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An Integrated Approach to Orchid Conservation in Colombia: What Do Orchids, Hummingbirds, Bears, Potable Water, and Indigenous Land Rights Have in Common?

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Abstract. The conservation of native orchids in Colombia represents a major challenge because of the high diversity of species, the peculiarities of their distributions, and the threats they face. Three elements of an integrated strategy for the conservation of orchids need to be addressed: (1) generation and socialization of significant knowledge through research and education; (2) support for habitat protection and management; and (3) promotion of sustainable uses of orchids both inside protected areas and outside of them. Such a strategy must answer three fundamental questions: Where should efforts be concentrated both for conservation of species as well as habitats? What actions should be taken to promote their conservation? And who should advance these conservation actions? The presentation reported on environmental education, research programs, and efforts to strengthen local institutional capacity as needed tools in promoting orchid conservation.

Key words: habitat protection, sustainable uses, habitat management

Introduction

H.L. Mencken stated, "For any problem, there is always a simple, direct, and often-times wrong solution." The loss of biological diversity may be perceived as a problem for which the simple solution of freezing habitat use through park establishment might be a reasonable option. The complexity of this problem, however, demands an integral approach of sufficient complexity to provide adequate attention to the socioeconomic, cultural, and environmental dimensions of the problem. The Convention on Biological Diversity (UNCED 1992) defined a strategy that includes critical elements for the solution of the problem of disappearing diversity. CBD recommends application of the ecosystem approach, which channels conservation efforts in the mainstream of human activities (Hamilton 2004, Table 1).

In Colombia, it is painful to see that precisely the areas with the highest levels of biological diversity coincide with regions of extreme poverty, where most of the population exhibits unsatisfied human needs in all parameters of human well-being. This situation also applies in most tropical countries, where a major portion of the world's biodiversity resides. The critical question is how to advance conservation of biodiversity in developing nations, where poverty levels reach 40%, unemployment affects 20–30% of the population, land tenure is poor and markedly insecure, and deforestation advances at alarming rates. The situation in Colombia is complicated by a series of other issues, such as illegal coca crops, corruption, and the violence that results from attempts to control the highly profitable illegal coca trade (Cavelier & Etter 1995).

Strong economic as well as moral reasons exist for conserving biodiversity—the natural capital with which society has to satisfy basic human needs and aspirations and secure a safe livelihood. Without appropriate levels of development, it is difficult for nations to achieve the goals of biodiversity conservation; and without conservation of the natural capital, sustainable human development is impossible.

The purpose of this presentation is to show that an ecosystem approach improves the likelihood of making progress in conserving the orchids of Colombia. When local people become stakeholders in conservation and development programs, their interest can be maintained, and the programs may have a chance to become sustainable.

Orchids as Indicators of Environmental Quality

Within the borders of Colombia, it is possible to find at least 2899 orchid species (C. Dodson unpubl. data) or ca. 10–12% of the total global number of species of Orchidaceae. The orchid family is estimated to have 20,000–35,000 species (Gentry & Dodson 1987, Ospina-Hernández & Dressler 1974). Within this elevated number, Colombia ranks as one of the richest countries

TABLE 1. Summary of the ecosystem approach to the conservation of orchids of Colombia, based on the United Nations Convention on Biological Diversity (CBD).

