NDF WORKSHOP CASE STUDIES
WG 4 – Geophytes and Epiphytes
CASE STUDY 3
Orchids
Country – **ECUADOR**
Original language – Spanish

CRITERIA USED TO SET EXPORT QUOTAS FOR APPENDIX I AND II *ORCHID* SPECIES FROM ECUADOR

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This case was prepared by the Museo Ecuatoriano de Ciencias Naturales del Ecuador, MECN CITES Scientific Authority. Jardin de Orquideas Armonia Mindo.

I. Background information on the taxa

Although Ecuador is a small country, it has a diversity of habitats and microclimates. Factors such as the elevation of the Andean mountain ranges, the influence of the warm current of El Niño, the Humboldt cold current, and rainfall have determined the proliferation of the ORCHIDACEAE family, whose diversity is concentrated at elevations between 300 and 3000 m.

The ORCHIDACEAE family in Ecuador is the most diverse of all plant families, with 4016 orchid species recorded so far (C.Dodson 2006). Of these, 1318 species (40%) are endemic. Orchids represent *33 % of the plant diversity of the country*. In other words, at least one in three species is an orchid, which makes Ecuador a country with very high orchid diversity relative to its surface. These discoveries have been possible thanks to the continuous scientific exploration that is taking place in Ecuador.

The current state of orchid research places Ecuador in a privileged position, given that the country has easily available tools that contribute to the knowledge of its flora. At present, there is the project *Flora del Ecuador- Familia Orchidaceae* (Dodson & Luer), *Enciclopedia de las Orquídeas Nativas del Ecuador* Volumen 5 and the reprint of *Libro Rojo de las Plantas Endémicas del Ecuador* (Red Book of Endemic Plants of Ecuador, in press), which compile information about the natural populations of endemic and native orchids, their range, main threats and current conservation status.

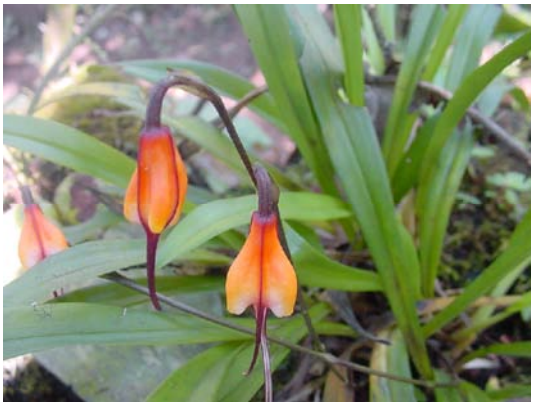
1. BIOLOGICAL INFORMATION

1.1 Scientific and common names

One of the Appendix-I listed orchid species of Ecuador is:

Phragmipedium fischeri Braem & H. Mohr

The following Appendix-II listed orchid species of Ecuador has been considered:



Dracula sodiroi (Schtltr.) Luer

According to the herbarium records of orchids of Ecuador, 4016 species are known. However, the largest nursery in the country uses 2275 species, and the two species of Ecuador mentioned above are subject to international trade. Appendix-I listed species are currently being monitored and reviewed in each nursery. Export quotas are to be approved once the nursery is registered with the CITES Secretariat. Incluye a las species que no se encuentran necesariamente

1.2 Species distribution

PHRAGMIPEDIUM FISCHERI BRAEM & H. MOHR

This species occurs in the high Andean forest at elevations between 1000 and 1500 m in the El Carchi province; it has only been collected in the Maldonado area.

DRACULA SODIROI (SCHTLTR.) LUER

The species occurs in high and low Andean forest at elevations between 1500 and 2500 m in the provinces of El Carchi, Imbabura, and Pichincha.

All the orchids of Ecuador are distributed in the protected area network (Sistema Nacional de Areas Protegidas, SNAP). Protected areas in Ecuador are shown in the map below:

1 Parque Nacional Cajas
2 Parque Nacional Cotopaxi
3 Parque Nacional Galápagos
4 Parque Nacional Machalilla
5 Parque Nacional LLanganates,
6 Parque Nacional Sangay
7 Parque Nacional Podocarpus
8 Parque Nacional Sumaco
9 Parque Nacional Yasuni
10 Reserva Biológica Limoncocha
11 Reserva biológica Marina de Galápagos
12 Reserva Ecologíca Antisana
13 Reserva Ecológica Arenillas
14 Reserva Ecológica El Angel
15 Reserva Ecológica Cayambe Coca
16 Reserva Ecológica Manglares Cayapas Mataje
17 Reserva Ecológica Cofán Bermejo
18 Reserva Ecológica Cotacachi Cayapas
19 Reserva Ecológica Los Ilinizas
20 Reserva Ecológica Mache Chindul
21 Reserva Ecológica Manglares Churote
22 Reserva Geobotánica Pululahua
23 Reserva de Producción Faunística Chimborazo
24 Reserva de Producción Faunística Cuyabeno
25 Reserva de Producción Faunística El Salado
26 Refugio de Vida Silvestre El Pasochoa
27 Refugio de Vida Silvestre Manglares Estuario Río Muisne
28 Refugio de Vida Silvestre Isla Corazón
29 Refugio de Vida Silvestre Isla Santa Clara
30 Refugio de Vida Silvestre la Chiquita
31 Área Nacional de Recreación El Boliche
32 Área Nacional de Recreación Parque Lago
33 Parque Binacional El Condor
34 Refugio de Vida Silvestre El Zarza
35 Reserva Biológica El Quimi
36 Refugio de Vida Silvestre Manglares El Morro
37 Refugio de Vida Silvestre Manglares Estuario Río Esmeraldas

1.3 Biological characteristics of the species

1.3.1 *Provide a general summary of the biological life history and characteristics of the species*

Phragmipedium fischeri is a terrestrial plant with inconspicuous pseudobulbs. It has groups of 5 lanceolate-elliptic sheath leaves 24 cm long and 2.2 cm wide; basal axillary inflorescence more than 15-25 cm long with multiple whitish-pink flowers; floral bracts 7 cm long, 5-15 mm wide; peduncle 5 cm long; sepals whitish-pink; 2 elliptic whitish-pink

petals; pink slipper-shaped lip with a white edge, white basally with yellow markings.

This species grows on mountain slopes that filter water continuously, on acidic soils. It prefers warm climate and well-drained shallow soil over rock. It blooms for 6-12 months, one flower consecutively after another. In very humid conditions with poor ventilation, the plants are vulnerable to fungal and bacterial infections, which lead to a natural population decline.

In cultivation, *Phragmipedium fischeri* needs good drainage and air circulation. The plants are usually divided into groups of 3 shoots; otherwise it takes too long for the plant to reestablish itself and bloom again. Larger plants produce larger and more numerous flowers.

This species can bloom for several months. Each flower lasts about one week. When a flower falls, the spike keeps producing flower buds, and only stops producing flowers when it is completely dry. The rhizomes of old plants produce new shoots by asexual propagation. This leads to a slow growth in the populations of the species, which are sometimes dense in rocky outcrops. It takes a few years for young plants to produce flowers and complete the reproductive cycle.

