Workshop team

## CONCLUSIONS

The “Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region” demonstrated that the incorporation of innovative technologies can significantly transform the capabilities of customs administrations in the identification and control of goods with an environmental impact. Technological tools such as forestry traceability systems, analyzers for the identification of substances that damage the ozone layer and advanced technologies for the detection of wildlife products were presented at the event. These solutions provide an effective response to illegal trade in goods regulated by international agreements such as the Basel Convention, the Montreal Protocol and CITES, as well as by domestic regulations.

The practical approach of the workshop, which included dynamics such as the technology showcase, working tables and technical visits, was essential for participants to evaluate the applicability and functionality of the technologies presented in various customs contexts. This format not only strengthened the technical capabilities of the participants, but also fostered the exchange of experiences and best practices among economies, academia, international organizations and the private sector.

One of the main conclusions of the workshop is that the technologies identified have the potential to be replicated and adapted in other economies of the Asia-Pacific region, considering the regulatory and operational particularities of each economy. Furthermore, these tools not only contribute to compliance with international and domestic environmental regulations, but also promote more sustainable supply chains aligned with APEC's environmental protection objectives.

The workshop highlighted the importance of inter-agency and international collaboration to maximize the impact of these technologies. However, challenges were also identified, such as the need to ensure financial sustainability, compatibility with existing processes, and the expansion of databases used for commodity identification. In this regard, strengthening strategic alliances between public and private actors, as well as promoting continuous innovation, will be key to overcoming these challenges.

In conclusion, the results of the workshop provide a solid basis to guide customs administrations of APEC economies in the implementation of technological solutions that strengthen environmental customs management, thus contributing to the construction of a more efficient and sustainable customs framework committed to the protection of biodiversity and ecosystems in the region.

Annex 1

| **Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region<br>DAY 1: Tuesday, 13 August 2024 – Puruchuco Room** | |
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| **TIME** | **TOPIC** |
| 08:00-08:30 | Arrival and Registration |
| **OPENING AND WELCOME OF MEETING** | |
| 08:30-09:15 | **Opening Remarks**<br><br>Gerardo Arturo López Gonzales<br>National Superintendent<br>National Superintendency of Customs and Tax Administration (SUNAT) of Peru |
| | **Welcome Remarks**<br><br>Raquel Hilianova Soto Torres<br>Vice Minister<br>Ministry of Environment of Peru |
| | **Group Photo** |
| **SESSION 1: THE ROLE OF CUSTOMS IN THE IDENTIFICATION AND CONTROL OF GOODS THAT NEGATIVELY IMPACT THE ENVIRONMENT** | |
| 09:15-10:00 | **Contextual Framework: Multilateral Environmental Agreements (MEAs)**<br>Diana Malú Torres Chicchón<br>Project Overseer<br>National Superintendency of Customs and Tax Administration (SUNAT) of Peru<br><br>**CBP Green Trade Strategy**<br>Kristin Isabelli<br>Branch Chief, Strategy Execution, Green Trade<br>U.S. Customs and Border Protection<br><br>**Australia Customs Best Practices**<br>Erin Roper<br>Assistant Director \| WCO and Customs Partnerships<br>Australian Border Force<br><br>**Q&A session** |
| **10:00 MORNING BREAK (30 MINUTES)** | |
| **SESSION 2: STRENGTHENING THE NETWORK OF CONTACTS IN GOODS CONTROL THROUGH INTERACTION MECHANISMS – PART I (DOMESTIC FOCUS)** | |

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| 10:30-11:30 | **PLENARY: Coordinated interinstitutional work**<br>Moderator: Ministry of Production (PRODUCE)<br><br>National Forest Service and Wildlife (SERFOR)<br><br>Center for Productive Innovation and Wood Technology Transfer (CITEmadera Lima)<br><br>Customs of Viet Nam |
| **SESSION 3: STRENGTHENING THE NETWORK OF CONTACTS IN GOODS CONTROL THROUGH INTERACTION MECHANISMS – PART II (INTERNATIONAL FOCUS)** | |
| 11:30-12:30 | **PLENARY: The work promoted by international organizations to contribute efforts to protect the environment**<br>Moderator: OCEANA NGO<br><br>United Nations Office on Drugs and Crime (UNODC)<br><br>International Criminal Police Organization (INTERPOL)<br><br>Wildlife Conservation Society (WCS) |
| **12:30 NETWORKING LUNCH (90 MINUTES)** | |
| **SESSION 4: TECHNOLOGICAL SOLUTIONS FOR TRACEABILITY AND LEGALITY VERIFICATION**<br>Presenter: Customs of Chile | |
| 14:00-14:40 | **The Origin Project**<br>David Gehl<br>Senior Manager for Transparency, Traceability and Technologies<br>Environmental Investigation Agency<br><br>**Managment Information System - $SIGO_{SFC}$ & Digitalized Filling System – SIADO Region**<br>Carlos Candia<br>Executive<br>Agency for the Supervision of Forest Resources and Wildlife (OSINFOR) |
| **SESSION 5: TECHNOLOGICAL SOLUTIONS AND TOOLS FOR FIELD IDENTIFICATION – PART I**<br>Presenter: Customs of USA | |
| 14:40-15:20 | **Wild Cats Parts Identification**<br>Ana Pamela Pastor Sánchez<br>Project Coordinator, Counter Wildlife Trafficking<br>PANTHERA |

