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The applicability of traceability systems for CITES ornamental plants with a focus on the Andean and other Latin American countries - A Preliminary Assessment

Document commissioned by UNCTAD, in consultation with CITES Secretariat

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NOTE

For further information on the UNCTAD BioTrade Initiative, please see http://www.unctad.org/biotrade or write to biotrade@unctad.org.

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This draft advance document will be discussed during the "Technical workshop on traceability systems for CITES Appendices II and III listed non-timber forest plant species (ornamental and medicinal plants)" to be organized on 22 September 2016 in Johannesburg, South Africa. The inputs from this workshop as well as other from meetings held during the 17th Conference of Parties of CITES will be included in the final version.

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List of abbreviations and acronyms

AIDC. Automated identification and data capture, *Automated Identification and Data Capture*
AR. *Argentina*
ASYCUDA. *Automated SYstem for CUstoms DAta*
B2B. *Business to business*
BO. *Plurinational State of Bolivia*
BR. *Brazil*
CBD. *Conference of the Parties to the Convention on Biological Diversity*
CITES. *Convention on International Trade in Endangered Species of Wild Fauna and Flora*
CL. *Chile*
CO. *Colombia*
COP. *Conference of Parties*
CR. *Costa Rica*
CTE. *Critical Tracking Event*
DNA. *Deoxyribonucleic acid*
EC. *Ecuador*
GT. *Guatemala*
GTC. *Global Traceability Conformance*
GTIN. *Global Trade Item Number*
IAC. *Issuing agency code, for ISO15459*
ID. *Identifier*
IT. *Information (and Communication) Technology*
ITC. *International Trade Centre*
IUCN. *International Union for Conservation of Nature*
KDE. *Key Data Elements*
LAF. *Legal Acquisition Finding*
Minambiente. *Ministry of Environment and Sustainable Development, Colombia*
MAE. *Ministry of Environment, Ecuador*
MINAM. *Ministry of Environment, Peru*
MX. *Mexico*
NDF. *Non-detriment finding*
PA. *Panama*
PE. *Peru*
POS. *Point of Sale*
RFID. *Radio Frequency Identifiers*
SGTIN. *Serialised Global Trade Item Number*
UI. *Unique identification*
UN/CEFACT. *United Nations Centre for Trade Facilitation and Electronic Business*
UNCTAD. *United Nations Conference on Trade and Development*
URL. *Unified Resource Locator, sometimes called a webaddress*
USD. *United States Dollar*
VE. *Bolivarian Republic of Venezuela*

Summary of main findings

The present study analyses the trade of CITES Appendix II and Appendix III listed ornamental plants (Cycadaceae, Orchidaceae, Bromeliaceae and Euphorbiacecae) from selected Andean (Plurinational State of Bolivia, Colombia, Ecuador and Peru) and Latin American countries (Argentina, Brazil, Chile, Costa Rica, Guatemala, Mexico, Panama and the Bolivarian Republic of Venezuela) and analyses the use of traceability systems as a tool to strengthen existing CITES processes, in particular Legal Acquisition Findings (LAFs) and Non-Detriment Findings (NDFs).

The following is a list of the main findings:

1. The floricultural trade worldwide has experienced a strong growth of 12 per cent per annum in the period of 2001-2014. The total trade in 2014 was USD 21.5 billion.
2. Of the CITES-listed ornamental plants and plant products exported from the considered countries in the time frame of 2010-2014, Cycadaceae represented 62.5 percent with nearly 27 million exported products (only considering leaves, live plants, roots and stems); Cactaceae represented 24 percent with over 10 million plant products (including seeds, live plants and stems), Orchidaceae represented 9.5 percent with 4 million plant products (live plants, leaves, roots and stems) being exported; Bromeliaceae represented 2.7 percent with just over 1 million live plants and Euphorbiaceae together with Zamiaceae represented the 2 percent with just under a million products (live plants, roots, wax).
3. Orchid exports from the chosen countries seem to have grown strongly until 2012, but experienced a slowdown in 2013; this might be true, however, due to an exceptional spike in trade from Brazil in 2012. Costa Rica is the largest exporter in the period of 2010-2014. Main markets are the United States, Japan and the European Union.
4. Trade of CITES-listed Cycadaceae on the contrary seems to be declining. Costa Rica is by far the most important exporter; trade from the only other trader Guatemala seems to have come to a standstill in 2013. The main markets are the European Union and the United States of America.
5. However, market assessment is made difficult by the inconsistent reporting between exporters and importers. Within the studied period of 2010-2014, exporters reported about 20 per cent more trade than importers in Orchidaceae and even 33 per cent more trade in Cycadaceae.
6. In the studied countries, Orchidaceae represent an important family within the trade in ornamental plants; the traded plants are practically all artificially propagated.
7. Regarding existing control systems, the interviewed CITES Management Authorities operate a comprehensive control system based on issuance and control of operating licenses[1] and control of exported quantities/specimens via CITES import and export permits and certificates. However, determining the species of exported plants is very difficult. This affects both the controls for operating licenses as well as the export control. Some private operators have internal traceability systems.
8. Traceability can clearly contribute to the robustness of Legal Acquisition Findings, and can also generate useful trade data to improve Non-Detriment Findings.
9. Recording of receptions of plant material at nurseries, creation of a database of properly identified parental plants and linking export permits to identified parental plants, can strongly strengthen the CITES permitting process, in particular if coupled with risk management systems in the controls for an operating license and in the issuance of CITES import and export permits and certificates.

[1] A license that allows a company to legally operate and is often renewed on an annual basis

10. A traceability system is recommended based on the above process elements, i.e. recording of receptions, recording and control of stocks, linking of CITES export permits and certificates to registered stocks; however, the socio-economic possible impacts arising from the use of such a traceability system should be understood and integrated into a pilot project. Recommendations for the development of a pilot study are made.

1 Introduction

1.1 Background

UNCTAD and the CITES Secretariats have a long standing partnership, defined by their MoU signed in 2010, that commits both organizations to ensure the conservation of species, enhance the livelihoods of the poor in remote and marginal areas, and promote business opportunities for entrepreneurs that comply with CITES requirements and relevant national legislations. Mention should also be made to the fact that UNCTAD and the CITES Secretariat have agreed to collaborate on matters related to implementing special automated customs procedures for CITES-listed species of wild fauna and flora within the UNCTAD ASYCUDA automated system. This is of particular relevance given the desirability to integrate any traceability system with automated custom management systems, such as ASYCUDA.

Particular attention is paid to the role of economic incentives for sustainable management of CITES Appendices II and III-listed species and benefit sharing with resource owners. UNCTAD channels its contribution through its BioTrade Initiative.

At the 15th and 16th meetings of the Conference of the Parties (COP) to CITES, it was decided to consider the possible development of traceability systems to assist with ensuring the sustainable use of CITES-listed species. In response, UNCTAD and the CITES Secretariat have been collaborating in drafting technical documents and workshops on traceability issues to better understand the requirements in developing such systems for species through the supply chain, from sourcing all the way to the market and final consumption by consumers.

Within non-timber plant species, CITES Parties and BioTrade partners have been considering or implementing traceability systems (see for example [1]), but no comprehensive study has yet been undertaken.

In view of the above, UNCTAD is preparing, in consultation with the CITES Secretariat and its BioTrade focal points, comprehensive studies to facilitate work related to the tracing of CITES-listed non-timber forest plant species, focusing on ornamental and medicinal plants.

The studies were meant in particular contribute to efforts to establish an umbrella traceability model for CITES-listed species of flora and fauna, for consideration by the CITES Parties. This is in line with the Secretariat's ongoing discussions with the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) regarding the possible development of a business requirement specification for international trade in wildlife (AC28 Doc 14.2.1[2], SC66 DOC. 34.1[3]). Such a specification would provide guidance on the use of a potential 'umbrella model' for developing track and trace systems for CITES-listed species. The current study will aim to contribute to providing an information base for CITES to consider in its work.

UNCTAD's work is being developed in two distinctive phases. As a first phase, the study will focus on ornamental plants in the Latin American region, with emphasis in the Andean subregion. A second study will be developed in 2016 to assess the feasibility of traceability systems for medicinal plants in the Asian region, with emphasis in the Mekong subregion. In consultation with relevant value chain stakeholders, the studies will also assess the applicability of other traceability systems that may be

[2] https://cites.org/sites/default/files/eng/com/ac/28/E-AC28-14-02-01%28Rev1%29.pdf
[3] https://cites.org/sites/default/files/eng/com/sc/66/E-SC66-34-01-Rev1.pdf

applied to non-timber plant species (ornamental and medicinal plants) included in CITES Appendix II and Appendix III.

The analysis, findings and recommendations of the work undertaken will be presented and discussed through interviews with key stakeholders, as well as at different stages in 2016 (the content presented will vary according to the different stages of completion of the study), as follows:

1. The ornamental plants study was discussed with Parties to CITES during a side event, in bilateral meetings and disseminated under information document (SC66 Inf.16) at the 66th meeting of the CITES Standing Committee in January 2016;
2. The findings and recommendations of the studies on ornamental and medicinal plants will be peer reviewed in spring and summer 2016
3. A technical workshop organized by UNCTAD in consultation with CITES Secretariat and other stakeholders will be held to discuss the findings and recommendations of the studies with relevant stakeholders involved in traceability systems for CITES-listed species, including government officials, relevant private business and international organisations, in autumn 2016.
3. The final study will be presented to and discussed with the Parties to CITES during the 17th meeting of the Conference of the Parties (CoP 17) in Johannesburg, South Africa, in October 2016; and
4. The final study will also be shared with relevant stakeholders, including BioTrade partners, during the fourth BioTrade Congress to be held at the 13th session of the Conference of the Parties to the Convention on Biological Diversity (CBD) in December 2016.

This study, commissioned in end-2015, assesses the applicability of "track and trace" systems that are applied to ornamental plants included in CITES Appendix II and III in the Latin American region with emphasis on the Andean subregion. In particular, the following countries are included in the study

Table 1-1 Countries considered in this study

Country	Abbreviated name
Argentina	AR
Plurinational State of Bolivia	BO
Brazil	BR
Chile	CL
Colombia	CO
Costa Rica	CR
Ecuador	EC
Guatemala	GT
Mexico	MX
Panama	PA
Peru	PE
Bolivarian Republic of Venezuela	VE

This study is timely, following the submission from the Management Authority of Switzerland and Liechtenstein at the 22nd meeting of the CITES Plants Committee in Tbilisi on October 2015, suggesting the exemption of finished goods packaged and ready for retail trade which contain components of Appendix-II orchids (PC22 Doc. 22.1). Following this submission, a working group was established to further study potential risks and/or benefits of an exemption for orchid components, particularly with regard to wild-collected specimens (see PC22 Sum 2[4] or Doc. 22.1 – p. 3[5]) and the advisability of submitting a proposal to the CoP17 to amend the annotation #4 paragraph for Appendix-II orchids to include such an exemption.

Limited information is available on orchids, aside from what is available in PC22 Doc22.1[5] and in the document prepared by the IUCN (PC22 Inf.6[6]). Particularly, gaps identified referred to trade in orchid products from source to final product, identification of major industry sectors, how non-detriment findings are made, traceability along the chain, trade reporting, orchids' parts and derivatives used in products, conservation concerns for wild population, among others.

1.2 Aim and scope

This study aims to contribute to the traceability work on traceability systems being undertaken by CITES Parties. In particular, it would provide information on the trade of CITES-listed ornamental plants originating in the Andean countries, mainly the Plurinational State of Bolivia, Colombia, Ecuador and Peru, as well as other Latin American countries, in particular Argentina, Brazil, Chile, Costa Rica, Guatemala, Mexico, Panama and the Bolivarian Republic of Venezuela; see also Table 1-1.

The study is focused on ornamental plants from the above listed countries. The aim is to support sustainable and legal trade in CITES listed non-timber forest plant species through traceability.

Its terms of references cover the following core activities:

- In-depth review of existing information on the supply chains for ornamental plants in the Latin American region, with emphasis on the Andean region, focusing on specimens of CITES-listed species and those being supported by BioTrade partners.
- Interviews on an on-going basis with key stakeholders from sourcing countries (governments, companies, producers, NGOs, etc.), industry members that are importing those species, as well as United Nations organizations involved in this trade in order to obtain detailed information on the benefits, best practices, lessons learned, challenges and requirements of traceability systems, particularly for small farmers and land-owners, and validate the findings of the study.
- Identification and review of existing traceability systems for ornamental plants, and determine those to be further analysed in the framework of the study.
- Mapping of the value chains for ornamental plants in the selected region, including the identification and role of key stakeholders involved in defining and implementing traceability systems, and the identification of livelihood benefits obtained by upstream and downstream stakeholders.
- Analysis and assessment of how the selected systems are being implemented, including their internal control systems (documentation and methodology used, as well as key intervention points and actors throughout the value chain to ensure the system's effectiveness to limit illegal harvesting and trade of the species, etc.,). The selected systems will then be categorized according to criteria defined jointly with UNCTAD and the CITES Secretariat and other relevant partners.
- Assessment of the socio-economic implications (benefits, cost and practical feasibility) of the selected systems, particularly considering the needs of small farmers and land-owners,

[4] https://cites.org/sites/default/files/eng/com/pc/22/ExSum/E-PC22-ExSum-02.pdf
[5] https://cites.org/sites/default/files/eng/com/pc/22/E-PC22-22-01.pdf
[6] https://cites.org/sites/default/files/eng/com/pc/22/Inf/E-PC22-Inf-06.pdf

governments and industries, in order to define their capacity-building needs and a fair distribution of benefits being generated throughout the value chain.
- Practical recommendations on how a traceability system should be defined and implemented for non-timber flora species within the CITES framework. A roadmap for taking the recommendations of the study forward in collaboration with the CITES Secretariat and Parties (and other relevant intergovernmental bodies) will also be developed.

The outcome of this study, which is based on international standards and norms, includes, inter alia,
- a technical overview of traceability systems available for ornamental plants;
- recommendations on how a traceability system should be defined and implemented and on how to address the capacity-building requirements for the related small-scale farmers and land-owners, CITES Authorities and industry; and
- a roadmap for presenting the study and its recommendations to CITES Parties (and other relevant intergovernmental bodies).