CBD objectives	CBD goals	Indicators in Colombia
Conservation	To improve the knowledge base for orchids and develop an information system for the study and evaluation of orchid species and habitats.	Increased quantity and quality of research on orchids. Establish data banks for Colombian orchids with increased cooperation with species identification.
	To advance in-situ and ex-situ conservation and restoration projects to improve protection of the orchid flora on a biogeographic scale.	Key areas for orchid conservation and restoration identified in urban and rural landscapes. Conservation of orchids promoted especially in national parks and private lands, but also in indigenous territories and public lands, in botanical gardens, seed banks and private growers and collectors.
	To establish communication and environmental education programs to increase public awareness and appreciation of orchids and the need to conserve species and habitats.	Increased level of public appreciation of aesthetic, economic, and ecological values of orchids.
	To improve integrated planning and management of ecosystems (landscapes, water and living resources) with community participation.	Increased efficiency in planning and management throughout the country but especially in parks, indigenous territories, watersheds, and private lands.
Sustainable use of species and ecosystems	To promote cooperative productive projects (bioproduction of orchids and other plant and animal species)	Increased knowledge of economic uses of orchids. Identification of promising orchid species (endangered and economically important) for production.
	To establish ecotourism and recreational programs for orchids and other species with sociocultural elements.	Ecotourism promotions that integrate natural and cultural assets with communities as true partners. Strengthened local organizations, which could become partners in ecotourism and nature conservation projects.
	To establish control of illegal trade of orchids and other species.	Well-trained professional- and technical-level personnel to control illegal trade of species.
Equitable benefit-sharing	To strengthen local organizations and enhance the capacity to manage ecosystem programs.	Well-trained personnel of local organizations and communities capable of planning, implementing, and evaluating projects.
	To establish community development programs as part of every project with mechanisms to share control of projects with local organizations and communities.	Opportunities realized for joint participation may include secure land tenure for indigenous communities, potable water, vaccination, public education, laboratories and materials, ethnoeducation, sustainable agriculture, socioeconomic small projects, etc.
	To establish protocols for approval of projects after concertation process with local organizations.	Clearly defined processes of ownership and control of projects. Beneficial insurance with credits to be received by appropriate institutions and organizations.
	To establish mechanisms that will insure the sustainability of projects.	Strengthened local organizations and networks for implementing strategies and projects. Increased level of international cooperation and support in terms of human, technical, and financial resources.

in orchid species (Dressler 1981, IUCN/SSC 1996). Orchids are present in almost all biomes or biotic districts of Colombia, and their presence highlights all vegetated landscapes of the country, including desert regions, mangroves, tropical savannas, dry and wet forests of tropical lowlands, Andean slopes, and the páramo (Ortiz-Valdivieso 1976). Gentry and Dodson (1987) introduced the term "species swarms" and pointed out that areas of exceptional concentration of species can be regarded as priority areas for conservation.

In general terms, a correlation exists between the number of species that live in a given region and the level of humidity of the area (Gentry & Dodson 1987, Gentry 1991). This tendency suggests that the zones of Colombia with the greatest orchid species richness should be found in the mid levels of the Andean slopes, in the regions of the Choco/Andes, in the Amazonia/Andes, in the slopes of inter-Andean valleys, along the wet slopes of the Sierra Nevada of Santa Marta, and in the high Andes. This suggestion has been corroborated by Ortiz-Valdivieso (1976), Ospina-Hernández (1996), and Escobar (1990–1998). As an example, on the Pacific slope of the Western Andes in the Department of Nariño, 420 morphospecies of orchids were reported in La Planada Nature Reserve, in an area of only 30 km^2, which constitutes 12% of the orchid species presumed to occur in Colombia (Orejuela 2002). From Tumaco on the coast of Nariño to the slopes of the Chiles and Cumbal snow-capped volcanoes, it is possible to find well over 700 orchid species. In the Nudo de los Pastos, Gentry and Dodson (1987) found 16 species of the genus *Telipogon* coexisting, six of them endemics for the area, and all related through accelerated microspeciation processes. Continuing from Pasto, Nariño's capital city in the highlands, to the Putumayo Department capital city of Mocoa, well in the tropical lowlands, it is possible to find 500–600 additional orchid species. In the transect between the Pacific lowlands across the Andes of Nariño and Putumayo to the Amazonian lowlands, the total number of species may be 1100–1300 species (30–40% of all orchid species thought to occur in Colombia).

This exceptional species richness is organized according to altitudinal and vegetational zones. Each altitude appears to have a particular group of species, which are replaced as one moves another "step" and so on for some six to seven steps. The overall effect may be called "the biodiversity stepladder," in which the cumulative number of species of both Andean slopes and the adjacent tropical lowlands may vary between a third and a half of the Colombian orchid species.