Phragmipedium fischeri does not tolerate human disturbance. Although it has similarities with *Phragmipedium schlimii*, it is a different species which is poorly known and needs to be treated separately, as it is endangered (P. Cribb, pers. comm. 2008).

The survival rate of the species is low because of its special requirements – highly alkaline soils and great ventilation. In controlled conditions the survival rate is 50%.

Dracula sodiroi is a terrestrial epiphyte with petioles 4 cm long; elliptic linear leaves 20 cm long and 2 cm wide; basal flowers have a peduncle 6 cm long; flowers are orange with 2.5 cm long burgundy tails.

These plants are relatively small and like lots of water. They grow preferably in cloud forests in the Andes, where they are often covered in mist; they prefer the low branches of trees with little light, at a temperature of 10 – 19ºC. Dracula flowers close when conditions are too dry; it is common for flowers that were open in the morning to close as their culture medium dries up. New leaves that fold before maturing are another sign that the moisture level is not optimal for the species.

Populations of *Dracula sodiroi* increase quickly by asexual propagation and often form dense clusters along roadsides. The species tolerates human disturbance.

The survival rate of the species is high, given its specific high moisture requirements. In controlled conditions the survival rate is 90%.

1.3.2 *Type of habitat*

Phagmipedium fischeri occurs in the high Andean forest at an elevation between 1000 and 1500 m in El Carchi province, in the north of Ecuador; it has only been collected in the Maldonado area. It greatest threat is the intense illegal harvest of orchids, especially in this area for species of this genus. The destruction of the forests where the species occurs to convert them to grassland is common in the area.

This species is currently under cultivation in the nursery Orquídeas del Ecuador. It is endemic to Ecuador and has not been recorded in the protected area network (SNAP).

Dracula sodiroi (Schltr.) Luer. This species occurs in the high and low Andean forest, at an elevation between 1500 and 2500 m. It is abundant in the north east of the Andes. It grows on roadsides with a terrestrial habit and in forests with an epiphytic habit. The largest populations have been recorded in the provinces of El Carchi, Imbabura and Pichincha and possibly in the following protected areas: 14 Reserva Ecológica El Angel, 15 Reserva Ecológica Cotacachi Cayapas and 19 Reserva los Ilinizas.

The species is common in cultivation in national and international greenhouses.

However, most endemic orchids prefer the vast primary forests of the Andean foothills; these epiphytes are also frequently found in solitary trees in grasslands, remnants of the native plants that once existed around them.

1.3.3 *Role of the species in the ecosystem*

The orchid species *Phragmipedium fischeri* and *Dracula sodiroi* form dense populations with a few individuals of other species, such as those of the genera *Pleurothallis*, Stelis and some species of Poaceae.

Phragmipedium fischeri toes not tolerate disturbance, whereas *Dracula sodiroi* tolerates disturbance to the extent of only growing in disturbed areas. It is therefore evident that deforestation caused by land conversion, grazing, burning, logging, road construction, hydroelectric projects and mining are the main threats to these endemic orchids. Indiscriminate illegal harvest for commercial purposes is also a major threat for many species of the genera *Phragmipedium*, *Masdevallia* and *Dracula*, for example, which attract the greatest demand in domestic and international markets.

1.4. Population

1.4.1 *Global population size*

The orchid family in Ecuador is the most diverse of all plant families, with 4016 species described so far, out of which 1318 are endemic, including *Phragmipedium fischeri* and *Dracula sodiroi*.

The largest nursery in Ecuador manages and keeps 2275 species of native orchids. However, wild populations of both species mentioned are rare.

1.4.2 *Current global population trends:*

___increasing _X_decreasing ____stable ____unknown

1.5. Conservation status

1.5.1 *Global conservation status* (according to the IUCN Red List):

___Critically endangered ___Near Threatened
_X_Endangered ___Least concern
_X_Vulnerable ___Data deficient

1.5.2. *National conservation status for the case study country*

The conservation status of *Phragmipedium fischeri* is Endangered. Although there are no records of herbarium samples according to the data of the *Libro Rojo de Species Endémicas del Ecuador* (Red Book of Endemic Species of Ecuador, Endara et al. 2008, in press), the species is cultivated in nurseries.

Dracula sodiroi is Vulnerable; there are records of the species in herbarium samples and nurseries in Ecuador.

The following data reflect the conservation status of the 1318 orchid species endemic to Ecuador, out of which 82.5% are endangered: 35 species are Critically Endangered, 132 are Endangered and 920 are Vulnerable.

The remaining 17.5 % corresponds to 13 species that were not evaluated because of a lack of data.

The species that are not threatened were classified as follows: 123 as Near Threatened, 33 as Least Concern, and 62 as Data Deficient-Not Evaluated.

1.5.3 *Main threats within the case study country*

___No Threats
_X_Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)

_X_Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
__X_Pollution (affecting habitat and/or species)
___Other_____
___Unknown
The three threats apply to both *Phragmipedium fischeri* and *Dracula sodiroi*.

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED

2.1 Management measures

Any nursery trading in plant species must comply with the resolutions and decisions in force of the CITES Convention. The Management Authority, after consulting the Scientific Authority, may send data on a given nursery to the CITES Secretariat so that it can be registered as an operation that propagates Appendix I plant species.

Besides, the nursery owners must submit information about the operation including a description of the facilities, a history and propagation plans, data on the number and type of parent plants it keeps and evidence of their legal acquisition.

Both the Management Authority and the Scientific Authority must review this information and judge whether the operation is eligible for registration.

In the process of determining the criteria to set export quotas, it was necessary to carry out a detailed inspection of the nursery that currently keeps, cultivates, propagates and sells Appendix I and II orchid species.

2.1.1 *Management history*

Exports of orchids of Ecuador are mainly for commercial purposes, followed by exports for exhibitions and finally specimens for scientific purposes.

Based on CITES official trade data for the 1997 - 2000 period provided by the Management Authority, Appendix-I listed species of the genus Phragmipedium were exported by Ecuador for commercial purposes; exports mainly involved Appendix-II listed species; according to the official data, no hybrids were exported.

In the 1997- 2000 period, 51,103 orchid plants were exported, out of which 14.18% were for exhibition purposes, 85% were for commercial purposes and 0.67% were for scientific purposes.