1.3 Methodology

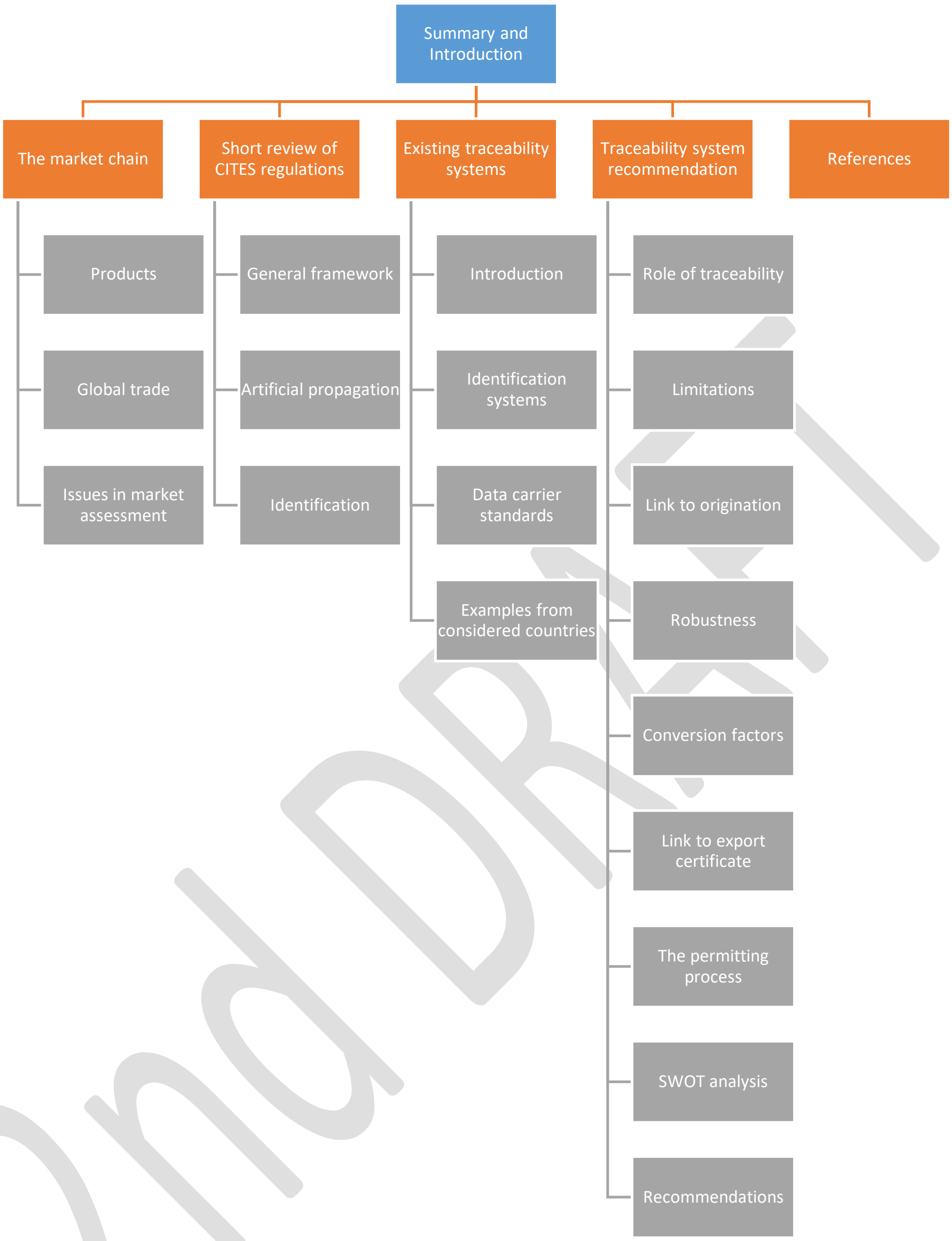
The study analyses significant trade of CITES-listed ornamental plants in Appendix II and III and identifies products derived from these species that dominate the trade from the selected countries. The study will consider the following ornamental plants: Bromeliads, Cycads, Euphorbiaceae and Orchids; as will be shown in section 3, however, the main traded items are from the Cycadaceae and Orchidaceae families. An analysis of the trade flows, in particular identifying main trade partners, trade volumes and trade value will also be undertaken as part of this study.

The study also identifies relevant efforts by the CITES Management and Scientific Authorities in ensuring traceability of ornamental plants listed under CITES Appendix II and III in the Andean and other Latin American countries. It compares the efforts made to understand traceability systems in other contexts, in particular those projects already being undertaken by CITES Parties for other species.

The study recommends the development of a traceability system for ornamental plants of species listed in CITES Appendix II and III, taking into consideration the following elements:
- The varying technical capabilities of supply chain[7] partners, in particular small-scale growers;
- The varying availability of technologies used in traceability, in particular related to automated identification and data capture (AIDC) technologies and data exchange technologies;
- The origin of materials (wild or artificially propagated), as well as the applicability of the traceability system to derivatives;
- The robustness of the system with respect to fraudulent activities involving CITES-listed species of ornamental plants; and
- The impact on and capacity-building needs of supply chain players particularly on small-scale growers, CITES Authorities and industry, in order to mitigate the risk of undue barriers to trade.

[7] A *supply chain* refers to the sequence of processes involved in the production and distribution of a commodity, usually between different companies. A *value chain* refers to the sequence of processes by which companies add value to an article; this includes also activities such as marketing and after-sales services that are not typically included in supply chains.

1.4 Structure of the document



2 The market chain

2.1 Introduction

The worldwide demand for floricultural products has grown significantly in recent years. Global exports of cut flowers, cut foliage, living plants and flower bulbs have grown from USD 8.5 billion in 2001 to USD 18 billion in 2010 and USD 21.5 billion in 2014 [2].

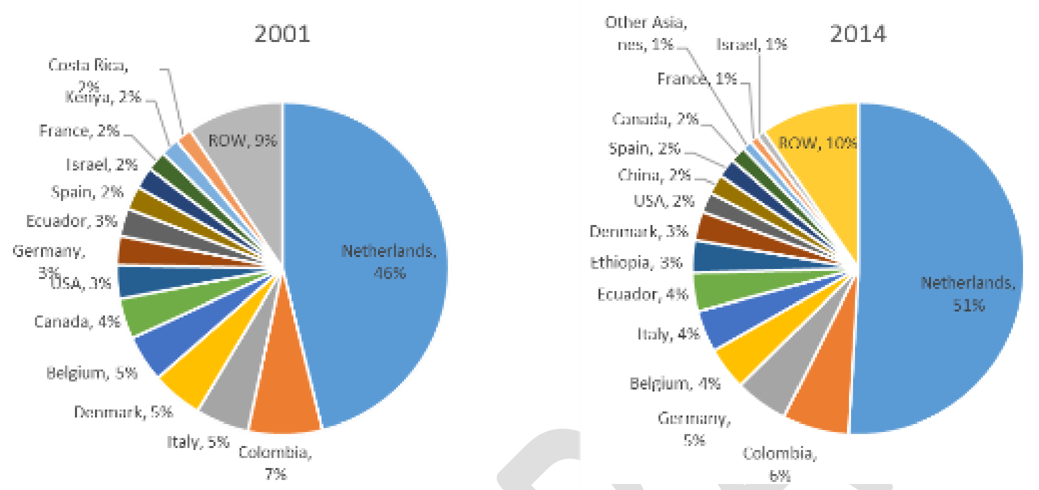


Figure 2-1 World export of cut flowers, cut foliage, living plants and flower bulbs, 2001 and 2014. Please note that the total market in 2014 is 2.5 times larger than in 2001. Source: UN Comtrade

Together with this strong growth of the general floricultural market, international trade of ornamental plants is also growing. The commercial trade of wild-collected and also artificially propagated plants is regulated in most countries in order to guarantee the sustainability of species. International trade is regulated as well, i.e. trade of the whole family of orchids, some genera of cycads and a number of other families are subject to the regulations of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Latin American and Andean countries are among the most important regions producing CITES-listed plants species, as the region has a rich biodiversity, due to extensive rain forests and the tropical climate. For example in Colombia and Ecuador, about 9,000 orchid species – or 30 percent of all known species – are found [3], [4].

In the timeframe of 2010- 2014, CITES Trade Database shows that the main traded CITES-listed plants families from the countries considered in this report[8], are Cycads (in particular one genus: *Cycas*), Cacti, Orchids and *Tillandsia* (a genus from Bromliaceae family) which nearly all of them (99 per cent) were artificially propagated. Costa Rica and Guatemala were the major exporters of *Cycas* during the selected period of 2010-2014. Mexico is the main exporter of cacti and in case of the orchids, the main exporters vary each year but Costa Rica and Brazil are among the main exporters. The fourth place is for the Bromeliaceae family and, in particular, *Tillandsia* live plants exported from Guatemala (99.7 per cent). Zamiaceae, the other suborder of cycads, is also traded but the trade volume is much lower than *Cycas* and again the main exporters are Costa Rica and Guatemala [5]. Table 2-1 shows the main exported plant families and the exported trade terms.

[8] Argentina (AR), Plurinational State of Bolivia (BO), Brazil (BR), Chile(CL), Colombia (CO), Costa Rica (CR), Ecuador (EC), Guatemala (GT), Mexico (MX), Panama (PA), Peru (PE), Bolivarian Republic of Venezuela (VE)

The combination of a large and growing trade volume with endangered natural habitats, puts pressure on the robustness and efficiency of control and monitoring systems of the ornamental plants trade.

Table 2-1 Units employed with all trade terms of commercial exports by selected Latin American countries of Bromeliaceae, Cactaceae, Cycadaceae, Euphorbiaceae, Orchidaceae and Zamiaceae. Relevant trade terms are in bold. Source: CITES Trade Database

	g	kg	m	ml	(blank)
Bodies		300			
Carvings			70,622		50
Cultures					56
Derivatives					
Dried plants		1,429			2
Extract	33				
Flower pots					
Leaves					17,910,571
Live					8,362,167
Logs					
Powder		1,258			9
Roots					1,588,909
Seeds					10,150,000
Specimens					1,040
Stems		92,194	43,755		876,395
Timber					
Timber pieces			17,165		
Total	**33**	**95,181**	**131,541**		**38,889,199**

Table 2-1 shows all units used for those trade terms that the countries of interest (see Table 1-1) have reported in their exports. Note that for relevant trade terms the blank unit is the most relevant with exception of carvings and timber pieces of Cactaceae where metre is the most relevant unit and bodies which in the period of 2010-2014 was used once in 2010 for exports of *Opuntia streptacantha* from Mexico to Japan.

Since metres cannot easily be compared with “pieces” (i.e. where the unit is blank), in order to get an understanding of the relative importance of the families of ornamental species, Table 2-2 makes that comparison in the same period for the same countries for those exports with unit=blank (which in most cases is the most frequent unit).

Table 2-2 The main exported plant families and traded terms with unit=blank from the selected Latin American countries between 2010-2014 (for commercial purposes), Source: CITES Trade Database

	Bromeliaceae	**Cactaceae**	**Cycadaceae**	**Euphorbiaceae**	**Orchidaceae**	**Zamiaceae**
Bodies		300				
Carvings		70,672				
Cultures					83	
Derivatives						
Dried plants		1,429			1,255	
Extract					33	
Flower pots						
Flowers						
Fruit		9			528	
Graft rootstocks				6,000		
Leather						
Leaves			20,204,248		71,613	66,640
Live	1,175,966	9,349	4,433,005	288,736	3,838,170	248,999
Logs						
Powder		1,267				
Roots			1,474,108	42,304	78,640	62,385
Seeds		10,150,147			0	
Specimens					2,513	
Stems		148,534	812,860	58,010	59,590	
Timber						
Timber pieces		17,165				
Wax				6,690,183		
Total	**1,175,966**	**10,398,871**	**26,924,221**	**7,085,233**	**4,052,425**	**378,024**

This study analyses the existing control and traceability systems for the Latin American region, focusing on the Andean subregion, evaluates their role to strengthen the CITES processes and provides recommendations. Since the region's principal exported plants are orchids, *Cycas and* Cacti, the next section assesses the market related to these species.

2.2 Products

2.2.1 Orchids

Orchids comprise the largest family of flowering plants with 25,000 to 35,000 species belonging to 600-800 genera [3]. They constitute a large part of global trade in ornamental plants. According to the CITES Trade Database, orchids are widely traded for ornamental reasons; the main purpose of trade is commercial with a small portion belonging to scientific and personal use. Table 2-3 summarizes the main traded products (locally or internationally) derived from orchids and their use. Figure 2-1 shows the commercial international trade volumes for orchids and *Cycas* versus the share of other trade purposes.

Table 2-3 Orchids product and main purposes of trade

Plant	Plant parts	Products	Trade purposes
Orchids	Whole plant Foliage Cut flowers Root Dried plants Derivatives and cultures	Ornamental plants	Commercial, Scientific, Personal (i.e. private collectors)
		Medicinal plants	
		Ingredients for personal care products	
		Food or ingredients to food products	

For ornamental products, the three main traded products are:

- Whole plants (usually potted);
- Seedlings, seed pods, cultures or plant parts for propagation; and
- Cut flowers.

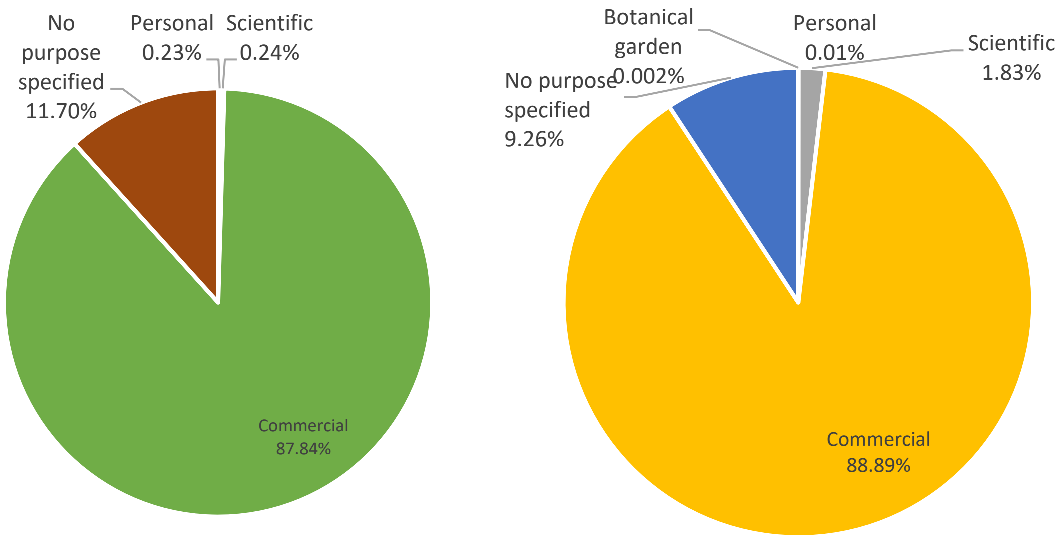


Figure 2-2 Share of the main purposes of international trade of orchids (right) and Cycas (left), 2010-2014, Source: CITES trade database

2.2.2 Cycads

Cycads are plants that have stout, woody stems and large, stiff evergreen leaves. Varying greatly in shape and size (ranging from 30cm to 13m tall), they grow in various climatic zones from rainforest to semi-desert. Cycads comprise two families (Cycadaceae and Zamiaceae) and 343 species, and similar to orchids, they are being used in a variety of products. Table 2-4 summarizes the main traded products and their trade purposes.

CITES data show that there has been a substantial trade in leaves, especially from species of *Cycas spp*, which are used in floral arrangements. The bulk of the trade is in cultivated plants from Costa Rica, the principal exporter. Cycads are traded mainly as ornamental plants, with nearly 59 million plants[9] being traded between 2002 and 2014 [5]. Of all these exports, more than 90 per cent belong to *Cycas revoluta* which is not native to Latin America but Japan.

Table 2-4 Cycad products and main purposes of trade

Plant	Plant parts	Products	Trade purposes
Cycads	Whole plant Leaves Stems Seeds Root Derivatives and cultures Dried plants	Ornamental plants Medicinal plants Hand crafts Food or ingredients to food products	Commercial, Scientific, Personal (i.e. private collectors)

For ornamental products, the four main traded products are: (i) whole plants, (ii) leaves, (iii) roots, (iv) stems.

2.2.3 Cacti

Cacti are a group of plants from the cactus family or Cactaceae. Cacti are succulent plants and, like all succulent plants, possess tissue that is able to conserve water. Cacti are endemic to the Americas with the exception of just one genus, Rhipsalis, whose distribution stretches from South America to Southern Africa and Sri Lanka. There are three 'hot spots' for species diversity [6]. Prime amongst these is Mexico and the adjacent South-Western United States of America (USA) where nearly 30 per cent of cacti genera are endemic and nearly 600 species are native. The arid areas of the South-Western Andes subregion provide another 'hot spot', covering parts of Peru, Plurinational State of Bolivia, Chile and Argentina. Eastern Brazil, including dry caatinga and the rocky high terrain of the campo rupestre, makes up the final 'hot spot'. Mexico has the highest abundance, followed by Brazil, Peru, Plurinational State of Bolivia and Argentina [6]. According to CITES Trade Database, Cacti are traded mainly in terms of seeds, stems and carvings, but also in other forms as shown in Table 2-5.