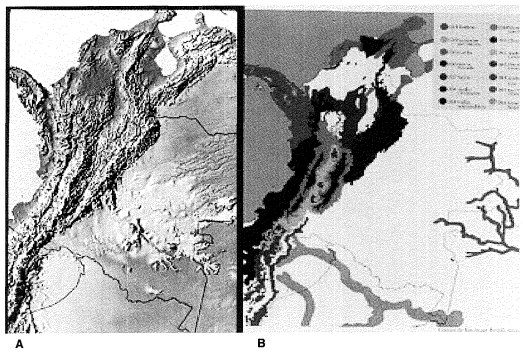
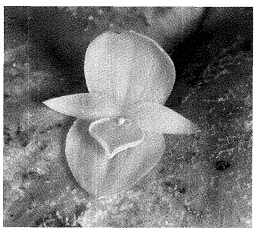


FIGURE 1. Orchid and bird areas of Colombia. **A.** Endemic orchid areas, 2004. **B.** Proposed endemic bird areas (Stattersfield et al. 1997). Courtesy BirdLife International.

The endemic bird areas postulated by Stattersfield et al. (1997) coincide with the areas of biotic endemisms postulated for Colombia by Hernández-Camacho et al. (1992). The orchid species described thus far for Colombia fit rather well with the patterns described for birds (FIGURE 1). Ortiz-Valdivieso (1976) described 243 species, 83 (34%) of which have restricted geographical distributions. Although this sample is not representative of the Colombian orchid flora, a particularly high level of endemism is apparent, especially in the Andean region. Taking these restricted range species as endemics, it was possible to define regions of high concentration of endemic species as Endemic Orchid Areas. The main centers of endemism for Colombia are the Chocó, the Pacific slope of the Western Andes, Central Andes, Northern Eastern Andes, Southern Eastern Andes (Amazonian slope), slopes of the inter-Andean valleys, and the Sierra Nevada of Santa Marta. Different groups of species become characteristic and distinctive elements of the Endemic Orchid Areas (Gentry 1991, Wolf 1991). These species are then defined as Biological Indicator Species of great importance for biodiversity conservation. Some of these species are listed as indicative of the corresponding Endemic Areas (FIGURE 2, APPENDIX 1).

Biodiversity and Sustainable Development

In the few regions where biological inventories have been conducted, high numbers of orchid species and endemisms have been found. These regions also display a large degree of congruence in the biodiversity and singularity of other groups of organisms (FIGURE 3). This is particularly true for most vascular plant groups



A

B

FIGURE 2. Examples of orchid species from the cloud forests of southwestern Colombia. **A.** *Pleurothallis* cf. *titan.* **B.** *Dichaea* cf. *undulifolia.* Photos by J. Orejuela.

A

B

FIGURE 3. Charismatic animal and plant species that share ecosystems with orchids in Colombia. **A.** Spectacled bear (*Tremarctos ornatus*). **B.** Oso de Anteojos hábitat.

and for terrestrial vertebrates and several insect groups, particularly butterflies both diurnal and nocturnal. In many areas, the forest ecosystems found to be rich in biodiversity were the home of indigenous human populations, who managed the ecosystem in a sustainable way, developing unique methods for appropriating resources and building strong cultures. The forest and river ecosystems provide sources of materials valuable to distinct ethnic groups, who hold the secrets to the sustainable use of species and habitats. Many regions with high overall species diversity perform essential ecosystem functions, such as water and soil protection; and a number of these regions are reasonably close to major population centers, where these ecosystem benefits are critical for the well-being of human populations.

The economic potential for the sustainable utilization of species and ecosystems may be high. Beyond the variety and beauty of the country's landscapes and the diversity of the species and habitats is an unrealized potential for socioeconomic development.

METHODS: A PRAGMATIC CONSERVATION STRATEGY

An integrated orchid conservation strategy for Colombia must answer adequately several fundamental questions: What can be done to protect the species and their habitats? Where must conservation efforts be directed? How should conservation efforts be advanced? Who should participate in conservation efforts?

Orchid Protection

The three interrelated major objectives of the Convention on Biological Diversity—conservation, sustainable use, and equitable benefit sharing—define the framework for action, if we are to meet the goal of orchid conservation.