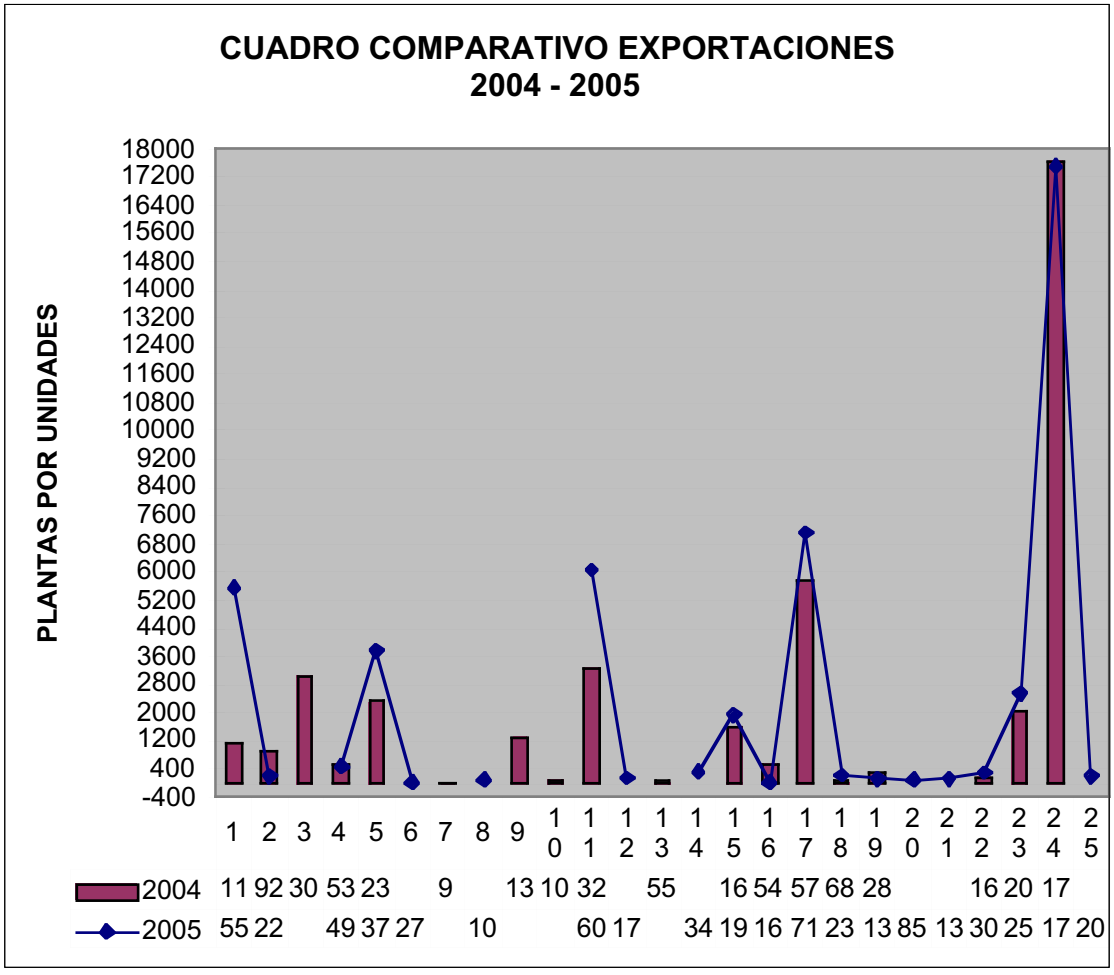
The data show that 90% of exports involved Appendix II species and 10% involved Appendix I species.

Exports of orchids of Ecuador are gradually increasing. For example, 12,099 plants were exported in 1997, 10,902 in 1998; 12,718 in 1999; and 15,384 in 2000. The following table shows a growth in orchid sales in the years 2004-2005 and the 26 countries that host the most important shows where the most important sales are made every year. (CITES official data. S.Lasso, Ministry of the Environment of Ecuador, 2005).

Table No. 1
Exports of orchids of Ecuador in the years 2004 -2005
40,877 orchid plants were exported in 2004, and 46,998 were exported in 2005.

#	COUNTRY	2004	2005
1	GERMANY	1132	5562
2	AUSTRALIA	927	222
3	BELGIUM	3048	
4	BRAZIL	536	490
5	CANADA	2320	3764
6	CHILE		27
7	COLOMBIA	9	
8	COSTA RICA		103
9	DENMARK	1324	
10	SPAIN	106	
11	FRANCE	3287	6064
12	THE NETHERLANDS		171
13	HONG KONG	55	
14	HUNGARY		343
15	UNITED KINGDOM	1605	1943
16	ITALY	540	16
17	JAPAN	5743	7124
18	POLAND	68	234
19	RUSSIA	284	135
20	SOUTH AFRICA		85
21	SWEDEN		130
22	SWITZERLAND	167	301
24	TAIWAN	2078	2553
25	USA	17,648	17,531
26	VENEZUELA		200
	TOTAL	40,877	46,998

Chart No. 1 Table of Exports



Translation of the text in the chart: Horizontal text: Comparative table of exports; vertical text: Plants in units

2.1.2. *Purpose of the management plan in place*

To manage the species sustainably and ensure that the exports of orchids of Ecuador are not detrimental to the survival of their wild populations, given that exports are mainly for commercial purposes and exhibitions rather than scientific purposes.

2.1.3. *General elements of the management plan*

To limit annual exports of orchids of Ecuador as well as the harvest of specimens from the wild. To this end, the nurseries have been subjected to close scrutiny regarding the following aspects:

Propagation methods

To verify the propagation methods for plants in the laboratory and the nurseries of Gualaceo, El Pangui and Guayaquil, the species propagated were reviewed, counted and observed, comparing them to the company's inventories.

STOCK OF PLANTS FOR EXPORT

To confirm the stock destined for export relative to the production in the laboratory and the nurseries, all the Appendix I and II species were reviewed. Random counts were made, according to maximum and minimum production volumes, considering the IUCN categories of the Red Book of Species of Ecuador such as: endemic, vulnerable to disappearing, endangered, near threatened, and extinct in the wild.

2.1.4. *Restoration or alleviation measures*

Propagation of plants under controlled conditions in the nursery is successful. The reintroduction of artificially propagated orchids by nurseries in grassland and regenerating forest is still uncertain, as there are no data available on the number of reintroduced plants that are still alive.

To monitor the reintroduction of species, the company keeps data sheets on the population of planted orchids involving *Phragmipedium fischeri* and *Dracula sodiroi*. This implies a long monitoring process, which will make it possible to find out the number of plants that managed to adapt and survive under uncontrolled conditions. The data will be published in 5 years.

2.2. Monitoring system

2.2.1. *Methods used to monitor the harvest*

No methods are available.

2.2.2. *Confidence in the use of monitoring*

There is no quantitative information about the nurseries' first harvest. However, given that only 7 nurseries are currently producing orchids for national and international exhibitions, it has been easier to regulate and control their activities.

2.3 Legal framework and law enforcement:

As a Party to the CITES Convention, Ecuador regulates trade in species according to the Articles of the Convention:

1. All trade in specimens of species included in Appendix I shall be in accordance with the provisions of this Article.

2. The export of any specimen of a species included in Appendix I shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:
   a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;
   b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora;
   c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and
   d) a Management Authority of the State of export is satisfied that an import permit has been granted for the specimen.

3. The import of any specimen of a species included in Appendix I shall require the prior grant and presentation of an import permit and either an export permit or a re-export certificate. An import permit shall only be granted when the following conditions have been met:
   a) a Scientific Authority of the State of import has advised that the import will be for purposes which are not detrimental to the survival of the species involved;
   b) a Scientific Authority of the State of import is satisfied that the proposed recipient of a living specimen is suitably equipped to house and care for it; and
   c) a Management Authority of the State of import is satisfied that the specimen is not to be used for primarily commercial purposes.