Table 2-5 Cacti products and main purposes of trade

Plant	Plant parts	Products	Trade purposes
Cacti	Live plant Carvings Powder Seeds Stems Timber pieces Dried plants	Ornamental plants Medicinal plants Hand crafts Food (fruits and vegetables) or ingredients to food products	Commercial, Scientific, Personal (i.e. private collectors)

Cacti are also traded as live plants, but the numbers are very low in comparison with plant parts. Although the seeds being traded are almost all from artificial propagation, the source of the carvings and the stems are mainly from the wild.

[9] Trade quantity is measured by number of live plants, leaves and roots. This figure does not include data of trade in other parts and derivatives (e.g. stems, seeds, dried plants, etc.) nor trade recorded in other units (e.g. kg, g, m³, m², shipments, sets etc.).

2.3 Global trade in ornamental plant from chosen Latin American countries

2.3.1 Orchids

According to CITES Trade Database, 99.9 per cent of traded orchids are from Appendix II (Figure 2-3**)** and mainly sourced from artificially propagated plants. The trade data shows that within the countries considered, Costa Rica is the largest exporter[10] in the selected timeframe with 70 per cent of the total

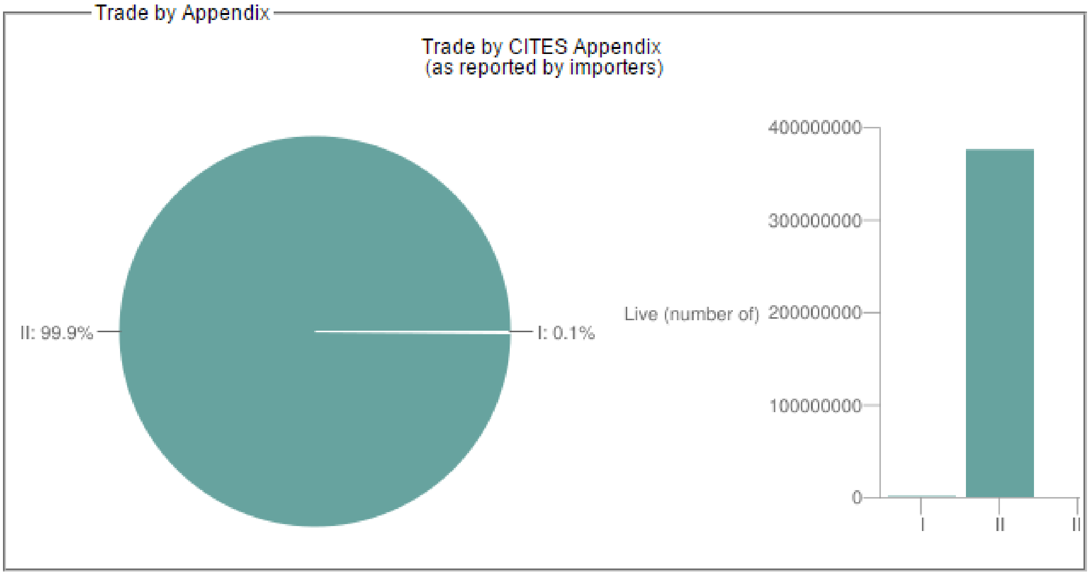


Figure 2-3 Trade by CITES appendix (as reported by importers) from 2009-2013, source: CITES Trade Database

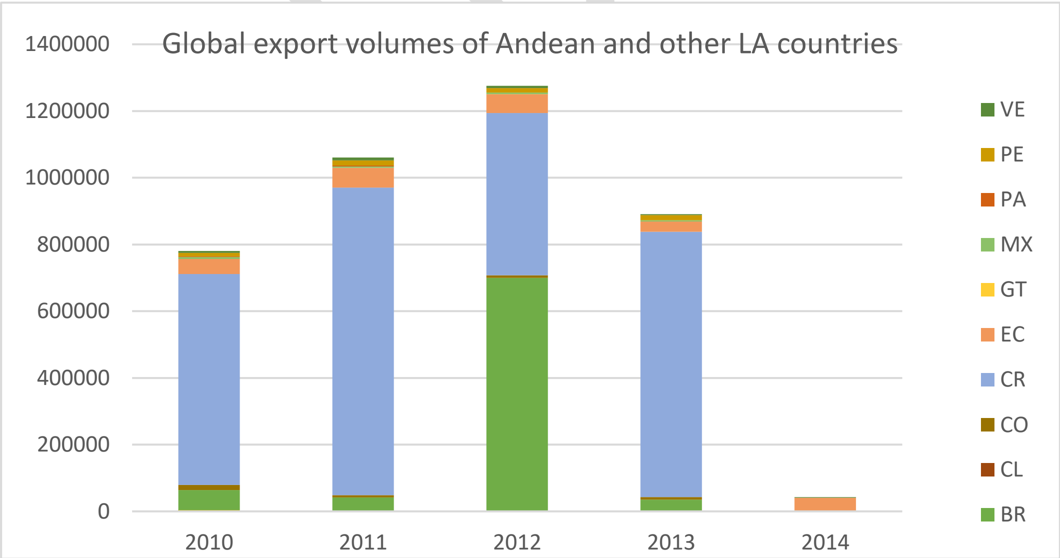


Figure 2-4 Quantities of exported orchids as reported by the exporter (for country abbreviation, see table 3), source: CITES trade database

volume, followed by Brazil (20.6 per cent) and Ecuador (5.7 per cent). Figure 2-4 shows the cumulative volumes of exported orchids or orchid derived-products[11] over the period of 2010-2014 as reported

[10] Based on quantities reported by exporter

[11] Trade quantity is measured by number of live plants, leaves and roots. This figure does not include data of trade in other parts and derivatives (e.g. specimens, cultures, stems, etc.) nor trade recorded in other units (e.g. kg, g, m^3, m^2, shipments, sets etc.).

by exporters. The significant decrease in export of orchids in 2014 is likely due to incomplete reporting as of the date of consultation (December 2015).

The main importers of Andean and other Latin American orchids –as reported by exporters- are the USA followed by Japan, Germany and Canada. In Figure 2-5 the main importers are sorted by quantity.

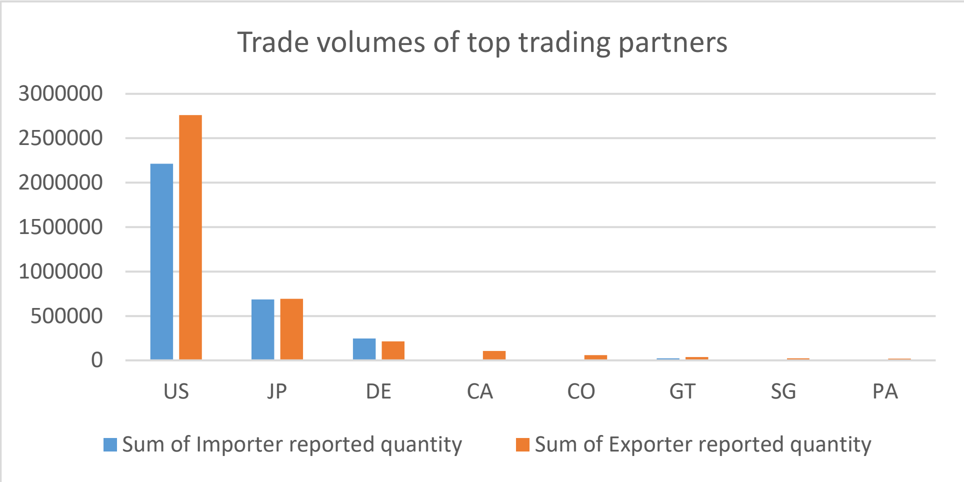


Figure 2-5 Cumulative trade volumes of orchids in Andean and Latin American regions, 2010-2014. Source: CITES Trade Database, (Countries: United States, Japan, Germany, Canada, Colombia, Guatemala, Singapore and Panama, in order).

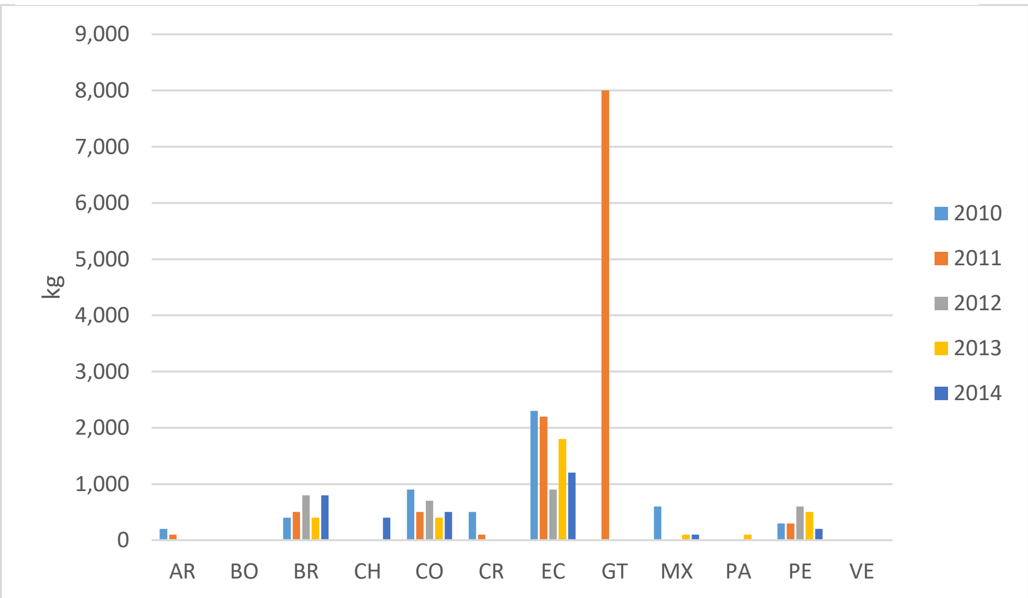


Figure 2-6 Exports (in kg) of ornamental plants contained in HS codes 06012030 and 06031300 from Andean and other Latin American countries to the European Union (EU28), as reported by the importers. For full country names, please refer to Table 2-1. Source: EUROSTAT

To study the orchid markets more in depth, the author chose to further investigate trade data within the European Union (EU28), since Europe is a main trade hub (import/export) for floriculture products and, in particular, orchids, as can be seen from Figure 2-1. Figure 2-6 shows the exports of Harmonised System (HS) codes 06012030[12] and 06031300[13] from countries considered in this study to the

[12] Orchid, Hyacinth, Narcissi and Tulip bulbs, in growth or in flower.
[13] Fresh cut orchids and buds, of a kind suitable for bouquets or for ornamental purposes.

European Union (EU28). Ecuador is the largest exporter to EU28 in weight (with the exception of 2011, where Guatemala was the largest exporter). Please note that the applied HS codes include other ornamental plants. Unfortunately, there are no dedicated HS codes for the ornamental plant families that are being considered in this report.

Table 2-6 Export value in EUR of ornamental plants contained in HS codes 06012030 and 06031300 from Andean and other Latin American countries to the European Union (in EUR). Source: EUROSTAT

Exporter	2010	2011	2012	2013	2014
Argentina (AR)	3,808	1,774	0	0	0
Plurinational State of Bolivia (BO)	0	0	0	0	0
Brazil (BR)	28,475	15,655	16,270	12,442	17,746
Chile (CL)	0	0	0	0	31,132
Colombia (CO)	20,287	11,181	20,410	17,228	16,048
Costa Rica (CR)	1,275	2,487	2,862	646	0
Ecuador (EC)	92,755	17,112	130,697	118,662	101,409
Guatemala (GT)	0	14,324	0	0	0
Mexico (MX)	6,063	0	0	7,190	7,481
Panama (PA)	72	0	0	5,248	0
Peru (PE)	12,010	9,866	12,675	16,708	13,223
Bolivarian Republic of Venezuela (VE)	0	0	650	0	1,505

Note that the HS codes used not only include orchids, so that the quantities shown in Figure 2-6 and Table 2-6, should not be interpreted to refer to orchids only.

2.3.2 *Cycas*

As mentioned above, the main and largest exporter of *Cycas* derived products is Costa Rica followed by Guatemala in a timeframe from 2000 to 2014 [5]. Moreover, from 2010 to 2014 they were the only exporters of the products among the countries of interest[14]. As stated before, there is a substantial trade in leaves, live plants and stems, but it should be considered that when analysing trade data for live *Cycas*, the terms used in CITES reports can be misleading [7]. *Cycas* traded as ornamental plants destined for landscaping can be of considerable size and are often shipped as stems only, without leaves or roots, and are reported as stems, logs or timber pieces. Similarly, trade in small plants with subterranean stems, as well as young plants with a large proportion of root, may be reported as roots. CITES records from 2010 to 2014 show that over 20 million leaves were traded from *Cycas* [5]. The main importers of *Cycas* from this region -as reported by exporters- are The Netherlands, USA, Poland and Germany. Figure 2-7 shows the main importers, sorted by quantity.

[14] Trade quantity is measured by number of live plants, leaves, roots and stems. This figure does not include trade data in other parts and derivatives (e.g. specimens, cultures, seeds, etc.) nor trade recorded in other units (e.g. kg, g, m^3, m^2, shipments, sets etc.).

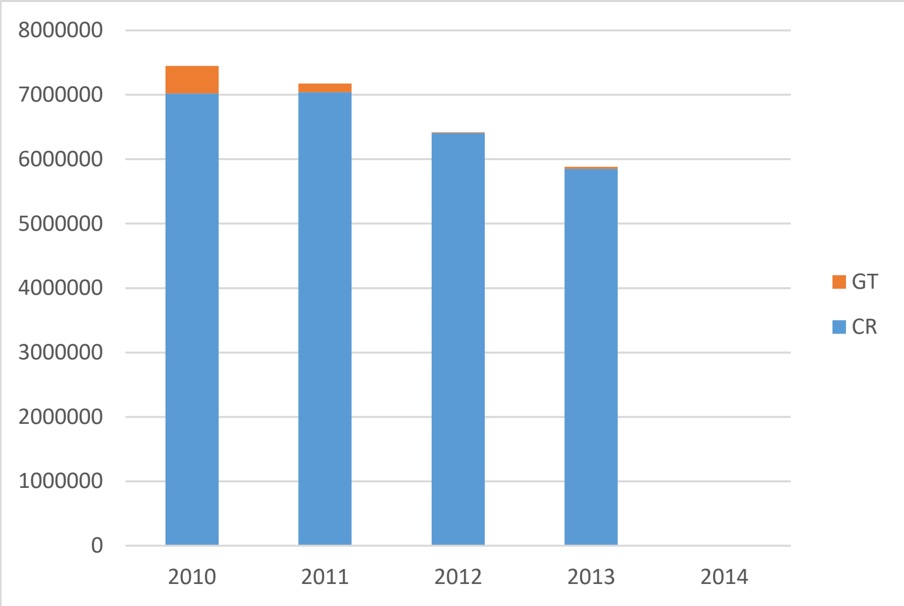


Figure 2-8 Quantities of exported Cycas as reported by the exporter. Source: CITES Trade Database

Figure 2-7 Cumulative trade volumes of Cycas of Andean and other Latin American countries (as reported by exporter and importer), 2010-2014. Source: CITES Trade Database.