Conservation

Generally accepted on a global basis is the effectiveness of promoting the conservation of species and habitats through establishment of protected areas or a system of special management areas. In such areas, the protection of species and habitats can be coupled with the promotion of appropriate development processes (Miller 1980, MacKinnon et al. 1986, McNeely et al. 1990). The Convention on Biological Diversity (UNCED 1992) and the CBD Global Strategy for Plant Conservation (CBD 2002) recommend that each nation develop a national system of protected areas or special management areas with complete representation of the overall diversity, both in terms of species and biotic provinces. The Colombian Ministry of the Environment, in 1998, directed that such a National System include particularities in the distribution and evolution of the most characteristic species. With regard to orchids, the system should include endemic orchids and also should satisfy the needs of species with large and disjunctive distributions.

Improving the knowledge base for the orchids of Colombia is an urgent need. Compared to neighboring countries, especially Ecuador, Colombia has had few specialists devoted to the study of orchid distribution and natural history. Because Colombia lags behind in knowledge of its orchid species, advancement of a conservation strategy has been limited. Actions that need to be undertaken include increased quantity and quality of research. Establishing databanks for Colombian orchids with solid international cooperation needs to be a priority.

In-situ conservation requires identification of key areas for orchid conservation and restoration in urban and rural areas, especially in national parks, reserves, and private lands but also in indigenous territories, in botanical gardens, and in private collections. Of particular interest are efforts being made to propagate species whose

populations have been drastically reduced by excessive collecting (legal and illegal) in their natural areas. When propagation protocols are followed to maximize genetic variability of orchid species, promoting repopulation processes in protected areas becomes possible.

Establishing communication and environmental education programs will increase the level of aesthetic, economic, and ecological appreciation of orchid species and the need to conserve them.

Principle I of the Convention on Biological Diversity states that management of land, water, and living resources is a matter of societal choice. The rights and interests of indigenous people and other local communities to manage ecosystems for their intrinsic values and for human benefits needs to be insured by improving participatory planning and management processes.

Sustainable Use

Sustainable use of the components of biological diversity maintains the potential of natural resources to meet the needs and aspirations of present and future generations. In terms of orchid conservation, the ecosystem approach is critical to help meet this demand.

The use of orchids and of other species that share their habitat to establish productive projects, be they for direct consumption or for sale in markets, requires increased knowledge about the economic uses of orchids and companion species. Promising orchids for ornamental purposes and for the conservation of endangered species need to be identified.

Most regions of Colombia rich in orchid species usually share high numbers of other species, such as bromeliads and anthuriums, birds and butterflies, as well as cultural assets, such as human settlements with traditional cultivation and living systems. Cultural and environmental assets of a region can be promoted in ways that benefit communities and local people, such as by means of ecotourism, recreation, and even educational and research enterprises. Ideally these activities need not decrease the quality of cultural heritage.

The quality of environmental assets must be protected from illegal trade of plant and animal species and deterioration of the landscape. Government agencies need to take an active role in control activities, but participation by local communities will help achieve these goals.

Equitable Benefit-Sharing

Frequently, this CBD objective is overlooked or dealt little consideration, yet it is one of fundamental importance, because sustainability projects depend on implementation of equitable benefit sharing. One critical aspect is the effective participation of local communities and organizations in the planning, implementation, and evaluation processes of projects. The long-term success of CBD projects depends on the inclusion of diverse and well-trained personnel of various organizations and community sectors.

Successful efforts require building strong organizations capable of assuming the leadership, ownership, and control of CBD projects. Strengthened local organizations can become effective development partners capable of channeling national and international cooperation to their communities and regions.

When local communities are represented by diverse organizations, integrated development schemes become feasible, with local organizations sharing control of topics as diverse as secure land tenure, cultural autonomy and reaffirmation, health, education, welfare, sustainable agriculture, political economy, and a better integration with neighboring communities through networks of effective cooperation and support.

Selecting Conservation Sites

The goal of conserving orchid species and their companion species requires consideration of the entire country. Early implementation of a conservation strategy, however, depends on special attention to areas particularly rich in species and in endemism. The appropriate selection of conservation units requires special attention and can be assisted by a practical system of criteria such as that suggested by Van Velzen (1992).

Biological Criteria

The protection of a community rich in species with high levels of endemism is desirable, and Colombia has several conservation "hot spots" that should be assigned priority.

Vulnerability Criteria

Threats to plant species and their habitats and the imminence and/or severity of perturbations need to be considered. Those areas under imminent human pressure but virtually intact need to receive priority attention.