4. The re-export of any specimen of a species included in Appendix I shall require the prior grant and presentation of a re-export certificate. A re-export certificate shall only be granted when the following conditions have been met:
   a) a Management Authority of the State of re-export is satisfied that the specimen was imported into that State in accordance with the provisions of the present Convention;
   b) a Management Authority of the State of re-export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and
   c) a Management Authority of the State of re-export is satisfied that an import permit has been granted for any living specimen.

For Appendix II species, Ecuador applies the following regulations:

ARTICLE IV.2
The export of any specimen of a species listed in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

ARTICLE IV.2.A)
A Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

ARTICLE IV.3
A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.

However, for hybrid species, Ecuador does not apply the following exemptions:

Artificially propagated hybrids of the following genera are not subject to the provisions of the Convention, if conditions, as indicated under a) and b), are met: *Cymbidium*, *Dendrobium*, *Phalaenopsis* and *Vanda*:

a) Specimens are readily recognizable as artificially propagated and do not show any signs of having been collected in the wild such as mechanical damage or strong dehydration resulting from collection, irregular growth and heterogeneous size and shape within a taxon and shipment, algae or other epiphyllous organisms adhering to leaves, or damage by insects or other pests; and
b) i) when shipped in non-flowering state, the specimens must be traded in shipments consisting of individual containers (such as cartons, boxes, crates or individual shelves of CC-containers) each containing 20 or more plants of the same hybrid; the plants within each container must exhibit a high degree of uniformity and healthiness; and the shipment must be accompanied by documentation, such as an invoice, which clearly states the number of plants of each hybrid; or

c) ii) when shipped in flowering state, with at least one fully open flower per specimen, no minimum number of specimens per shipment is required but specimens must be professionally processed for commercial retail sale, e.g. labeled with printed labels or packaged with printed packages indicating the name of the hybrid and the country of final processing. This should be clearly visible and allow easy verification.

As no identification manuals on hybrids are available for use by regulating bodies such as the Ministry of the Environment, Customs and the Environmental Police, all plant exports are accompanied by appropriate CITES documents.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED

3.1. **Type of use** (origin) **and destinations** (purposes)

The orchids of Ecuador *Phragmipedium fischeri* and *Dracula sodiroi* in the nurseries that propagate and cultivate them originally came from the wild. Artificially propagated plants are mainly produced for commercial purposes, exhibitions and scientific purposes.

Both species are valued for their use in flower arrangements and as garden plants.

3.2. Harvest

3.2.1. *Harvesting regime*

Normally, mature plants with large rhizomes are collected, leaving small plants for the population to survive. It is only permitted to collect plants in the populations outside protected areas, under the control of local forest authorities. The survey and review of herbarium samples have determined that no natural populations of *Phragmipedium fischeri* or *Dracula sodiroi* have been recorded within the protected area network of Ecuador.

The Scientific Authority also reviewed and assessed all the plants in the nursery to confirm whether they were artificially propagated or wild taken. As regards artificial propagation, the plants meet the criterion laid down in Resolution Conf. 9.18 (Rev), which includes the definition of 'artificially propagated.'

3.2.2. *Harvest management/control*

Only the populations outside protected areas may be harvested, according to the regulations of local governments and forest authorities.

The harvest of the parental stock of orchids of Ecuador by nurserymen involves removing 3 complete individuals from the wild.

This quota of 3 individuals is based on the results of studies on orchid diversity in the Andes, where frequencies and abundances were analyzed by using 50 m x 20 m permanent transects located at the following elevations:

Western Sector	**Eastern Sector**
Transect 1 = T1 3530 m	Transect 6= T6 3440 m
Transect 2= T2 3430 m	Transect 7= T7 1550 m
Transect 3= T3 3440 m	Transect 8= T8 2500 m
Transect 4 = T4 2500 m	Transect 9= T9 3430 m
Transect 5= T5 1550 m	Transect 10= T10 3530 m

Transects were used to rapidly determine the diversity and abundance of epiphytes, as the sampling was made in forests with homogeneous vegetation (Gentry & Dodson, 1987).

The data collection stage implied collecting and recording characteristics of all epiphytic and terrestrial orchids, elevation, genus, presence of flowers and fruits and frequency; the specimens were later identified by comparing them with herbarium samples in the country.

Statistical analysis:

To carry out the quantitative analysis and the comparisons between the habitats, the 10 transects were classified according to their location – Western Sector or Eastern Sector – by means of the following calculations:

Simpson's Diversity Index.- This index is used when the degree of relative dominance of few species in the community is the primary interest rather than when all the species are equally abundant (Ludwig, 1988).

Simpson proposed the first diversity index in 1949. It is used in Ecology as:

$$\lambda = \sum_{i=1}^{s} p_i^2$$

where:

pi is the proportional abundance of the finite species given by

$$P_i = \frac{n_i}{N^*} \; 1, 2, 3, \ldots\ldots, S$$

N = total number of individuals in the population
ni = number of individuals of the finite species

Abundance = number of individuals of all the species
Relative abundance (Ab) refers to the number of individuals present

$$\%\ Ab = \frac{\text{Number of plants of the species considered} \times 100}{\text{Number of species}}$$

Absolute frequency

$$Fr = \frac{\text{Number of plots where the species occurs}}{\text{Total number of plots sampled}}$$

Relative frequency (FR)

$$FR = \frac{\text{Number of sampling units with the species} \times 100}{\text{Sum of the frequencies of all the species}}$$

After analyzing data about the ten transects, the following table was produced with the values of the most frequent and abundant genera; other genera are less frequent and were therefore represented by fewer individuals.

Number Genera found Frequency of individuals / Transect

No.	Genera	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Total
1	Altensteinia					2		1		4		7
2	Barbosella			3								3
3	Cranichis										3	3
4	Cyrtochilum			5								5
5	Elleanthus	2	32	6	18	104	19	58	26	8	6	279
6	Epidendrum	36	5		3	27	21	52	65	19		228
7	Gomphichis			5							4	9
8	Lepanthes	93	83	39	104	211	291	95	15	88	43	1062
9	Masdevallia	88	204	4	78	302	144	138	30	20	62	1070
10	Maxillaria	2	4				8	1				15
11	Oncidium			2	2	3		1	4			12
12	Odontoglossum	2		3		4	3	1		3	12	28
13	Pachyphyllum					6		3	4			13
14	Dracula				56		175					231
15	Pleurothallis	113	46	29		107	37	20	50	10	18	430
16	Stelis	43	35	60	6	21	13	61	34	53	44	370
17	Phragmipedium					5		4				9
18	Trichosalpinx					2	5	109			1	117

In the ten transects, 18 genera were found, represented by 62 species. The number of species was divided by the number of genera found to calculate species abundance for each genus. The resulting figure was 3.4. Given that plants are not divided into fractions in nature, the value of 3 was considered, which led to setting a wild harvest quota of three individuals of these genera. These data are the results of two scientific studies (M. Mites 2001 and E. Freire 2000).

Unfortunately, however, no updated or similar guidelines to this are available to determine the wild harvest of lowland genera. This is due to the lack of studies on the diversity and abundance of epiphytes occurring at elevations between 0 and 1500 m in Ecuador. The diversity of lowland orchids is only known from floristic inventories of trees in which determining the population of epiphytes was not a major component.