2.3.3 Cacti

The CITES trade database shows that the main exporter of the cacti in 2010-2014 is Mexico. The most traded product of cacti is seeds; seeds are 100 per cent artificially propagated. The Netherlands is the major importer of cacti with 99.7 per cent of the whole trade, followed by USA with only 0.08 per cent.

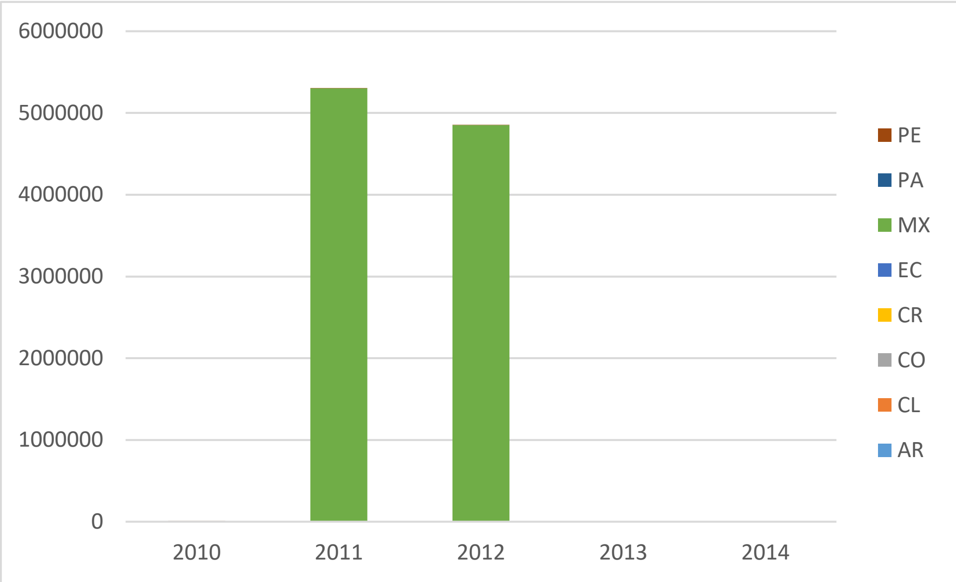


Figure 2-9 Quantities of exported Cacti as reported by exporter. Source: CITES Trade Database

2.4 Issues in market assessment

When analysing and assessing the trade data for orchids and *Cycas*, some discrepancies were observed specially in terms of reported quantities by importer and exporter. As can be seen in Figure 2-5 and Figure 2-7, the quantities reported by exporters and importers are not identical. Reasons for the differences could be (i) not all export permits were used; (ii) misalignment in reporting periods; (iii) misreporting; (iv) data quality issues (such as incomplete reporting); (v) trade fraud; and (vi) other reasons. Figure 2-10 and Figure 2-11 show the difference between reported quantities for orchids and for cycads. Positive differences indicate that the exporter has reported a higher volume than the importer. Almost in all cases, however, the quantity reported by exporters is higher than the quantity reported by importers.

In the case of orchids for the considered countries for the 2010-2014 timeframe, 663,053 additional specimens were reported by exporters (that were not reported by importers), representing about 19.5 per cent of all trade. For *Cycas,* this difference is 6,709,745 specimens or about 33.1 per cent of all trade.

The issue of inconsistency in trade data is not limited to the CITES Trade Database. Reported quantities by exporters and importers for HS code 060313 (fresh orchids) in the UN Comtrade database[15] are also not identical.

[15] http://comtrade.un.org/

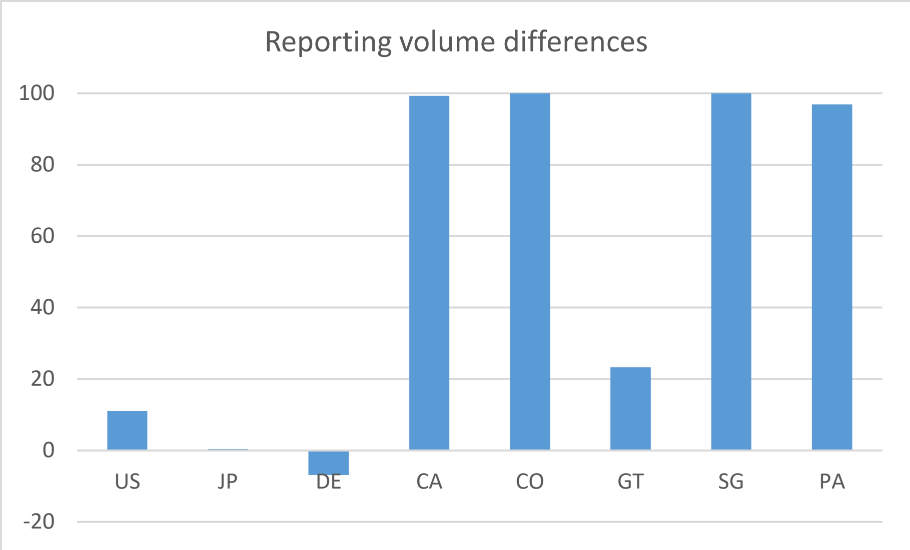


Figure 2-10 Differences in reported volumes of orchids by exporter and importers expressed in percentage of reported export volumes, 2010-2014. Source: CITES Trade Database

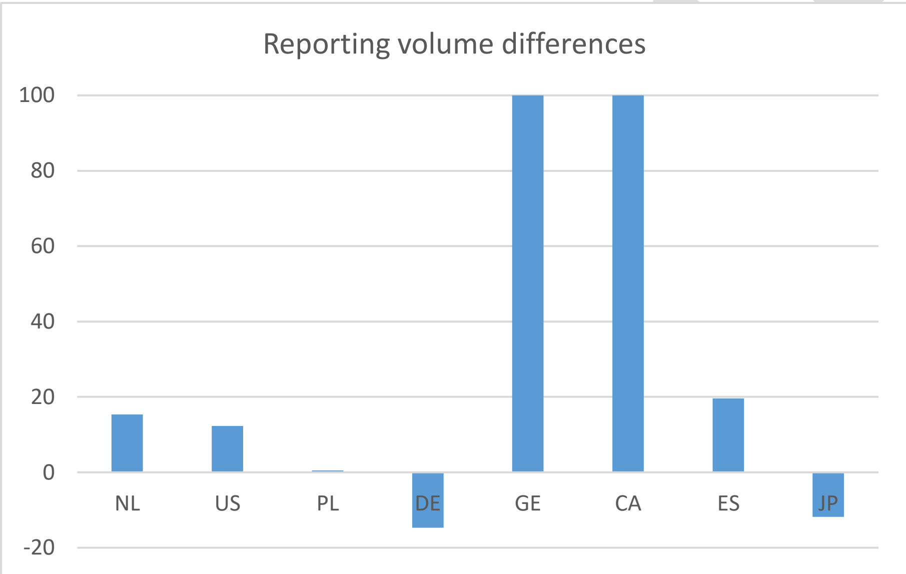


Figure 2-11 Differences in reported volumes of cycads by exporter and importers expressed in percentage of reported export volumes, 2010-2014. Source: CITES Trade Database

In UN Comtrade statistics, USA, Mexico and Canada are the top importers from the considered countries (according to what is reported by exporters), which is not the case when looking at the trade volumes reported by importers. Figure 2-12 shows the trade volume for 2010-2014. Table 2-6 shows the top six destinations of HS code 060313 from the considered countries in dependence on whether the exporters' declarations are used as a base (left hand side) or the importers' declarations are used (right hand side). As can be appreciated, there is a very significant difference in ranking.

Table 2-7 On the left hand side, sum of export value of HS code 060313 for the top six exports destinations for the countries considered in this study- as reported by themselves. In comparison, sum of import value of HS code 060313 for the top six importers from the countries considered- as reported by the importers. (Period: 2010-2014). Source: UN Comtrade database. Minor discrepancies might be present due to differences in exchange rates.

Country	Sum of trade value (USD) as reported by exporter	Country	Sum of trade value (USD) as reported by importer
USA	508,675	Mexico	586,024
Mexico	378,550	Australia	417,699
Azerbaijan	86,356	Czech Rep.	180,409
Panama	77,055	Canada	127,765
Canada	66,658	USA	124,227
Curaçao	45,880	Guatemala	91,303

Considering these inconsistencies in trade data, there could be other markets for orchids and their products which are not correctly reflected in the statistics shown above.

A well-designed and comprehensive traceability system could significantly improve such trade data.

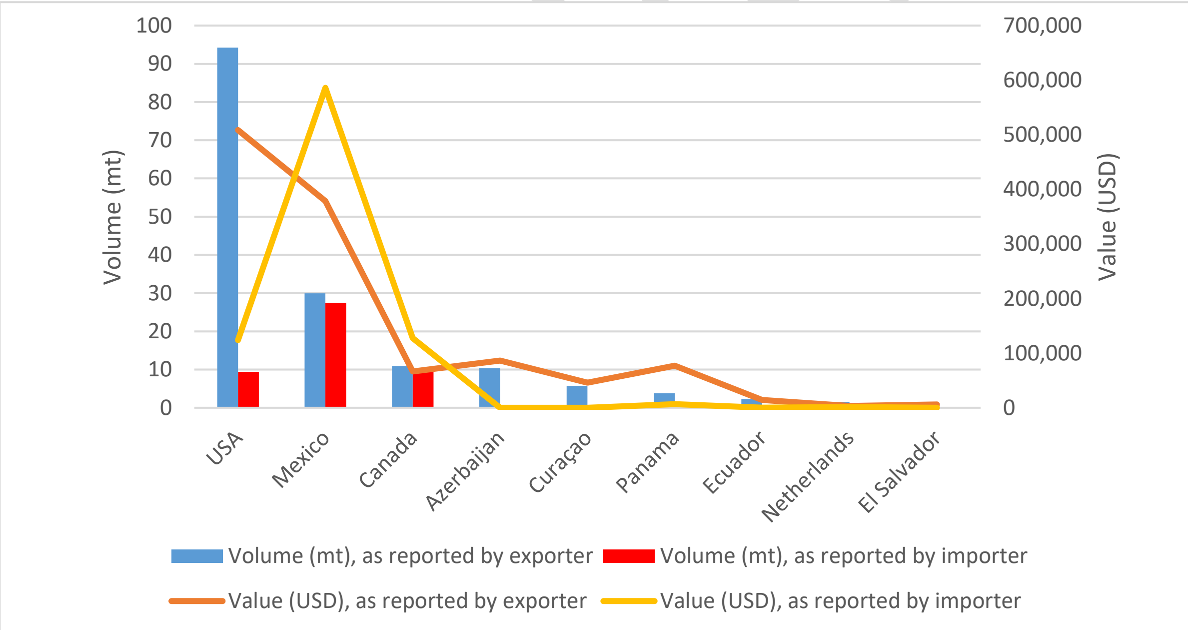


Figure 2-12 Volume and value reported by top importers and exporters in 2010-2014, HS code: 060313. Source: UN Comtrade database

3 Short review of CITES regulatory framework

3.1 Introduction

CITES uses permits and certificates to regulate international trade in species listed in the CITES Appendices. Trade of listed species is controlled on a *specimen* level[16].

All Parties to the Convention must designate a Management Authority that issues permits or certificates for exports and imports of specimens of CITES-listed species per Article IX of the Convention. In order to obtain such a permit, entities have to apply for it, either through a National Single Window or directly with the Management Authority. Within its process to grant or not such a permit/certificate, the Management Authority must consider the following:

- The legality of the trade process, and
- The sustainability, or the "non-detriment" of trade for the survival of the species in the wild (as determined by the Scientific Authority of the same country).

3.2 General framework

In 1975, specimens from the wild were under such pressure that fear over their conservation status led to listing the entire family in the Appendices of the newly adopted CITES.

In 2008, the following species of the Orchidaceae family were added to Appendix I, giving them the highest level of protection: *Aerangis ellisii, Dendrobium cruentum, Laelia jongheana, Laelia lobata, Paphiopedilum spp., Peristeria elata, Phragmipedium spp. and Renanthera imschootiana*. The rest of the Orchidaceae family is in Appendix II, where the international trade may be authorized by the granting of an export permit or re-export certificate.

Over 25 million orchids are traded annually in the world, 95 per cent of which are artificially propagated Appendix II species or hybrids [8]. Exemptions from CITES controls facilitate trade in these man-made specimens in some cases. Exemptions also apply to certain parts and products (seeds, pollinia, plants in vitrocultures, cut flowers of artificially propagated plants, fruits, parts and derivatives of artificially propagated Vanilla plants) that can be traded without harming Appendix II-listed species. Table 3-1 and Table 3-2 summarise the exemptions and inclusions.

In the case of cycads, all species are included in Appendix II, except *Cycas beddomei*, native to India, which is in Appendix I. The greatest trade in cycads is as ornamental plants, of which 90 per cent belongs to only one species: *Cycas revoluta*.

CITES records show that there has been a substantial trade in leaves, especially from species under *Cycas spp*, mainly used for floral arrangements. The main exports are cultivated plants from Costa Rica.

[16] https://www.cites.org/eng/disc/text.php

Table 3-1 Inclusion of orchids and its products in Appendix I, II and III

Appendix I		**Appendices II and III**	
Any readily recognizable part or derivative is included		Any specified readily recognizable part or derivative is included	
Plant parts and derivatives	**Always included**	**Plant and derivatives**	**Included if specified**[17]
Plant hybrids	**Not applicable if unannotated**	**Plant hybrids**	**Included unless excluded**

Table 3-2 CITES exemptions for key plant families and their derived products

	Appendix I	Appendices II and III
Orchid products exempted	Seedling or tissue cultures obtained in vitro, in solid or liquid media, and transported in sterile containers are not subject to the provisions of the Convention (if artificially propagated according to CITES) of - *Aerangis ellisii* - *Dendrobium cruentum* - *Laelia jongheana* - *Laelia lobate* - *Paphiopedilum spp* - *Peristeria elata* - *Phragmipedium spp.* - *Renanthera imschootiana*	Seed, spores and pollen (including pollinia)[18] Seedling or tissue cultures obtained in vitro (in glass vessels), in solid or liquid media, transported in sterile containers Cut flowers of artificially propagated plants Fruits and parts and derivatives thereof of artificially propagated plants of the genus *Vanilla* and of the family Cactaceae are not covered by CITES
Cycads products exempted		Seed, spores and pollen (including pollinia) Seedling or tissue cultures obtained in vitro (in glass vessels), in solid or liquid media, transported in sterile containers Cut flowers of artificially propagated plants

[17] CITES Parties have agreed that for plant species included in Appendix II, the absence of an annotation relating to that species indicates that all readily recognizable parts and derivatives are included. Finished products made with Appendices II and III plants are generally included in CITES, unless specifically excluded.

[18] Does not apply to seeds from Cactaceae exported from Mexico, and to seeds from *Beccariophoenix madagascariensis* and *Neodypsis decaryi* exported from Madagascar.

Cacti products exempted		*Pereskia* spp., *Pereskiopsis* spp. and *Quiabentia* spp. Artificially propagated hybrids and/or cultivars of *Hatiora graeseri*, *Schlumberga buckleyi*, *Schlumberga russelliana Schlumberga truncata*, *Schlumberga orssichiana Schlumberga truncata*, *Schlumberga opuntioides Schlumberga truncata, Schlumberga truncata* (cultivars), and Cactaceae species colour mutants grafted on the following grafting stocks: *Harrisia* 'Jusbertii', *Hylocereus trigonus* or *Hylocereus undulatus*, and *Opuntia microdasys* (cultivars) are not controlled by CITES. All parts and derivatives of Appendix II cacti are controlled except: a) seeds, except those from Cactaceae species exported from Mexico b) seedling or tissue culture obtained in vitro, in solid or liquid media, transported in sterile containers c) cut flowers of artificially propagated plants d) fruits and parts and derivatives thereof of naturalised or artificially propagated plants of the family Cactaceae e) stems, flowers, and parts and derivatives thereof of naturalised or artificially propagated plants of the genera *Opuniia* subgenus *Opuntia* and *Selenicereus.*

3.3 CITES definition of artificially propagated

The CITES definition of artificially propagated is included in Resolution Conf. 11.11: (Rev. CoP15) Regulation of trade in plants and in Article VII, paras 4 and 5 of the Convention.