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| | **Refrigerant Analyzer in the framework of the implementation under the Montreal Protocol**<br>Johan Oswaldo Leon Moreno<br>Environmental Management Specialist<br>Ministry of Production (PRODUCE) |
| **15:20 AFTERNOON BREAK (30 MINUTES)** | |
| **SESSION 5: TECHNOLOGICAL SOLUTIONS AND TOOLS FOR FIELD IDENTIFICATION – PART II**<br>Presenter: Customs of USA | |
| 15:50-16:45 | **Molecular techniques for species identification**<br>Diego Cardeñosa, PhD<br>Postdoctoral Associate<br>Florida International University<br><br>**Screening techniques for the control of transboundary movements under the Basel Convention**<br>Edwin Camelo Martínez<br>Project Analyst for Persistent Organic Pollutants<br>United Nations Development Programme (UNDP)<br><br>**XyloTron: Computer Vision System for Wood Species ID**<br>José Ugarte<br>Materials and Supplies Laboratory Specialist<br>Center for Productive Innovation and Wood Technology Transfer (CITEmadera Lima) |
| **SESSION 6: TECHNOLOGICAL SOLUTIONS FOR LABORATORY IDENTIFICATION**<br>Presenter: Master of Ceremony | |
| 16:45-17:25 | **Mass Spectrometry Analysis in a Flora and Fauna Laboratory**<br>Edgard Espinoza, PhD<br>Criminalistics Section Chief<br>National Fish and Wildlife Forensic Laboratory, Ashland, Oregon, USA<br><br>**Mass Spectrometry DART-TOFMS Analysis of Timber**<br>Erin McClure-Price, MS<br>Forensic Chemist<br>Wood Identification and Screening Center, Ashland, Oregon, USA |
| 17:25-17:30 | **Closing Day 1** |
| **Workshop on Technological Solutions for Green Customs in the Asia-Pacific Region**<br>**DAY 2: Wednesday, 14 August 2024 – Cajamarquilla and Puruchuco Rooms** | |
| **TIME** | **TOPIC** |

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| 08:30-08:45 | Recap of Day 1 & Review Day 2 Agenda<br><br>Diana Malú Torres Chicchón<br>Project Overseer<br>National Superintendency of Customs and Tax Administration (SUNAT) of Peru |
| **SESSION 7: TECHNOLOGY SHOWCASE and Q&A<br>Cajamarquilla Room** | |
| 08:45-10:15 | Participants will have the opportunity to interact with scientists and experts who will present their tools and technologies. During this session, all your questions can be answered. |
| **10:15 MORNING BREAK (30 MINUTES)** | |
| **SESSION 8: ROUNDTABLE<br>Puruchuco Room** | |
| 10:45-12:15 | Roundtable: Discussions<br>Exercise N° 1: Participants discuss the first of two provided questions.<br>Exercise N° 2: Participants discuss the second of two provided question.<br><br>Each table reports to all workshop participants. |
| **12:30 NETWORKING LUNCH (60 MINUTES)** | |
| 13:30-15:00 | Gathering at meeting point & field visit to the Customs Laboratory |
| **SESSION 9: FIELD VISIT TO CUSTOMS LABORATORY** | |
| 15:00-17:00 | **The role of the Peruvian Customs Laboratory in the Identification of Goods**<br>Maritza Moncada Ramirez<br>Head of Peruvian Customs Laboratory<br>National Superintendency of Customs and Tax Administration (SUNAT) of Peru<br><br>**Wildlife Forensic Science of Flora and Fauna**<br>Edgard Espinoza, PhD<br>Criminalistics Section Chief<br>National Fish and Wildlife Forensic Laboratory, Ashland, Oregon, USA<br><br>**Laboratory Tour** |
| 17:00-17:15 | **Closing Day 2**<br>Workshop Completion Survey<br>Closing remarks from Project Overseer |
| **The Workshop's Cultural Activity*<br>Huancahuasi Restaurant<br>Ave. Javier Prado Este N° 1405, La Victoria, Lima, Peru<br><br>* By Invitation Only** | |