Consequently, to harvest plants from the wild, the management units established according to the environmental legislation of Ecuador are subject to the guidelines of the Management Plan.

Guidelines of the Management Plan

The Management Plan is an instrument that helps nurserymen establish the nursery areas, the objectives of the operation and its specific activities. The management plan must include the following aspects:

- Background .- A short historic description of the reason for the nursery's existence.
- Purpose or general objective of the nursery's activities.
- Description of the site.– Geographical location of the nursery, surface occupied by the nursery and its complementary areas, and description of the artificial structures of the nursery.
- Specific objectives.– Description of the specific activities the nursery will undertake.
- Regulations for visitors
- Zoning of the nursery.- Each area of the nursery must be well defined (i.e., storage area, greenhouses or shade houses, laboratory, etc.)
- Guidelines for area management.- Description of the regulations for use of each area and rules for visitor control.
- Guidelines for the harvest of cultivated species and description of the management of species to be cultivated.
- Annexes.- Photographs of the facilities, identification sheets for each species, zoning map, species inventory, research project supporting the harvest of vegetative material from the wild; any parental stock in cultivation must be supported by the following:

1. Verification of the scientific names of the plants, for which 3 individuals of each species should be collected in a botanical expedition if possible, or at least 2 duplicates of each species for identification in herbaria of Ecuador; one duplicate must be deposited in the National Herbarium, a second duplicate must be deposited in the nursery, and a third duplicate must be sent on loan to a herbarium, where foreign experts can identify it.
2. After the plant's name is verified abroad, the duplicate must be returned to its country of origin to become part of the collection of the herbarium that started the procedure.
3. All the samples used in identification must be fertile, that is, the sample collected must contain flowers and also flowers preserved in alcohol so that they can be dried and taxonomically identified at a later stage.
4. When collecting plants, nurserymen must record the following data in a field journal: date; area (province, county, town); name of collector and accompanying persons; short description of the life zone, data on the substrate where the sample was found; elevation; geographical coordinates when possible to have exact data on the habitat of the sample, sample number; all these data should be recorded in the label accompanying the sample; the label and the dry sample should be attached to a board and included in the collection of the Natural Science Museum – Botanical Section of Ecuador.
5. Once identification is completed, each species in the nursery will have a number or code that will facilitate management of the species and the number of duplicates or plants of that species produced in the nursery.
6. Assigning a number to each species contributes to easier inventories of the species in the nursery and helps in verification and marketing processes. It is therefore important to have a coding system for nursery species to obtain real and updated data on the stock for sale and parental stock in cultivation for registration of the nursery with the CITES Secretariat.

To apply the definitions in CITES, it is necessary to verify the legal origin of the collection in the nursery, propagation issues and the non detrimental harvest of specimens; therefore, to increase the parental stock of a nursery, a scientific study must be undertaken, which implies submitting a project and obtaining a research permit. This is the only way to justify the harvest of specimens from the wild. Few specimens should be collected —a maximum of 3 duplicates— in order not to jeopardize the survival of the species in the wild.

However, export quotas for orchids from Ecuador are set by reviewing the production stocks in nurseries.

3.3. Legal and illegal trade levels:

Levels of trade of orchids from Ecuador are currently legal on an international level, as each nursery has an updated management authorization resulting from the latest verification of the management plan and the review of the export stocks. Export quotas for a species are only accepted if, upon verification of the stock, the stock exceeds the quota by at least 10%; for species whose stock is lower than the quota requested, the verified stock is reduced by 10%, considering a minimum number of 50 individuals, as 99% of the quotas exceed 100 units.

In the case of the species of our case study, for example:

Phragmipedium fischeri Requested quota = 400
Verified stock = 400
Approved quota = 360 (10% reduction)

Dracula sodiroi Requested quota = 200
Verified stock = 200
Approved quota = 180 (10% reduction).

This measure must be adopted because any nursery needs to keep at least 10% of its production to use as propagation material, stock for exhibitions, etc.

In the review of the stock to assess the quotas requested, the types of propagation were also reviewed for all the species listed by the company.

II. Non-detriment finding procedure (NDFs)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFs?

__yes _X__no

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

Information to make a non-detriment finding of a parental stock of orchids is not available yet. However, based on the experience of working with epiphytes, the following should be considered: field plot – survey method, which would be the transect matrix, recording the species number, elevation, genus, presence of flowers, fruits, cumulative number or frequency, collection number. Abundance should be determined in different provinces, both in protected areas and in areas subject to human disturbance. A comparative analysis of abundance and

diversity of the wild populations of epiphytes can also be made, analyzing the conservation status and habitat preferences, ecology and population dynamics of orchid species of Ecuador.

To set export quotas, files and documents on exports from the beginning until the monitoring period are reviewed, as well as documents justifying the activities of the nursery from the outset, such as: authorizations, exports made and collection permits for parental stock as follows:

a) Parental stock, in nurseries and the laboratory

To verify the number of species, all the native parent species and hybrids were counted, as well as the species in nurseries and species propagated in the laboratory, with the help of the company inventory. The sampling was random according to the parameters of Appendices I and II; maximum and minimum plant production volumes, categories of the Red Book of Species of Ecuador such as: endemic, vulnerable to disappearing, endangered, near threatened, and extinct in the wild.

To verify the propagation methods for plants in the laboratory and the nurseries, the species reproduced were observed and compared to the nursery inventories.

b) Stock of plants for export

To confirm the stock destined for export relative to the production in the laboratory and the nurseries, all the Appendix I and II listed species were counted according to maximum and minimum production levels, also considering the categories of the Red Book of Species of Ecuador such as endemic, vulnerable to disappearing, endangered, near threatened, and extinct in the wild.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION, SAMPLING METHODOLOGIES AND ANALYSIS USED

The distribution of *Phragmipedium fischeri* and *Dracula sodiroi* is uneven. We selected the 50 m x 20 m plots of El Carchi province and the data from the review of the samples recorded in the major herbaria of the country, such as the National Herbarium of Ecuador (QCNE) and the Herbarium of the *Universidad Católica del Ecuador* (QCA); the data show that *Phragmipedium fischeri* has only been collected in the Maldonado area, in the north of the country. The decline of the forests where it occurs suggests that the species is currently endangered.

The species *Dracula sodiroi*, however, is abundant in the north east of the Andes, where it grows in primary forest with an epiphytic habit and on roadsides with a terrestrial habit. The first record was taken in 1900, and the last one was taken in 2000.

SPECIES PROPAGATED IN THE LABORATORY, PARENTAL STOCK AND SPECIES IN NURSERIES.
This nursery has a production section devoted to the maintenance and management of plants, mostly orchids. To expedite the process, the review began in the laboratory.

LABORATORY
It is used to propagate plants in vitro for conservation purposes, to trade in native species, endemic species and hybrids from the wild, and to import species.

The propagation of orchids requires specific state of the art technology and a very thorough selection and care of the parent plants. The parent plants are pollinated to produce seed and go through several growth stages in adequate culture media for their development.

Information about the lab was provided in electronic format and hard copy, which helped verify the existing flasks:

a) It had 21 shelves containing 3435 flasks with 326 species.
b) We randomly counted 173 species, which represents 53 %. Of these species, 19 were unidentified, which represents 5%.
c) We found 24 contaminated flasks, which amounts to 0.7%. Contamination was very low.