The definition of 'artificially propagated" refers to [9]:

a) "Under controlled conditions": means in a non-natural environment that is intensively manipulated by human intervention for the purpose of plant production. General characteristics of controlled conditions may include, but are not limited to, tillage, fertilization, weed and pest control, irrigation, or nursery operations such as potting, bedding or protection from weather;
b) "cultivated parental stock": means the ensemble of plants grown under controlled conditions that are used for reproduction, and which must have been, to the satisfaction of the designated CITES authorities of the exporting country:
    i. established in accordance with the provisions of CITES and relevant national laws and in a manner not detrimental to the survival of the species in the wild; and
    ii. maintained in sufficient quantities for propagation so as to minimize or eliminate the need for augmentation from the wild, with such augmentation

occurring only as an exception and limited to the amount necessary to maintain the vigour and productivity of the cultivated parental stock; and

c) "cultivar" means, following the definition of the 8th edition of the International Code of Nomenclature for Cultivated Plants, an assemblage of plants that (a) has been selected for a particular character or combination of characters, (b) is distinct, uniform, and stable in these characters, and (c) when propagated by appropriate means, retains those characters.

The term 'artificially propagated' shall be interpreted to refer to plant specimens:

a) Grown under controlled conditions;
b) Grown from seeds, cuttings, divisions, callus tissues or other plant tissues, spores or other propagules that either are exempt from the provisions of the Convention or have been derived from cultivated parental stock;

Plants grown from cuttings or divisions are considered to be artificially propagated only if the traded specimens do not contain any material collected from the wild; it is recommended that an exception may be granted and specimens deemed to be artificially propagated if grown from wild-collected seeds or spores only if, for the taxon involved:

I. The establishment of a cultivated parental stock presents significant difficulties in practice because specimens take a long time to reach reproductive age, as for many tree species;
II. The seeds or spores are collected from the wild and grown under controlled conditions within a range State, which must also be the country of origin of the seeds or spores;
III. The relevant Management Authority of that range State has determined that the collection of seeds or spores was legal and consistent with relevant national laws for the protection and conservation of the species; and
IV. The relevant Scientific Authority of that range State has determined that:
  a) Collection of the seeds or spores was not detrimental to the survival of the species in the wild; and
  b) Allowing trade in such specimens has a positive effect on the conservation of wild populations;

At a minimum, to comply with subparagraphs IV. a) and b) above:

I. Collection of seeds or spores for this purpose is limited in such a manner such as to allow regeneration of the wild population;
II. A portion of the plants produced under such circumstances is used to establish plantations to serve as cultivated parental stock in the future and become an additional source of seeds or spores and thus reduce or eliminate the need to collect seeds or spores from the wild; and
III. A portion of the plants produced under such circumstances is used for replanting in the wild, to enhance recovery of existing populations or to re-establish populations that have been extirpated; and

It is also recommended that in the case of operations propagating Appendix-I species for commercial purposes under such conditions they are registered with the CITES Secretariat in accordance with Resolution Conf. 9.19 (Rev. CoP15) on Guidelines for the registration of nurseries exporting artificially propagated specimens of Appendix-I species.

3.4 Identification of artificially propagated plants

According to CITES [10], there are nurseries that produce annually more than 35 million orchid plants, many to be sold on the national markets. Although the legal trade in wild collected orchids only forms a small proportion of the total volume[19], there is still an important illegal trade associated with it. The form in which orchids are usually traded, i.e. without flowers, makes it difficult to identify the species. A critical distinction in combating illegal trade is the ability to distinguish between wild-collected and artificially propagated plants.

The key points of the CITES definition of artificially propagated plants are [7]:

- Plants must be grown in controlled conditions. This means, for example, the plants are manipulated in a non-natural environment to promote prime growing conditions and to exclude predators. A traditional nursery or simple greenhouse is 'controlled conditions'. A managed tropical shade house would also be an example of 'controlled conditions'. Temporary management of a piece of natural vegetation where wild specimens of the plants already occur would not be 'controlled conditions'.
- Wild collected plants are considered wild even if they have been cultivated in controlled conditions for some time. The cultivated parent stock must have been established in a manner not detrimental to the survival of the species in the wild and managed in a manner which ensures long term maintenance of the cultivated stock. The cultivated parental stock must have been established in accordance with the provisions of CITES and relevant national laws. This means that the stock must be obtained legally in CITES terms and also in terms of any national laws in the country of origin. For example, a plant may have been illegally collected within a country of origin then cultivated in a local nursery and its offspring exported declared as artificially propagated. However, such offspring cannot be considered to be artificially propagated in CITES terms due to the illegal collection of the parent plants.
- Seeds can only be considered artificially propagated if they are taken from plants which themselves fulfil the CITES definition of artificially propagated. Specimens grown from wild collected seeds can exceptionally be regarded as artificially propagated if they are grown in a range State and fulfil several other precautionary conditions [9]. Table 3-3, summarizes the key characteristics of wild and artificially propagated plants.

Table 3-3: Key characteristics of wild or artificially propagated plants

	Wild	Artificially propagated
General appearance	Irregular shape and size Wounds and insect damage Possible fire damage	Uniform Healthy plant parts
Roots	Irregular Dead and broken Coarsely cut back when removed from wild	In shape of pot Roots cut back but healthy
Soil	Local soils and associated plants	Usually clean of soil Horticultural soil present (e.g. peat, sand, perlite, rockwool)
Leaves	Crushed, torn or bent Less turgid Cracked along the midrib or cell collapse when removed from wild	Uniform Healthy Clean and fresh

[19] For 2010-2014 from the considered countries a total of 6906 specimens were exported, compared to 4,032,879 specimens from artificial propagation and 11,793 specimens bred in captivity. Source: CITES Trade Database.

4 Existing traceability systems

4.1 Introduction to traceability systems

Traceability is most commonly defined as "the ability to access any or all information relating to that which is under consideration, throughout its entire life cycle, by means of recorded identifications" [11]. In other words, traceability is a system identifying and connecting all entities in the supply chain of a product unit and thereby making it traceable at every point in time.

While the ISO definition is flexible towards different applications, e.g. different methods of "recorded identifications" such as paper records or electronic records, all traceability systems depend on Unique Identification (UI), Critical Tracking Events (CTEs) and Key Data Elements (KDEs). Thus, the key questions to be answered when establishing a traceability system are

- What to trace?
- When to record?
- What to record?

Table 4-1: The basic ingredients of traceability

Element of traceability	**Unique identification**	**Key data element**	**Critical tracking point**
Examples	• Single Units • Batches • Barrels • Boxes	• Unique identifier • Supplier ID • Quantity • Date	• Reception • Processing • Mixing/ Grading • Dispatch
Performance dimensions	*Precision*	*Breadth*	*Depth*

4.1.1 What to trace: The principles of unique identification

Traceability aims to establish links between supply chain partners in the supply chain of a particular product unit. It is therefore important to identify both the companies and products uniquely throughout the supply chain. Without unique identification, traceability systems will not be able to link specific information elements within or between companies. For example, if a trader were to buy an identical raw material 123 from three suppliers (A, B, C), store them indiscriminately in the raw material storage and then produce a product 459 from it, the knowledge of which supplier's raw material was used would be lost. If, on the other hand, the supplier is identified together with the raw material, traceability back to the supplier is possible.

	SSCC (Serial Shipping Container Code)			
Application Identifier	Extension Digit	GS1 Company Prefix →	← Serial Reference	Check Digit
0 0	N_1	N_2 N_3 N_4 N_5 N_6 N_7 N_8 N_9 N_{10} N_{11} N_{12} N_{13} N_{14} N_{15} N_{16} N_{17}		N_{18}

Figure 4-1 Example of a unique identification code combining company identification with product unit identification

Since unique identification is such an important ingredient to traceability, multiple coding systems have been proposed and multiple organisations founded to supply the market with unique identifiers. GS1[20] for example is a global provider of unique identification products. Other providers

[20] www.gs1.org

can be found here: https://c.ymcdn.com/sites/aimglobal.site-ym.com/resource/resmgr/Registration_Authority/Register-IAC-Def_012516.pdf.

Ideally, companies employ international standards in identifying suppliers, products, trade and logistics units, in particular ISO/IEC 15459.

4.1.2 When to record: The principle of recording Critical Tracking Events

Traceability aims to identify the path of a product throughout its production process and supply chain. To achieve this goal, it is essential that every supply chain partner records its actions and makes the information available. The principle of recording transformations states that any transformation of the product has to be recorded in such a way that the traceability system is able to trace and track a product unit throughout the process. Examples for such transformations are mixing, processing or splitting. For instance, when traders mix flowers from different origins, they have to record which origins were put into which box.

4.1.3 What to record: the principle of Key Data Elements

Critical Tracking Events (CTEs) define the actions that trigger data recording. Typically, there are three main categories of CTEs per entity: Reception, Processing and Dispatch, as depicted in Figure 4-2. Typical CTEs with their most common KDEs. A traceability system has to define the Key Data Elements (KDEs) to be recorded at each of these CTEs, as well as the degree of differentiation between the CTEs. For example, a processor of ornamental plants might define separate processing CTEs for mixing and drying, as the former process changes the composition of the good and the latter does not. To achieve traceability, it is essential that KDEs recorded at the beginning and end of a transformation process link inputs to outputs.

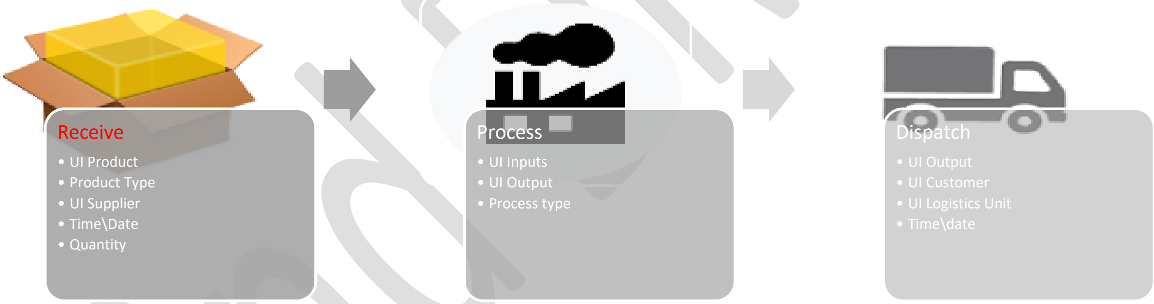


Figure 4-2 Typical CTEs with their most common KDEs

The length of the supply chain covered by a traceability system is called its *depth* and depends on its purpose. In some cases, certain supply chain steps, such as distribution are excluded from traceability systems.

KDEs consist of the most important information from a traceability perspective at each CTE. KDEs have to be defined such that tracking and tracing through the Critical Tracking Event is possible. Furthermore, they have to include information that is necessary to achieve the purpose of the traceability system. For example, KDEs for artificially propagated ornamental plants might be the species, the propagation method, the operator and the code of the parent plant.

KDEs will differ along the supply chain as the product is transformed and different information becomes relevant. In general, KDEs might include basic description elements, origin and destination, processes applied to the product or legal status. A traceability system has to define specific KDEs for every CTE. The amount of information recorded at each KDE is commonly called the *breadth* of a traceability system.

4.2 Identification systems used world-wide for traceability

Globally unique identification is one of the key principles required for traceability. Any item being traded globally requires globally unique identification, so that its particular history can be retraced, the processes and procedures applied to it identified, and any risks/hazards, for instance, related to lack of compliance avoided. Local identification for products, traceable units (such as product instances), logistic units, business sites, etc. are not globally unique and generally not acceptable if the identified product can leave the premises of the business.

Globally unique identifiers are required in particular for:

- Businesses
- Locations
- Product types
- Product instances (trade units)
- Logistic units (cartons, pallets, containers)

Other identifiers are used to identify, for instance, returnable or fixed assets, business relationships, etc. However, for traceability of products the above are the most important.

In most cases, the implementation of globally unique identification carries a very similar or same cost as the implementation of locally unique identification. In the vast majority of cases, locally unique identification carries no advantages, in particular if the globally unique identification system is made up of

GLOBALLY UNIQUE ID = PREFIX + LOCALLY UNIQUE ID

Unfortunately, often enough government departments do not make use of globally unique identification and issue instead local identifiers. This malpractice then leads to an unnecessary proliferation of identifiers that businesses have to use in their official communication with the authority, but cannot use in international trade, because of their lack of uniqueness.

The cost of using locally unique identifiers created along the chain should not be underestimated. As a consequence of using locally unique identifiers, businesses often need to re-label goods to fit their internal procedures or to assign a globally unique identifier to a good. Re-labelling is a major source for errors and typically a break point where information from the originating system is lost.

Also, globally unique identification facilitates identification of parties for the public authorities involved in the supply chain. Often export permits require collaboration between different authorities. This collaboration is often made difficult by using different identifiers for businesses, locations, trade units and logistic units.

A major obstacle in globally unique identification is that there are currently no globally unique identification systems available free of charge for businesses and public authorities. Since the costs for adopting locally unique identification schemes are seldom explicit and most often do not affect the issuer but rather the receiver, governmental agencies more often than not design their own non-unique schemes.

Globally unique identification schemes are standardised under ISO 15459. ISO also runs a register of all identification schemes, so that entities in need of identification products can identify possible suppliers of those products that are guaranteed to comply with ISO 15459. Such entities are called *issuing agencies* and are identified with an *issuing agency code* (IAC). The IAC is a prefix which differentiates the individual identification schemes. Each scheme may well have its own rules about the remainder of the code, so the IAC also tells the user how to interpret the code. Issuing agencies have full liberty how to structure their code segment after the IAC.

GS1, a global not-for-profit organisation dealing in standardisation and particularly identification, has a special IAC. This is any globally unique identifier starting with a number (0-9) that has to be considered in the context of GS1's set of identifiers[21] [12].

In the context of GS1's products, a Global Trade Item Number (GTIN) is used to identify a product of a particular supply chain partners. Different batches of that product can be identified by adding a serial number to the GTIN, forming a so-called Serialised Global Trade Item Number (SGTIN). The production location is identified by a Global Location Number (GLN). Logistic units, such as pallets are identified by a Serial Shipping Container Code (SSCC). The traceable unit is typically a batch and identified by a SGTIN or a combination of a GTIN with a production/best before date. Higher value items are sometimes identified uniquely by an SGTIN.

Access to unique identification is one of the key issues of global traceability [12]. This is particularly true for small operators early in the chain. Until recently, identification products were not generally available to them due to a lack of understanding, but also access obstacles to leading identity providers (and the lack of support and training).

A promising initiative by UN Global Compact, International Trade Centre (ITC) and GS1 should be mentioned, which is currently at a pilot stage [13]. The Blue number initiative[22], is a concrete contribution to the second Sustainable Development Goal to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The Blue Number is a unique ID for any individual, entity or asset contributing to the food system. It is a specific Global Location Number, or "GLN", which identifies a farm or Small Medium Enterprise in any part of a food and agriculture value chain. It provides the holder with a universal identifier appended with additional information for use in international registries, databases and other information storage infrastructures. The Blue Number is issued by GS1, and obtained via a dedicated global online system where:

- farmers and agribusinesses can register and volunteer information about themselves;
- farmers and agribusinesses can create a sustainability profile on their products, services and capacity, including for trade or export;
- information can be shared with stakeholders, trading partners and regulators; and
- farmers and agribusinesses can declare they are ready for capacity-building support from national stakeholders, governments and various UN agencies.