Feasibility of Management Criteria

A conservation strategy needs to consider the utility of the area for recreation, education, research, and environmental services, such as protection of watersheds, soil, and landscapes.

Priority Areas in Colombia

The present protected area system of Colombia has 48 units that cover ca. 9% of the national

territory (Sanchez et al. 1990). These areas are outstanding but insufficient to adequately protect orchid species and their ecosystems. Amazonia is perhaps the region with the best coverage of protected areas, which are complemented by indigenous territories. Outside this macro-region, most other areas of the country lack representation in the system. For example, the Andean region has a good number of protected areas, but they are not sufficiently large and also lack altitudinal amplitude. The greatest concentrations of species both in terms of numbers as well as singularities are found in the subtropical (premontane) and temperate (montane) regions, rather than in Amazonia. The Pacific region has few protected areas in relation to its high diversity and elevated number of endemisms. The dry regions of the country remain virtually without representation in the system. The same situation is valid for the Orinoquian region, which has only one national park.

All the Biotic Endemism Areas (Hernández-Camaacho et al. 1992) contain a solid representation of orchids. The major centers of avian endemism (Stattersfield et al. 1997), which coincide with areas rich in orchid species, include the following strategic macro-regions: Andean Choco and Pacific slopes of the Andes, Andean Amazon and Amazonian slopes of the Andes, Central Andes, Eastern Andes (north and south), Sierra Nevada of Santa Marta, Inter-Andean valleys and adjacent Andean slopes, and dry forest formations.

In several areas, the most representative species are orchids. For example in the Sierra Nevada of Santa Marta, a fifth of the orchid species described are endemics. In the northern Eastern Andes, Escobar (1983) found 47 species of orchids of the genus *Masdevallia,* of which 20 were endemics; and in the Pacific slope of the Western Andes, ca. 80–100 species may turn out to be endemics; many of these undoubtedly will be species new to science (Orejuela 2002). In the geographical range of the postulated Endangered Orchid Areas (EOAs), many new areas can be identified for inclusion in the national, regional, municipal, and private network of nature reserves.

Endemic species may be relatively abundant in their habitats, even when these areas are small. Frequently, endemics are found in forest fragments on isolated mountaintops, in dry forest enclaves, and on high Andean plateaus; oftentimes they have discontinuous distributions. A high number of endemics are distributed in the complex mosaic of habitats of the Andean region (Escobar 1983). Since many areas rich in orchids are outside the park and reserve system, conservation efforts need to be considered for other protected area categories, such as indigenous territories, protected watersheds, private reserves, and buffer zones of national parks.

This study recommends a strategy that considers the establishment of a system with a few large reserves along with many small private nature reserves. For the conservation of orchids with large geographical distributions, usually shared with several animal and plant taxa, the strategy of a few large national parks with ample altitudinal ranges should be supplemented with protected watersheds and territories of traditional communities. This system should place special emphasis on interconnecting forested fragments in the conservation units through the designation of ecological corridors, be they horizontal (along the main axis of the Andean ranges, or vertical, following the dendritic patterns of major watersheds.

How to Succeed in This Enterprise

The ecosystem approach to sustainability integrates the human social, cultural, and economic dimensions of biodiversity conservation. Aspects of this approach include the following: (1) open dialogue between scientific and traditional knowledge; (2) knowledge accessible to those who influence decisions and relevant to resource users; and (3) fuller appreciation and reverence for nature in all its forms and beauty through a process that provides a sense of belonging in the landscape.

This ecosystem approach to conservation aids people in channeling a reasonable portion of nature's bounty in their own direction. Many traditional people already know how to achieve this process without lowering the quality of the environment or depleting any critical resources. A sense of empowerment is given to local communities with the capacity to administer their regions. The process helps promote cooperation at all levels and among all audiences.

Who Should Participate?

In ecosystem conservation programs, meaningful dialogues and interactions need to involve all relevant role-players in society and scientific disciplines to insure the involvement of necessary expertise and stakeholders at local and international levels.

Two general types of role-players in the ecosystem conservation process need to be recognized: local community insiders and individual and organizational outsiders.