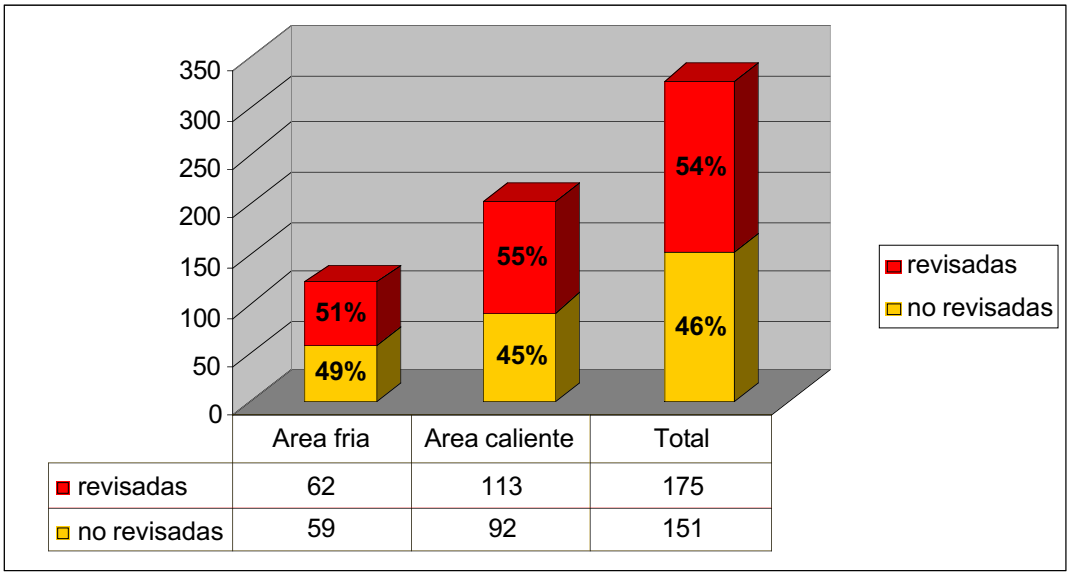
The following table is a summary of production in the laboratory.

Table No. 2
Species propagated in the laboratory

AMOUNT	WARM AREA	COLD AREA	TOTAL
Number of shelves	15	6	21
Number of flasks	3060	375	3435
Number of species	113	62	175
Species sp.	16	3	19
Contaminated species	19	5	24
Total species	205	121	326
Percentage reviewed	54%	51%	96%

Source: Report by Evert Salvador

Chart No. 2: Laboratory



	Area fria	Area caliente	Total
revisadas	62	113	175
no revisadas	59	92	151

Translation of the text in the chart: Revisadas: reviewed; no revisadas: not reviewed; area fria: cold area; area caliente: warm area;

We reviewed 175 species out of 326, which amounts to 54%. This was done randomly, based on the Appendix I parameters, minimum sales of 50-500 plants, and sales of more than 1000 plants, as shown in chart No. 1.

A review of the shelves showed that each flask is labeled.

Flasking

This is the stage where the flasked seedlings are taken to the No. 1 area in the greenhouse, where the lighting conditions are not controlled. Temperature and moisture. We counted 137 flasks on shelf No. 11 of Levels D, E, and F of the laboratory propagation matrix, which represents 61% of the flasks of the levels in this area.

Out of 22 species, we counted 11 species, 7 of which are listed in Appendix I. The sampling represents 50%.

When the seeds and tissues have germinated and developed – that is, when leaf primordia are present – the plants enter the following stage, called transplantation or growth.

Transplant area

This is the area where the seedlings are transplanted into trays with 20, 50 or 100 divisions. We counted the species of greenhouses Nos. 3, 13 and 16, which contain the seedlings that will later be transplanted into individual pots depending on their development.

The sampling was made using the list provided by the nursery. We reviewed the species present in highest numbers in the trays in each of the tables of greenhouses Nos. 3, 13 and 16, with the following results:

Table No. 3. Species growing in trays

AMOUNT	**Greenhouse** No. 3	**Greenhouse** No. 13	**Greenhouse** No. 16	**Total stock** I= 3, 13, 16	**%** reviewed
Species reviewed	33	36	76	145	49.82 %
Species inventoried	46	62	183	291	50.17 %

PARENT PLANTS

Greenhouses 9, 14 and 16 are devoted to the maintenance and care of orchid parent plants; they contain the first plants collected from the wild and species imported from abroad in the case of hybrids.

On average, there are 3 individuals of each parent plant. Parent plants are grouped depending on the conditions required for their proper development. Greenhouse No. 16 is mentioned in two sections for this reason.

To review the species held in the nursery, we requested a list of the plants. We verified the existence of parent plant species and individuals.

We counted 929 species in greenhouses Nos. 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 16, 17, 18, 19, 20, and 21, which amounts to 55.46 % of the 1675 species listed by the nursery.

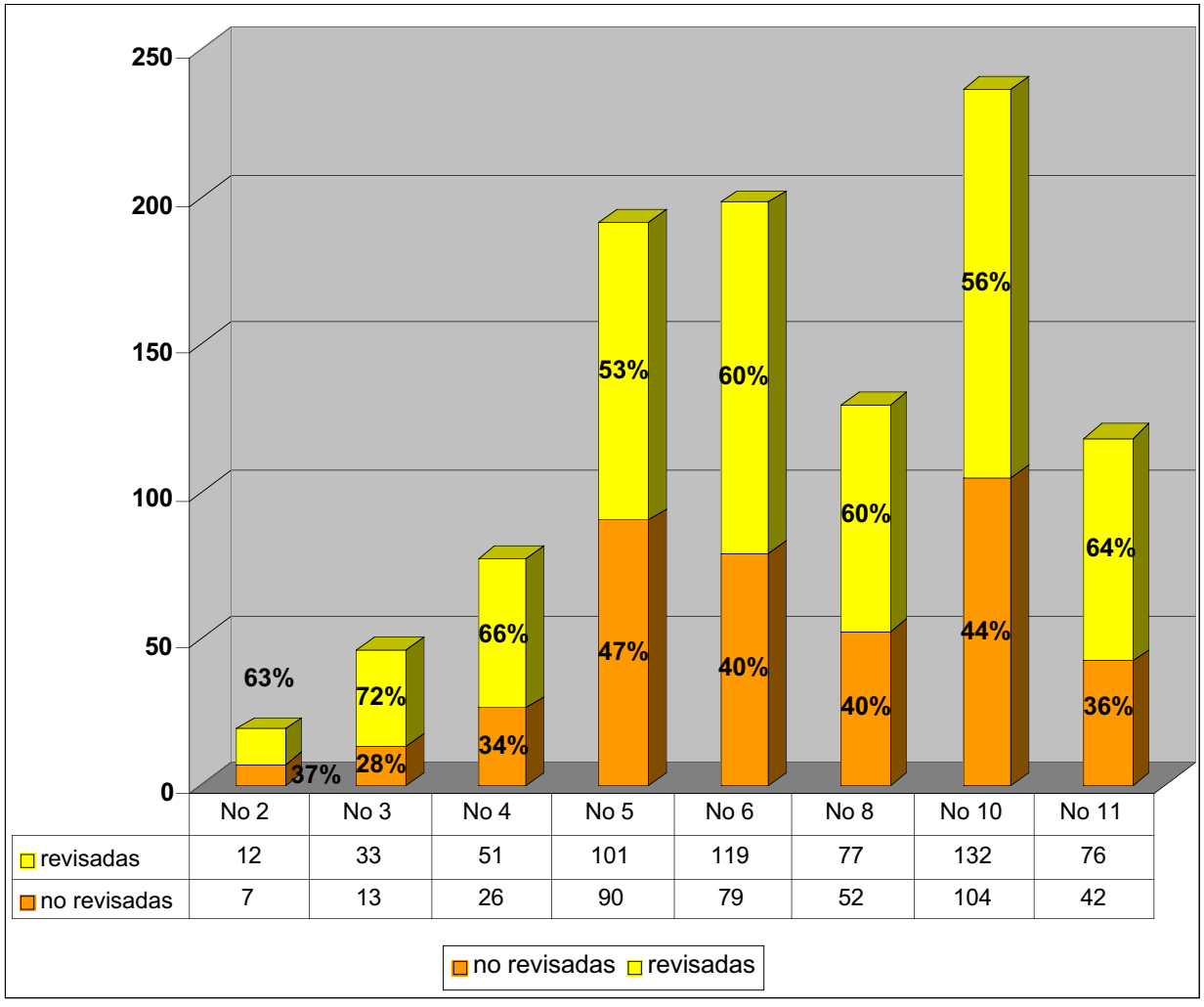
Table No. 4. Summary of the species for each greenhouse