How big or small the traceable units are, is called the *precision* of a traceability system and depends on the available resources as well as practicability; see Figure 4-3.

[21] http://www.gs1.org/barcodes
[22] http://www.gs1.org/sites/default/files/docs/retail/BlueNumber-1pagerA4.pdf

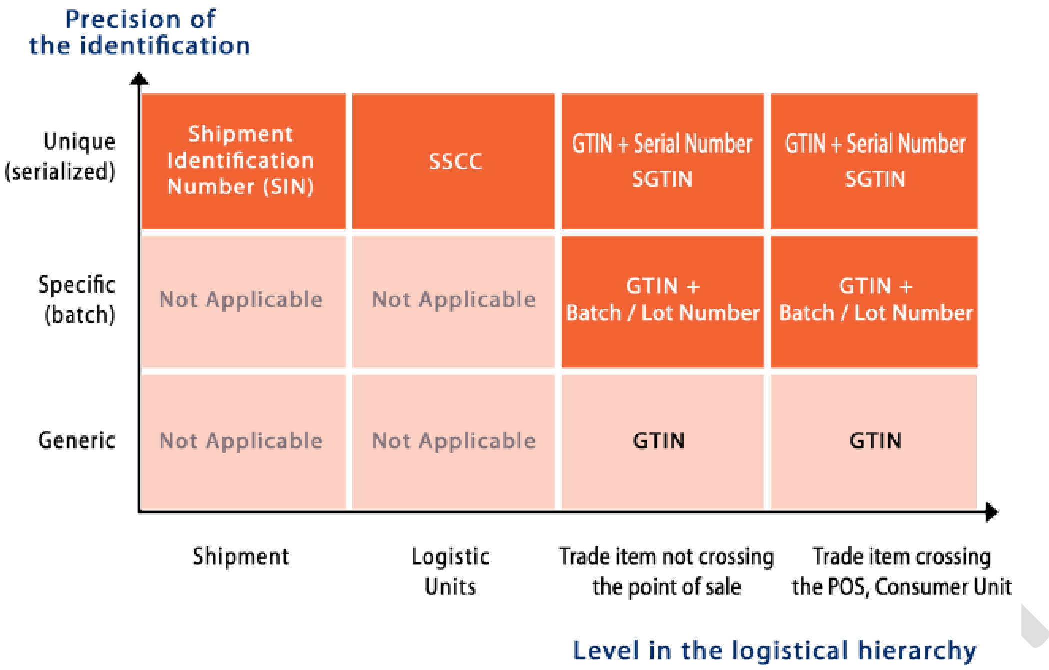


Figure 4-3 Precision of traceability vs identification system

Most commonly, unique identification is provided in the form of alphanumeric codes, which can then be encoded into barcodes and RFID tags – the so-called Automated Identification and Data Capture (AIDC) technologies. Special mechanisms have been provided to encode additional information for faster data transmission, such as weight, lot number, expiration date, destination and many other elements. An example of a GTIN with additional barcoded information is seen in Figure 4-4.

Figure 4-4 Example of a GTIN with additional barcoded information, such as expiration date and lot number

It is recommended that government agencies and CITES Parties collaborate with GS1 and other Issuing Agencies registered under ISO15459 to come as near as possible to a point where all businesses and their products can be identified globally uniquely.

4.3 Data carrier standards

An area of some confusion is the difference between identifiers, traceability and data carriers.

Figure 4-5 Data carriers often used in agrifood chains

Data carriers have the simple function to carry information along the chain. Data carriers can be humanly readable labels, but in the interest of automated identification and data capture (AIDC), data carriers today are understood as machine readable information carriers.

There is an on-going dichotomy between data carriers carrying only identifiers, where the associated information is held elsewhere, typically in an IT system and those data carriers that attempt to carry relevant information independently (1; 2). For the purpose of this discussion we will assume that only identifiers are transported.

The most important data carrier today is the one-dimensional barcode. Although a number of different formats exist, the EAN/UPC Code128 barcode is by far the best known, because it is represented on most items globally sold through supermarkets.

- EAN/UPC:
  - Specified for retail Point-of-Sale (POS) because they are designed for high volume scanning environment
  - Used at POS and in logistics
  - Limited to carrying GS1 Keys and special identifiers for restricted applications like variable measure trade items and internal numbering

0 12345 67890 5

For logistic operations the GS1-128 (UCC/EAN-128) bar is used most often to code Serial Shipping Container Codes (SSCC). It can be used to carry all GS1 keys, but is not to be used for items crossing the point of sales (POS).

(01) 0 0012345 67890 5

In recent times, two dimensional have become popular. The two standards mostly used are:

- DataMatrix
  - DataMatrix is a "2D Matrix" symbol and is used in logistics and healthcare
  - (GS1) Currently specified for items not crossing POS
  - Can typically contain up to 2,335 alphanumeric characters
  - Size determines readability; error correction codes attempt to increase reliability

(01)07612345678900(17)100503
(10)AC3453G3

- QR Code[23]
  - QR Codes are a "2D Matrix" symbol used in consumer facing activities
  - Can encode URLs
  - Can contain up to 4,296 characters, but readability depends on size
  - (GS1) Currently restricted for use with applications that will involve imaging scanners within mobile devices and not for Point Of Sale (POS) processing

The DataMatrix standard is used mostly for business to business (B2B) transactions. Its main purpose is to hold serialised information such as a lot number, expiration/best before dates and similar data in a machine readable format.

The QR Code is mostly used in business to consumer (B2C) transactions and, within this, to encode URLs for marketing and easy consumer access to information. The unique capability to store URLs and its optimisation for mobile devices makes the code very adequate for such activities. Most companies today wishing to transport information to consumers would select a QR Code. However, its use in B2B transactions is limited – for no particular reason.

The above data carriers require line of sight when scanning them. At the reception bay, pallets might have to be unpacked, individual cartons scanned, and the pallet rebuilt. In a further automation step, Radio Frequency Identifiers (RFID) were invented to remedy the shortcomings of line-of-sight barcodes.

RFIDs make wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. As other data carriers, they can transmit identities or other data. For the purpose of this study, it is assumed they transmit identities only.

There are two basic RFID types:

- Active tags using a battery to emit a signal
- Passive tags that respond to an external activation made by a reader

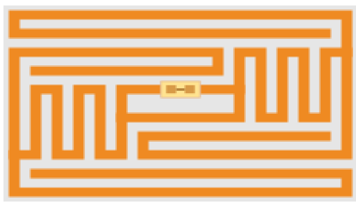


Figure 4-6 EPC RFID tag used by Wal-Mart. Source: Wikipedia

With active tags, it is typically easier to achieve 100 per cent read rates, which is why they are used often in anti-theft systems. Given their higher price, their use is limited for simple identification

[23] Quick Response codes

purposes. Different frequency bands are employed for different purposes. In particular, low frequency (LF) tags are used widely for animal identification and ultra-high frequency (UHF) tags are used in logistics. However, the particular frequency bands are not standardised globally. Modern readers can deal with this easily, but tags issued in one country may be illegal in another country.

It is of particular importance to stress that data carriers alone do not establish traceability. The use of RFID facilitates chain information management, because it eases the automated data capture process, but it does not establish traceability itself. Traceability requires association of identifiers with locations and processes, and following such identifiers through the chain from their emergence until their obliteration.

4.4 Examples of traceability and control systems in use for CITES-listed ornamental plants in selected Latin American countries

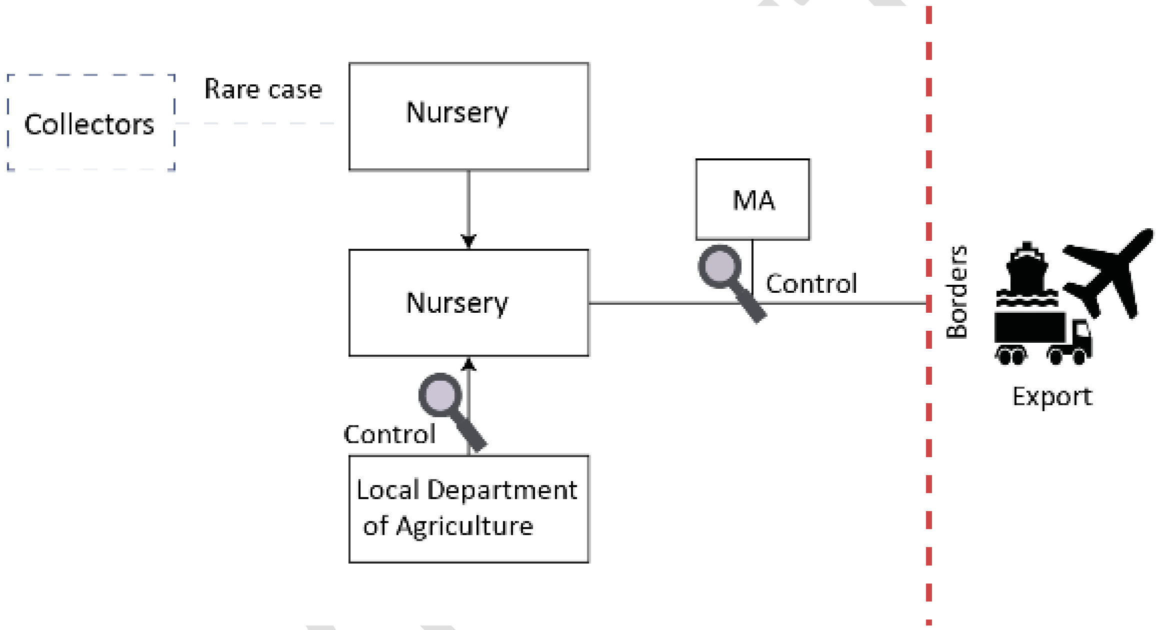


Figure 4-7 Schematic representation of the value chain of ornamental plants in the countries of interest. Source: own.

In this subsection, three examples of control systems for exports of CITES-listed ornamental plants are described in some detail. The export value chain itself is depicted in Figure 4-7; it is extremely short, basically consisting of a single step, the nursery. Interviewed nurseries obtain new mother plants very rarely; although in principle the possibility exists that a collector obtains material from the wild (with a proper permit), none of the nurseries could remember a concrete case. Nurseries do buy material from other nurseries, but then basically propagate whatever species they have. Nurseries export plants directly, i.e. without the use of traders. Exports are controlled by different authorities, the CITES Management Authority (MA) being one.

As such, there is no economic activity beyond the nurseries themselves. In particular, there is no active management of the wild resource, which in the interviewed countries was not part of the value chain at all. An implementation of a traceability or a control system will only affect therefore nurseries themselves.

Traceability systems for ornamental plants beyond the confines of a single company could not be found. The only example of a traceability system identified (see below), related to a system covering parts of one nursery's internal operation; its main function was to return plants brought from the greenhouse to the sales area back to their original location. However, in all countries that were interviewed, a control system was present. That control system involved typically branches of the Ministry of Agriculture and Environment.

As can be seen in the below case studies, the Management Authorities of the countries of interest operate very similar procedures. The main controlling elements are an annual operating license – issued typically by a local branch of the Ministry of Agriculture – that contains a register of parental stock and allows for estimation of production levels. The correctness of the reported stocks is checked during a physical visit. Export permits are then subject to available plant material from the operating license. The degree of verification varies with the countries from one annual verification visit and a sample-based inspection of exported goods to several physical visits of each consignment. Common good practices among the countries interviewed are:

(i) An annual visit to verify parental stock on a sample basis as part of the issuance of an annual operating license; and
(ii) Inspection of all export consignments at the border.

Countries that implement stricter regimes are likely to find resistance from the private sector. Timeliness of exports is essential for live plant exports and arranging physical visits in remoter areas where nurseries might be located, potentially causes time delays.

4.4.1 Colombia[24]

Colombia operates a comprehensive control system for CITES-listed plants. The system concerns mainly orchids, being the largest export item. Between 2010 and 2014, out of 39,684 exported CITES-listed plant specimens 38,022 (95.8 per cent) were of the *Orchidaceae* family.

In Colombia, five nurseries export orchids directly. Smaller nurseries are also operational, but produce only for the local market. There is no trading of orchids (e.g. where exporters and producers are different entities). Some of the nurseries also import species to re-export later. See also Resolution Conf. 91.19 (Rev. Cop15): Registration of nurseries that artificially propagate specimens of Appendix-I plant species for export purposes. Colombia has one nursery listed: https://cites.org/eng/common/reg/nu/CO.

All nurseries are subject to an operating permit issued by the Ministry of Environment and Sustainable Development (Ministerio de Ambiente y Desarrollo Sostenible, Minambiente).

All exported orchids are artificially propagated. The possibility to request a permit for direct export of parental plants exists, but is not currently being used. Nurseries in principle can obtain new species from the wild, if a corresponding permit has been requested and granted for research purposes. Since orchids are under protection only from 1977 onwards, often an unverifiable claim is made that specimens were obtained before that date.

In order to obtain an operating permit, nurseries submit annually an inventory of plants to Minambiente. The regionally responsible Department will then perform a physical inspection where a sample of plants will be checked. This physical check is conducted by trained inspectors, but plant species identification is quite complex.

[24] Information based on interviews with Diego Higuera, Andrew Niessen and Juan Carlos Uribe (see Section 7) and discussions at the event [15].

Based on the information collected from the visit and the projections of the nursery, a maximum export quantity is established by the CITES Management Authority, located at Minambiente.

When a nursery wishes to export, it submits a request to the National Single Window (Ventanilla Unica de Comercio Exterior, VUCE[25]). In the supporting documentation, the company submits a copy of the inventory at the time of application for the permit.

The CITES Management Authority determines the Legal Acquisition Finding mainly based on the operating permit of the nursery and the current inventory of specimens. There is no explicitly pre-established maximum limit of exports per species from a particular nursery.

Not all export shipments are physically inspected when they leave the country. In exceptional cases, the CITES Management Authority might make a documentary check. Even if the shipment is inspected, there are no expert botanists at crucial exit points, such as airports. The identification of species is a critical issue.

Colombia has an interest in promoting sustainable trade for example in orchids, cacti and Zamia. For that reason, the country is currently undergoing a revision of its respective laws and regulations. There is also a need to design necessary regulations for private collection. Any strategy for improving the trade situation toward legality should consider and support small-medium producers and nurseries enabling them to increase their competitiveness.

4.4.2 Ecuador[26]

Ecuador operates a comprehensive control system for CITES-listed plants. The following concerns mainly orchids, being the largest export item. Between 2010 and 2014, out of 245,996 exported CITES-listed specimens, 231,330 were of the *Orchidaceae* family. *Orchidaceae* also represented 98.8 per cent of all exported plant species in the same timeframe from Ecuador.

In Ecuador, nurseries export orchids directly and there is no trading of orchids (i.e. where exporters and producers are different entities). Between 70-80 per cent of all produced orchids are exported; within Ecuador, there is more demand for hybrids.

All nurseries are subject to an operating license issued by the Ministry of Environment (Ministerio del Ambiente Ecuador, MAE).

All exported orchids are artificially propagated. Nurseries in principle could obtain new species from the wild, if a corresponding permit has been requested and granted for research purposes. However, this happens very rarely or not at all. The currently operating nurseries already have hundreds or thousands of species in their portfolio. Private collections are currently not regulated.