Greenhouse number	**Species inventoried**	**Species verified**
Greenhouse 2	19 species	12 sp.
Greenhouse 3	46 species	33 sp.
Greenhouse 4	77 species	51 sp.
Greenhouse 5	191 species	101 sp.
Greenhouse 6	198 species	119 sp.
Greenhouse 8	129 species	77 sp.
Greenhouse 10	236 species	132 sp.
Greenhouse 11	118 species	76 sp.
Greenhouse 12	46 species	24 sp.
Greenhouse 13	62 species	36 sp.
Greenhouse 16	183 species	76 sp.
Greenhouse 17	72 species	21 sp.
Greenhouse 18	93 species	47 sp.
Greenhouse 19	162 species	93 sp.
Greenhouse 20	21 species	16 sp.
Greenhouse 21	22 species	15 sp.

It is important to mention that Greenhouse No. 1 is not included in this analysis because it contains mixed and acclimatization trays. Greenhouse No. 7 is known as 'the jungle' because the plants in it are not controlled or identified with codes; Greenhouse 9 contains parent plants; Greenhouse 14 contains special plants with different and unusual characteristics; Greenhouse 15 has mixed and individual trays.

The following chart shows the percentages reviewed:

Chart No. 3: Greenhouses Nos. 2 - 11



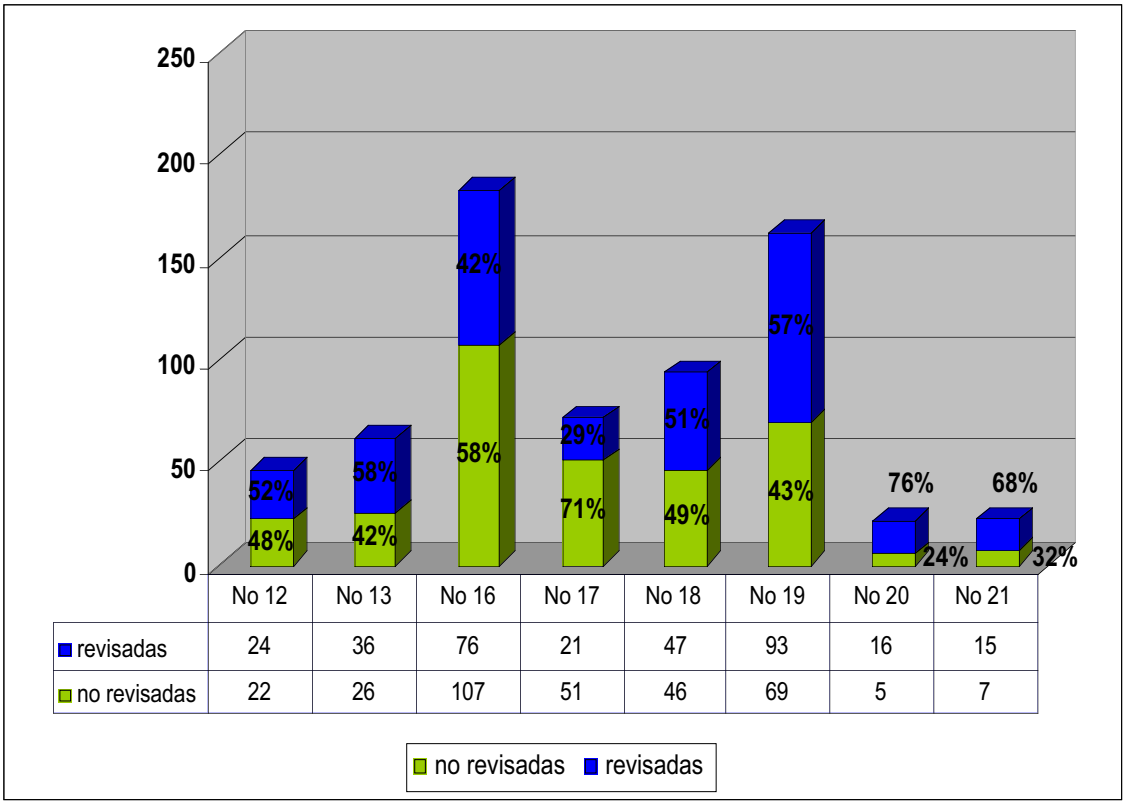
	No 2	No 3	No 4	No 5	No 6	No 8	No 10	No 11
revisadas	12	33	51	101	119	77	132	76
no revisadas	7	13	26	90	79	52	104	42

Translation of the text in the chart: Revisadas: reviewed; no revisadas: not reviewed

Analysis: the chart shows a progressive increase in the number of species in Greenhouses 2, 3, 4, 5, 6, 8, 10 and 11. This is because not all the greenhouses contain native species, and some are used to cultivate hybrids. Greenhouse 1 is not included in this analysis because it has

mixed trays and acclimatization trays; Greenhouse 7 is 'the jungle,' and Greenhouse 9 contains parent plants. These greenhouses are included in other types of review and shown in other charts.

Chart No. 4: Greenhouses Nos. 12 - 21



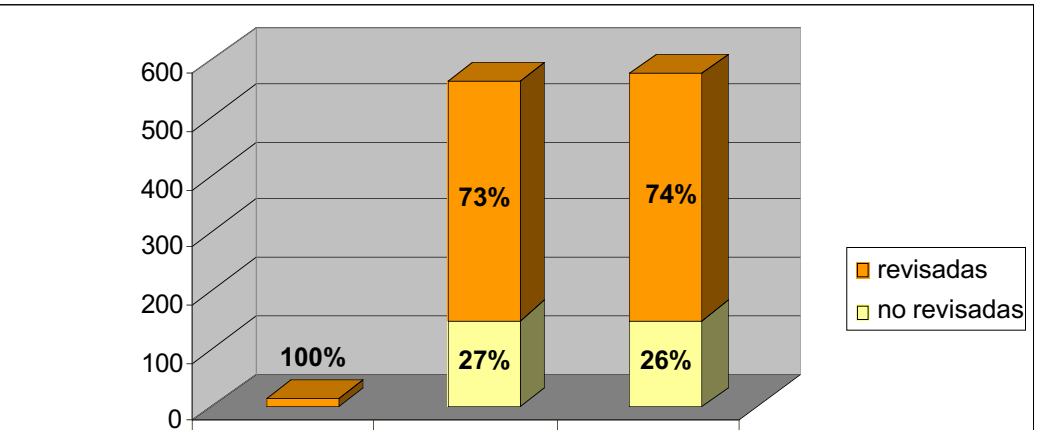
	No 12	No 13	No 16	No 17	No 18	No 19	No 20	No 21
revisadas	24	36	76	21	47	93	16	15
no revisadas	22	26	107	51	46	69	5	7

Analysis: Greenhouses 20 and 21 contained more native and endemic species and fewer individuals. This is the reason why the sampling is greater than in Greenhouses 12,13,16,17,18,19,20 and 21. Greenhouses 14 and 15 were not included in the analysis because they contain special plants and mixed and individual trays respectively.

Greenhouses in El Pangui

- We used a list supplied by the nursery to review the greenhouses and verify all the species present. We counted all the specimens found on the tables of the respective greenhouses and recorded them in the worksheets.
- In El Pangui we reviewed 411 species out of 563 species inventoried, which amounts to 73%.

Chart No. 5: Greenhouses in Guayaquil – El Pangui



	Guayaquil	Pangui	Total
revisadas	14	411	425
no revisadas	0	152	152

The chart shows that 14 species (100%) were verified in Guayaquil, all hybrids. In El Pangui, 411 species were randomly sampled, considering endemism, Appendix I listing and the categories of the Red Book of Endangered Species of Ecuador. This represents 73% of the species present.

Greenhouses in Guayaquil
We used a list supplied by the nursery to review the greenhouses in Guayaquil and verify all the hybrids in cultivation. We counted 14 species (100%), with 56,592 plants.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

Stock of plants for export

- As regards Appendix-I listed orchids, we verified 100% of the production and stock for export.
- In Appendix-II listed species, production is 80% successful. We counted the species and all the individuals in the greenhouses according to the verification parameters.

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

- There is no follow-up of studies of orchids of the Andes; no other permanent plots have been established either to study habitat preferences, ecology and population dynamics of orchid species of Ecuador.

- No quantitative data are available on the distribution and abundance of most species of native orchids. Data are only available on the diversity and distribution of the 1318 endemic species and 62 species of the studies on orchids in the Andes.
- Although the conservation status of the 1318 species of endemic orchids is known, no species were considered extinct according to the IUCN Red List, because there is no real evidence of their extinction. However, this does exclude the possibility that local extinctions have taken place, particularly in species growing in very fragmented sites such as riversides on the Coast, the Sierra and the Amazon in Ecuador.
- In the data verification process undertaken to review the export quotas, we found fewer individuals than those requested for export. This was because the plants missing were in the laboratory and physically distributed in different greenhouses. As a result, we reduced the export quota, as the information was not totally truthful. Annex No. 8.1. contains the list of quotas requested.
- Out of 2275 species for which export quotas were requested, we verified 1529 species randomly, which amounts to 67%. In some cases, the stock volume of the nursery did not match the inventory of the greenhouse, because the nurserymen did not have software to update the list of sold volumes, available stocks and mortality indices.
- The laboratory should have a more comprehensive matrix to monitor the planting to include pollution and mortality values. This would lead to more accurate information about how many seedlings are produced and survive acclimatization and transplant.
- No quantitative information is available on the current status of wild populations of lowland orchids, as no studies have been undertaken on these species. The non-detriment finding has been made on the basis of data for highland species.

6. RECOMMENDATIONS

- Annual monitoring is necessary in the permanent plots from which the value of the non-detriment finding was obtained to determine the current state of the habitat and the tolerance of the species to disturbances and horticultural demand.
- Plants in the wild should be labeled in a distinctive way; this also applies to parent plants and native and hybrid cultivated plants in the nursery so that the species can be periodically monitored to determine their conservation status.
- Monitoring matrices including monitoring dates, mortality, transplantation and pollination should be used in permanent plots and nurseries,

- To confirm the stock destined for export relative to the production of the laboratory and the nursery, all the Appendix I and II species should be calculated randomly or according to maximum and minimum production volumes, considering the IUCN categories and the Red Book of Species of Ecuador such as: endemic, vulnerable to disappearing, endangered, near threatened, and extinct in the wild.
- The nursery's databases should be updated to prevent a waste of time and confusion when plant stocks are verified.
- Specimens labeled as "sp." should be monitored so that they can be properly identified and do not remain isolated in the nursery's greenhouse.
- A reforestation program should be set up to introduce plants into protected areas. A monitoring plan should also be established at the same time to obtain information about the plants' adaptation.

REFERENCES

ARSINIEGAS, M. 2008. Mapa de Areas Protegidas del Ecuador. Sistemas de Información CIAM.

DODSON, C. & R. Escobar. 1994. Orquídeas Nativas del Ecuador. Volumen 1. Primera edición. Editorial Colina. Medellin. pp 11-20.

DODSON,C. & P. Marmol. 1989. Orchids of Ecuador: Icones Plantarum Tropicarum Missouri Botanical Garden. Serie II fascicle 5-6.

ENDARA, L. 2008. Familia Orchidaceae. 257-372 en: Valencia, R., N. Pitman, S. León – Yánez & P.M. Jorgensen (eds). Libro rojo de las plantas endémicas del Ecuador 2008. Publicaciones del herbario QCA, Pontificia Universidad Católica del Ecuador, Quito. In press.

ENDARA, L. 2000. Familia Orchidaceae. 257-372 en: Valencia, R., N. Pitman, S. León – Yánez & P.M. Jorgensen (eds). Libro rojo de las plantas endémicas del Ecuador 2000. Publicaciones del herbario QCA, Pontificia Universidad Católica del Ecuador, Quito.

FREIRE, E. 2000. Diversidad y Composición Florística de la Reserva Orquideológica Pahuma. Tesis de Doctor en Biología. Escuela de Biología de la Universidad Central, Quito.

M. MITES. 2001. Diversidad y Taxonomia de Orquídeas en la Provincia del Carchi. Tesis de Doctor en Biología. Escuela de Biología de la Universidad Central, Quito – Ecuador.

MITES. M & P. Galiano. 2006. Informe Peritaje de Viveros y Reservas de la Empresa Orquídeas Del Ecuador. Archivo Ministerio del Ambiente del Ecuador.