In order to obtain an operating license, nurseries submit annually a list of plants (identified by a company internal code, which is a locally unique identifier) and projection of sales to the Ministry. The regionally responsible Department will then perform a physical inspection where a sample of plants will be checked.

Based on the information collected from the visit and the projections of the nursery, a maximum export quantity is established by the CITES Management Authority, located at the MAE.

[25] http://www.vuce.gov.co/

[26] Information based on interviews with Pablo Sinovas, David Veintemilla and Omar Tello (see Section 7), [16] and discussions at the event [15].

When a nursery wishes to export, it submits a request to the National Single Window. In the supporting documentation (bill), each species is identified with the same company internal code from the initial submission of stocks. There is no national system which collects these codes.

The CITES permit process is linked with the phyto-sanitary certificate process. The CITES Management Authority determines the Legal Acquisition Finding mainly based on the operating permit of the nursery and the current number of exported specimens against the maximum limit.

Given that Ecuador uses a risk management approach in border controls, not all export shipments are physically inspected when they leave the country. Even if the shipment is inspected, there are no expert botanists at crucial exit points, such as airports. The identification of species is a critical issue.

4.4.3 Peru[27]

GS1 Peru in conjunction with AGRO ORIENTE VIVEROS S.A.C implemented an internal traceability system within the framework of the BioTrade project known as "Proyecto Perúbiodiverso (PBD)". The project was funded by the Swiss State Secretariat for Economic Affairs (SECO) and the German Society for international cooperation (GIZ), and had as local counterparts the Ministry of Trade and Tourism (MINCETUR), the Commission for the promotion of Peruvian exports and tourism (PROMPERU) and the Ministry of Environment (MINAM).

Figure 4-8 Plant species identification via GTIN-13. Src: GS1 Peru

The project [14] consisted of:

- Elaboration of a traceability manual;
- Implementation of the manual in one nursery and sales room; and
- Audit against GS1s Global Traceability Conformance (GTC) standard where 105 traceability indicators are evaluated.

In the course of the project, GS1's identification standards were implemented. In particular, plant species were mapped against a GTIN-13 (see section 4.2) and plants then identified with a barcode; see Figure 4-7. In addition to the species, the nursery section and within the section the specific table where the plants are stored were registered. The main purpose of identification was to facilitate species identification within the nursery operation.

The internal traceability system recorded information in four steps:

- Division: in-vitro propagation, production of seeds, acclimatising and transport.
- Preparation: identification of tables, preparation of soil, division of plants, planting and returning to the greenhouse.
- Cultivation: cultivation activities, phyto-sanitary controls and treatments, and identification.
- Sales: transport of plants to point of sales, and identification of returns.

In addition, a register was created with all providers, transporters, clients in addition to internal personnel.

The pilot project was successful and the nursery obtained the GTC certificate. Its usefulness for CITES purposes is somewhat limited, however, since plants are not individually or batch identified and therefore a control on specimen level is not facilitated. Identification via a barcode of the species will help enforcement, if a resource is available where that barcode can be looked up and compared to

[27] Information based on interviews with Mirbel Epiquién Rivera, Isela del Carmen Arce Castañeda, Vanessa Ingar Elliott, Harol Gutierrez Peralta and Karol Villena (see Section 7) and discussions at the event [15].

the physical plant. For access to a database of photos via mobile phone, adding a barcode would be very useful.

4.4.4 Main issues identified

The systems found in the above countries to control exports of orchids found are quite rigorous and should allow for a reasonable level of control.

In order to keep the physical controls to a reasonable level and streamline therefore the export process, consistent identification of the mother plant for exported material should be added to the present control systems in order to strengthen it. It also became apparent in the interviews that having an electronic registry of mother plants would be highly beneficial for the coordination between the local Departments of Agriculture and the CITES Management Authorities. In order to limit the economic impact of any additional measures on the public service organisations, inclusion of risk-based controls should be considered.

Given that the current control systems are already quite stringent it is unlikely that the proposed modifications will have a large impact on the economic operators. Any additional effort – e.g. the creation of an electronic registry of mother plants – should be compensated by additional management benefits and less physical controls after inclusion of risk-based management concepts.

The main issue raised by all stakeholders (both from the private as well as public side; see Section 7) is the identification of species, both during the visits of nurseries by regional officers, as well as at the border. Identification of species of ornamental plants is a highly specialised task that requires significant training. If the plant has flowers, the task might be easier, but even in that case, it is not a simple task due to the very large number of species of orchids. At the border, plants may arrive without a flower and identification becomes really difficult, becoming a specialist's task.

Producing pictorial identification material of plants as shipped might help border officers identify species substitution, the greatest risk in the control system. However, efforts have been made by Parties to increase the availability of identification materials for Custom officials and others[28].

Differentiation of artificially propagated from wild material is also not necessarily easy. Material that was only recently harvested might be identifiable through insect bites or other marks that naturally occur in the wild and which plants in nurseries don't usually have. However, if a wild harvested plant is left sufficient time in a nursery or at least in a controlled environment, the natural markings might disappear.

It would seem appropriate to use a risk-based methodology to conduct DNA testing on a sample basis. A country could assign a suitable number of DNA tests annually (based on a budget allocation) and then use a risk-based methodology as described later on to assign such tests to individual verification activities, either at the nursery or at the border.

In addition, public stakeholders in most countries expressed concerns on the training status of regional and border officials. Regular trainings in species identification, differentiation between wild and artificially propagated plants, sampling of plant material and risk-based methodologies would seem worthwhile to strengthen the control processes.

[28] See: Review of identification and guidance material (Decision 16.59), cites.org/sites/default/files/eng/com/ac/28/E-AC28-10.pdf

5 Traceability system for CITES-list ornamental plants

5.1 The potential role of traceability in CITES processes

As stated above in Section 3.1, a CITES Management Authority must consider the following within its process to grant or not import, export, re-export permit and certificates:

- The legality of the trade process, and
- The sustainability, or the "non-detriment" of trade for the survival of the species in the wild (as determined by the Scientific Authority of the same country).

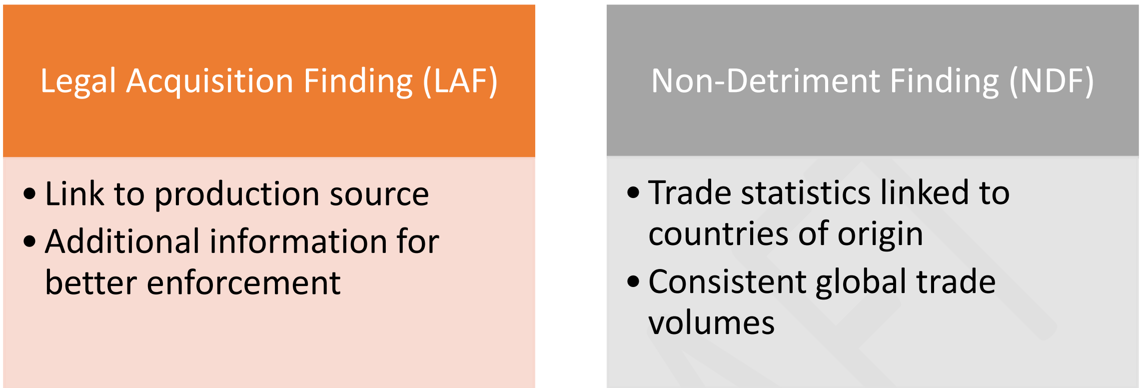


Figure 5-1 Potential roles of traceability in strengthening CITES processes

Information about origin, supply chain steps and process may certainly help determine whether the material was indeed acquired legally. In addition, traceability links trade statistics to production origin and to origin of the parent plant. This information can be used by nations in their efforts to make Non-Detriment Findings (NDFs); see Figure 5-1.

Traceability can be used for the developing statistics databases that are subsequently used as input into Non-Detriment Findings (NDFs) and for the Review of Significant Trade under CITES. However, perhaps the most immediate use of traceability is in the support of LAF, in particular, to document the relationship of the goods to be exported with a legal origin process (see section 6.3).

5.2 Limitations of the use of traceability systems in the trade of ornamental plants

There are a number of limitations for the use of traceability systems in the trade of specimens of CITES-listed ornamental plants.

A portion of the ornamental plant trade is illegal, unregulated and/or unreported; for these black market activities, traceability is not an ideal tool (see also Box 1). If both buyer and seller act knowingly outside of the law, they are very unlikely to document transactions and make that information available in some form or another. Traceability can help law enforcement activities to some extent because (a) the analysis of product flows may provide hints of illegal activity; and (b) companies can be held accountable based on the data they have previously submitted. However, the impact of traceability on reducing black market transactions should not be overestimated.

The main benefit of a traceability system to CITES trade therefore would be the avoidance of entry of illegal material into legal chains, e.g. the avoidance of "laundering".

Making laundering more difficult can have several consequences. It can raise awareness within supply chains and push semi-legal chains into legality. It can also, however, convert (semi-)legal chains into illegal chains because of additional data requirements and the associated burden of complying. This might be the case for example if (a) current business models are interrupted (e.g. small-scale production); (b) the additional documentation requirements exceed the capacity of the supply chain stakeholders; or (c) the transaction costs associated with the additional requirements reduce the profit margin.

Arguably, the success of a future traceability system will not only depend on the determination of the Parties to implement it, but also on the value created for the supply chain, particularly in the early stages. It is therefore important to consider measures for positive discrimination for those who work legally in ornamental plants and their products. Given that legal trade is almost exclusively related to artificially propagated species, this positive discrimination should probably be connected to the ease of trade for reliable nurseries (see below).

The second limitation is the assumption that a legal origination process exists. All Latin American countries consulted for the purpose of this study, required an operating permit for nurseries. This operating permit depends on the inventory at the nursery, which in turn is validated by the (regional) authority. The Legal Acquisition Finding then includes a validation if the number of specimens to be exported is in accordance with the inventory and/or maximum production limit.

Third, the quality of data captured in the legal origination process must be monitored by Parties implementing traceability. Traceability can be understood as a system of claims[29] and requires verification to make sure that data held in a traceability system is valid. If the traceability system is not sufficiently robust, its introduction may create a smokescreen of legality that will fail to address the actual problem, e.g. the pressure on the population of some ornamental plant species.

BOX 1. TRACEABILITY AND LEGAL COMPLIANCE

In **white markets**, where customers and producers trade only in legal goods, traceability may act as assurance of legality claims. As traceability identifies every partner in the supply chain, it supports the claim that a good was sourced legally. This might be especially valuable when there is a risk for the illegally sourced product entering the legal market, and customers demand assurance that the product was sourced and manufactured in accordance to legal standards. Consumers might not even need access to the data; knowing that officials have access could be sufficient for assurance.

This feature is equally valuable in **grey markets**, where illegal products are laundered into legal business chains and where the illegal origin of goods is deliberately kept from clients. In these markets, traceability can provide evidence whether a good was sourced legally. This can also be used in law enforcement as it points towards products with questionable sourcing.

In **black markets**, where both the customers and producers are aware of trading in illegally, traceability can support law enforcement as a lack of a documentation trail can highlight products of questionable origin. Traceability can function as a gatekeeper and deny illegally sourced products market entry or at least increase the risk of participating in black markets. However, if both sellers and buyers agree on illegal transactions, traceability is not likely to help very much.

[29] That is it records claims. Claims turn into facts only after verification.

5.3 Linking to a legal origination process

The traceability system that is suggested for use by Parties to CITES links the export/import permit or certificate process to a legal origination process and combines it with a risk-based control method.

Legal origination for ornamental plants refers to either the legal collection of a specimen from the wild, the legal purchase of a specimen, or the legal creation of a specimen, e.g. through artificial propagation.

A legal origination process for ornamental plants will consist of the following steps:

1. All entries of CITES-listed ornamental plants, plant parts and seeds are recorded with:
    a. Date
    b. Supplier (name, business registration number or similar)
    c. CITES permit information (if applicable)
    d. Species
    e. Number of specimens
    f. Identification codes (see point 2)
2. Registration of parental plants, e.g. specimens collected from the wild and plants purchased for propagation. Plants of the same species can be registered as a batch if their origin is the same (e.g. they come from the same supplier under the same CITES permit). This also applies to seeds and plants parts. Preferentially, however, whole plants are individually identified. All identifiers should be globally unique and must be unique within the context of the operator.
3. The inventory of parental plants, seeds and plant parts will be registered, ideally in an electronic system.

5.4 Robustness of the legal origination process

The legal origination process would need to be sufficiently robust in order to add value to the process. It is already current practice to review on an annual basis the current inventory.

The recommendation would be to include registered receptions, to combine the verification process with a risk management system, and to make an electronically available record of the verification process.

Such a risk management system would provide two values (which can be used independently to some extent):

- the sample size of verification (0-100 per cent); and
- which plants to check.

Table 5-1 Example risk factors determining the sample size

Factor	Sample size	
	Higher	**Lower**
Individual identification of plants		X
At least partly batch identification	X	
Any plants registered as wild harvested	X	
Significant amount of plants imported		X
Last control favourable		X
Issues with export permits since last control	X	
…		

From this, a sample size can be calculated (e.g. using a spreadsheet tool). This sample size will have an average according to the countries current practice. However, in nurseries with a higher risk profile, ampler checks will be made than in nurseries that have less associated risk. Table 5-1 collects potential factors influencing the sample size without being exhaustive. In principle, a very small sample size could be allocated for a particular year and a nursery with a very low risk profile.

The sample size can either be calculated in per cent, keeping the proportion of plants checked in a nursery constant. It would then be applied to the total number of (parent) plants to obtain the number of plants to check. Alternatively, the sample size can be determined as a total number, keeping the average effort per nursery constant. For an example, see Table 5-3. The latter would proportionally check more plants for smaller nurseries than for larger ones, but would allow for easier planning by the authority undertaking the verification.

Table 5-2 Example highlighting the difference between a constant sample percentage and constant sample size in checking nursery stocks.

Approach	Value (Example)	Large nursery			Small nursery		
		Stock	Plants checked	Per cent of stock checked	Stock		Sample as per cent of stock
Constant sample percentage	5%	10,000	500	5%	2,000	40	5%
Constant sample size	100	10,000	100	1%	2,000	100	5%

Regarding the individual plants to check, if the list of parental specimens is available electronically beforehand, a risk management approach can be taken to this, too. Potential risk factors are shown in Table 5-2.

Table 5-3 Example of risk factors determining which plants to check

Factor	Sample size	
	Higher	**Lower**
Individually identified plant		X
Batch identified plant or parts	X	
Wild harvested origin	X	
Imported origin under control of CITES		X
Imported from free trade zone	X	
Last control favourable		X
Significant number of descendants	X	
Any earlier export issues with descendants of plant/batch	X	
…		

Applying these principles to a nursery inventory of parental plants, plant material and seeds would then identify individual plants or batches to check. Inspectors would be recommended to check the parental plant and its descendants.

5.5 Conversion between raw materials and products

No conversion factors will be applied between products and raw material, given that most exported plants come from artificial propagation and have no upper limit of plants generated from a single parental plant.

Similarly, if a plant is sold as parts (tissue), no controllable limit can easily be established. The limit would be (usable) plant weight, but this is not easy to establish or control.

For whole plants, either exports are disallowed or the conversion factor is trivial.

5.6 Linking the export certificate to a legal origination process

In order to strengthen the CITES export permit issuance process through traceability, it is then recommended to record the originating plant or batch identifier(s) in the export, re-export permit or certificate. This is graphically represented in Figure 5-2.

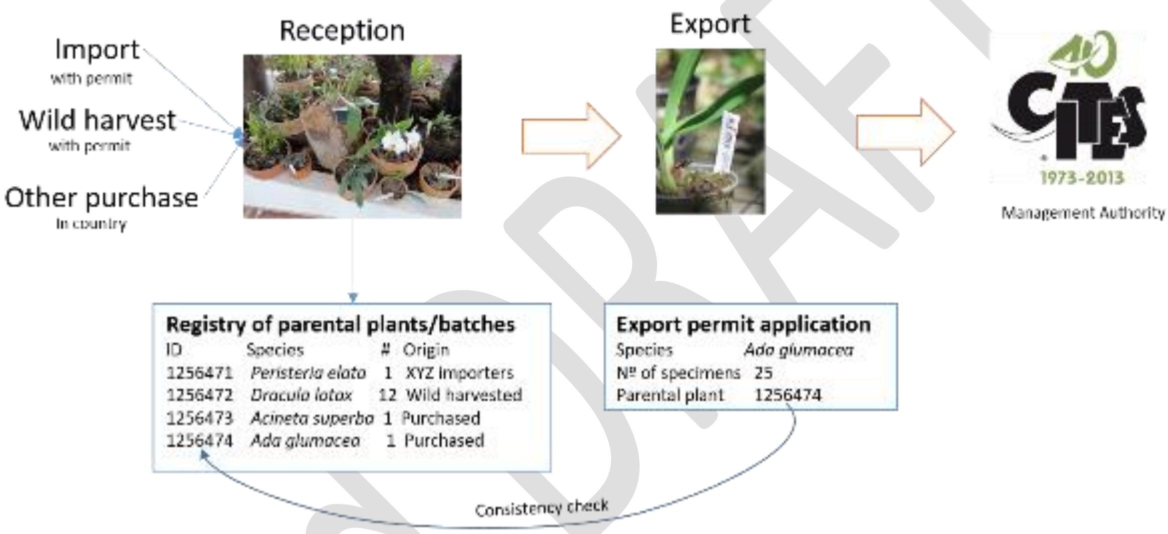


Figure 5-2 Strengthening CITES processes through traceability

In principle, the originating plant or batch could even be annotated in the permit itself. CITES permits are extensible, so a text field can easily be added. However, it is not clear whether traceability to the originating plant from the importing country adds any value, unless there was an externally accessible register of originating plants or batches.

Table 5-4 collects some of the ornamental plant products and their identification strategy for export permit applications.

In the case where an electronic register of plants is available, the identifiers used in the permit or certificate application can be verified. In addition, the following or similar checks can be made:

- Number of descendent specimens of plant or batch in total;
- Number of descendent specimens of plant or batch in current year;
- Identifier being used by another other exporter;
- Number of exported plants per species; and
- Quantity of exported plant parts and seeds.

Table 5-4 Some products and their recommended identification

Type of specimen to be exported	Identification
Artificially propagated from single plant or batch	Parental plant identifier or parental plant batch identifier
Artificially propagated from mixed parental plants	List of identifiers of individual plants or batches
Hybrid	List of identifiers of individual plants or batches
Plant parts or seeds	List of identifiers of individual plants or batches

5.7 The permitting process

The permitting process can be seen as an extension to the process shown in Figure 5-2. The above can then provide the basis for a further risk-based check, for example in the form of an alert to the border authorities to perform either a documentary check or a physical inspection. Alternatively, where CITES permits and certificate issuance is part of the issuance of a phyto-sanitary certificate[30] (which require a physical inspection), inspectors could be alerted to carry out additional checks (see Table 5-3).

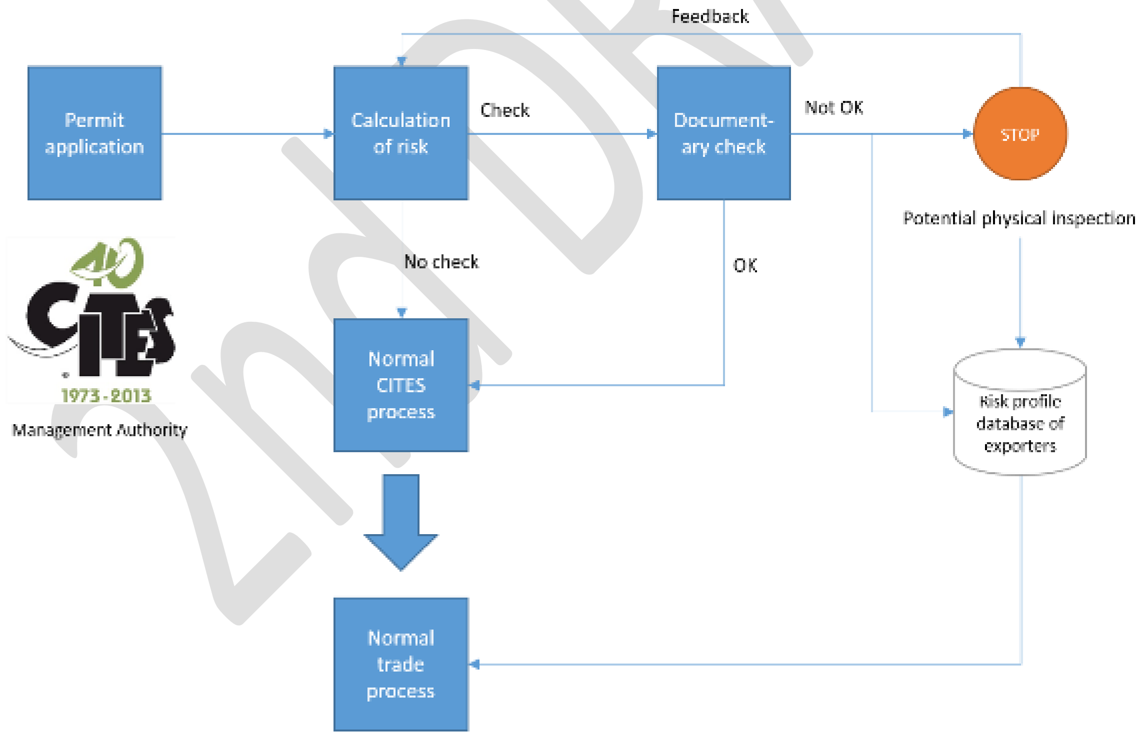


Figure 5-3 Risk-management based process to decide verification level

The CITES Management Authority could suggest to the phyto-sanitary inspectors and/or the border inspectors to perform an inspection on a certain percentage of goods related to CITES

[30] Countries can also use phytosanitary certificates as certificates to authorize the export of artificially propagated specimens of Appendix-II plant species. See: https://cites.org/eng/resources/reference.php#phyto

documentation. For a particular export process, the probability of being verified by the agents can then depend on risk factors such as the ones listed in Table 5-5.

Table 5-5 Example risk factors for export verification through a documentary check or a physical inspection

Factor	Inspection	Documentary check	Control frequency	
			Higher	**Lower**
Total number of exported plants higher than expected	Yes	Yes		
Number of plants inconsistent with inventory	Yes	Yes	X	
High number of imported plants	No	Yes		
Main exported species of exporter	No	No	X	
Any certificate issues in last 12 months	No	No	X	
Last control favourable	No	No		X
Parent plants identified individually	No	No		X
…				

5.8 Strengths, weaknesses, opportunities and threats of the recommended solution

Traceability as a tool for strengthening CITES

Strengths

- Simple to use
- Several levels of complexity available, depending on technical capacity
- Step-wise improvement possible
- Applicable to other CITES-listed species

Weaknesses

- Replacement of species still possible
- Like other documentation systems, addresses only white and grey market
- Works best when supported by an electronic system

Opportunities

- Strengthens the Legal Acquisition and to some extent the Non-Detriment Finding
- Allows faster control by Management Authority
- Allows for integration with Approved Trader and similar schemes

Threats

- Lack of capacity, especially in developing nations
- Does not address the black market, which is a sizeable portion of the trade in ornamental plants

5.9 Recommendations

General experience in implementing traceability in the food, fishery, livestock and other sectors shows that implementation of traceability is a very detailed process. In some cases, implementation is quite straightforward, and with the right motivation of the private sectors, has been quite successful. In other cases, implementation has proven to be lengthy and complicated, with mixed results at best. A combination of public and private sector support seems absolutely essential for success.

Given the above, the implementation of a traceability system to strengthen CITES processes needs to be tested more in-depth before it can be considered proven that traceability has a positive impact on the final end goal, namely the conservation, legal and sustainable use of CITES-listed species.

A number of elements are critical for success:

- Technical viability, in particular regarding identification and record keeping at the nurseries, including small-scale nurseries;
- Designing the right mix of positive and negative incentives for the private industry to participate;
- Adherence to international standards and norms when available, including joint work with standard setting organizations;
- Provision of capacity building initiatives for developing countries and, particularly, least developing countries lacking adequate infrastructure to implement and use traceability systems;
- Obtaining the buy-in from Parties that there is indeed a need to strengthen CITES processes through the use of traceability systems for ornamental plants;
- Provision of a traceability toolkit (or integration into the e-permitting toolkit), so that traceability is easy to implement, yet meaningful to CITES Management and Scientific Authorities; and
- Feasibility of the recommended processes in regarding technical, economic and conservational aspects must be demonstrated e.g. by conducting a socio-economic impact analysis.

All these could be checked in next phase, for instance through a pilot project. This pilot project should have, *inter alia,* the following criteria:

- It shall be large enough to have a measurable impact; ideally it would cover one to three Management Authorities for a period of time (e.g. 6 months)
- Parties participating in the pilot shall already have a legal origination process; ideally they would also support electronic recording of parental plants and batches
- It should involve at least one developing country, or more, in the technical feasibility assessment. Ideally – if enough budget is available – this would include a country with low technological capacity to gain practical experience how such a process can be implemented under difficult circumstances
- A socio-economic impact assessment should be made that compares implementation and operation cost with the likely impact on CITES-listed species
- It should attempt to quantify the amount of illegal and unreported trade using local expert knowledge
- It should involve a trading partner with a history of strong interest in sustainable use of ornamental plants and their products to provide better motivation to food business operators
- It should concentrate on ornamental products first, because there is less mixing involved. Later, the methodology can be expanded to medicinal or personal care uses
- It may firstly consider Parties that already use risk management in export related procedures

5.10 Roadmap for taking the outputs and recommendations of this study forward

This study is meant to contribute to a general study of the use of traceability for CITES-listed non-timber plant species. The following steps are recommended for the implementation of the outputs and recommendations:

1. Complement the current study with a study on other plant products, notable processed plant products, such as products from medicinal herbs.
2. Provide both validated studies as case studies to the traceability working group that was recommended in the SC66 to be established at CoP17, Sept 2016, Johannesburg.
3. Integrate the recommendations with the Guide on Best Practice on the Implementation of Traceability Systems, currently under development by UN/CEFACT
4. Identify a pilot project according to the criteria listed above and implement the pilot, including a socio-economic impact study. Draw conclusions from the pilot whether to propose the traceability system for adoption by the Parties
5. Present recommendations and pilot results to relevant committees of CITES.

It is expected that points 2 and 3, together with evidence developed under point 4 contribute to the development of an umbrella traceability system suitable for CITES Parties.

6 References

[1] D. Ashley, “Traceability systems for a sustainable international trade in South East Asian python skins,” 2014.

[2] UN Comtrade, “UN Comtrade,” 2015. [Online]. Available: http://comtrade.un.org/data/.

[3] T. J. Givnish, D. Spalink, M. Ames, S. P. Lyon, S. J. Hunter, A. Zuluaga, W. J. D. Lles, M. A. Clements, M. T. K. Arroyo, J. Leebens-Mack, L. Endara, R. Kriebel, K. M. Neubig, W. M. Whitten, N. H. Williams, and K. M. Cameron, “Orchid phylogenomics and multiple drivers of their extraordinary diversification,” *Proc. R. Soc. London*, vol. 282, no. 1814, 2015.

[4] A. M. Pridgeon, P. J. Cribb, M. W. Chase, and F. N. Rasmussen, *Genera Orchidacearum Epidendroideae (part 3)*. Oxford University Press, 2014.

[5] CITES, “CITES Trade Database,” *The Convention on International Trade in Endangered Species of Wild Fauna and Flora*, 2014. [Online]. Available: http://trade.cites.org/.

[6] Kew and CITES, “Cites & cacti,” 2012.

[7] Kew and CITES, “CITES and Cycads,” 2004.

[8] M. Africa and C. Muñoz, “Orchid Conservation and Trade : Are These Concepts Incompatible ?,” *Proc. Second Sci. Conf. Andean Orchid.*, pp. 46–55, 2009.

[9] CITES Secretariat, “Resolution Conf. 11.11 (Rev. CoP15),” 1994. [Online]. Available: https://www.cites.org/eng/res/11/11-11R15.php. [Accessed: 02-Nov-2015].

[10] CITES Secretariat, “CITES World,” 2002.

[11] P. Olsen and M. Borit, “How to define traceability,” *Trends Food Sci. Technol.*, vol. 29, no. 2, pp. 142–150, 2013.

[12] H. Lehr, “Communicating Food Safety, Authenticity and Consumer Choice. Field Experiences.,” *Recent Pat. Food. Nutr. Agric.*, vol. 5, pp. 19–34, 2013.

[13] J. Bracken, “GS1.” 2015.

[14] GS1 Peru, “Proyecto Trazabilidad en Orquídeas Agro Oriente Viveros SAC,” 2006.

[15] UNCTAD, “Meeting Report of UNCTAD side event ‘ Traceability Systems for Ornamental Plants ,’” Geneva, 2016.

[16] P. Sinovas, E. King, and A. Hinsley, “Trazabilidad del comercio de vida silvestre en Ecuador. Informe técnico preparado para el Ministerio del Ambiente de Ecuador y el Programa ProCamBío-GIZ,” Cambridge, United Kingdom, 2015.

7 Persons and institutions consulted

Organisation	País	Individual
CITES		
CITES Secretariat	Switzerland	Tom de Meleunaer Marcos Regis Silva (Retired) Haruko Osuko Milena Sosa Schmidt
CITES Management Authorities		
Ministerio del Ambiente	Ecuador	David Veintemilla
Ministerio de Ambiente y Desarrollo Sostenible	Colombia	Diego Higuera
Ministero del Ambiente y Energía	Costa Rica	José Joaquín Calvo
Ministerio del Ambiente	Peru	Mirbel Epiquién Rivera Isela del Carmen Arce Castañeda Vanessa Ingar Elliott Harol Gutierrez Peralta
	Mexico	Mª Isabel Camarena
Federal Food Safety and Veterinarian Office	Switzerland	Ursula Moser Mathias Lörtscher
Other international organisations		
UNEP-WCMC	United Kingdom	Pablo Sinovas Kelly Malsch
UN ECE UN/CEFACT	Switzerland	Markus Pikart
UNCTAD	Switzerland	Bonapas Onguglo Lorena Jaramillo Mariona Cusi
ITC	Switzerland	Joe Wozniak
Private sector stakeholders		
Orquivalle	Colombia	Andrea Niessen Juan Carlos Uribe
Agro Oriente Viveros S.A.C	Peru	Karol Villena
Centro De Rescate De La Flora Amazónica	Ecuador	Omar Tello
Migros	Switzerland	Franziska Staubli
NGOs		
TRAFFIC	United Kingdom	Anastasiya Timoshyna
IUCN	United Kingdom	Daniel Challender
GS1 Global	Belgium	Jim Bracken
GS1 Switzerland	Switzerland	Anders Grangard
Plant experts		
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Tradmed	United States	Josef Brinckmann
Royal Botanic Garden Sydney	Australia	Nathalie Nagalingum
Royal Botanic Gardens – KEW	United Kingdom	Noeleen Smyth