Principle 2 of the Convention on Biological Diversity calls for decentralizing management to the lowest appropriate level. To promote greater efficiency, effectiveness, and equity, management needs to involve all stakeholders. Such in-

FIGURE 4. General view of the La Planada Nature Reserve in southwestern Colombia.

volvement will balance local interests with wider public interest and increase local responsibility, ownership, accountability, participation, and use of local knowledge.

For orchid conservation, open dialogue needs to include the following topics: in-situ and ex-situ communities; public and private conservation sectors; the formal academic community and the informal education sector; the park and reserve system community along with local people and traditional communities; official government agencies along with the socioeconomic and environmental planning, management, and control functions of private nongovernmental organizations (NGOs) as well as national and international organizations.

La Planada Nature Reserve: A Model

La Planada Nature Reserve provides a concrete conservation example for implementing the strategy suggested in this paper. Its location in the mid portion of the Andes, just above the tropical lowlands of the Choco biogeographical province (1000–2100 m elevation with 4500 mm annual rainfall) makes the reserve a haven for epiphyte diversity (FIGURE 4). La Planada shares a rich biological and cultural heritage. Orejuela (2002) identified 420 orchids species (many still undescribed) belonging to 87 genera, in the course of a 3-year period. The most diverse group of orchids at the reserve was the genus *Pleurothallis* with more than a hundred species. Other genera rich in species were *Stelis, Lepanthes, Epidendrum, Maxillaria,* and the *Oncidium-Odontoglossum* assemblage (FIGURE 2). La Planada rates high on each of the four criteria recommended for selection of conservation areas: species richness, species singularity or endemism, moderate to high human pressure on ecosystems, and at the date of establishment a high level of management feasibility. From the start, the project was supported by well-established organizations, including a Colombian NGO (the Foundation for Higher Education-FES) and the World Wildlife Fund-US. Within a short time, the level of institutional support, both public and private, increased substantially. Management programs integrate nature conservation and socioeconomic and cultural development with activities ranging from promotion of health and formal education to agricultural production to support of a neighboring indigenous population, the Awa, in their efforts to secure land tenure.

The emphasis placed on conserving the cloud forest ecosystem is based partly on the remarkable variety of species it harbors as a leading center of avian endemism in South America, a major center of anuran biodiversity, and an endemic center rich in bats, three species of monkeys, and the home of the spectacled bears (FIGURE 3). The conservation emphasis, however, also is based on the goods and services that the cloud forest renders local human populations and the potential of the ecosystem for socioeconomic development. The thin cover of mist that shrouds the Andean forests of southwestern Colombia hides in a subtle way the many treasures of a flora of unusual beauty and of unquestionable value.

CONCLUSIONS

The ecosystem approach to conservation may focus on four interrelated themes: (1) Natural diversity and cultural diversity are interdependent and basic to promote human development. (2) Links between ecological systems and human economy define both the destiny of people and the integrity of their regions. (3) Maintenance of the social and cultural vitality of the human groups of a region poses a challenge to ecosystem conservation programs. (4) Social organization and participation are community mechanisms for anticipating and facing changes and for maintaining economic viability, cultural integrity, and quality of the environment.

Orchids are among the most outstanding, charismatic, and numerous of plants in Colombia, but their complex survival and reproductive strategies place them simultaneously among the most vulnerable to extinction caused by human pressures. Orchids are an outstanding indicator of environmental quality and of priority areas for conservation. They perform a keystone function in ecosystems and are basic to the survival of bees, flies, and butterflies, which in turn play key roles in plant pollination and biological con-

trol in natural ecosystems. As a keystone species, orchids are solid contributors to ecosystem well-being. When these ecosystems function well, they provide ample goods and services, such as watershed and soil protection, essential to the sustainability of human welfare.

The conservation goal is not merely to identify and protect orchids and their habitats, but to discover, develop, and assist the capacity for sustainable use of natural resources that exist in local communities.

How to reduce the level of human pressure on both natural and productive ecosystems and how to foment more harmonious human behavior in nature become fundamental questions. Answers to these questions require recognizing the fundamental cause of human behavior. A lack of environmental culture may be at the root of the problem. This environmental illiteracy is manifested in competitive behavior, an extra-activist mentality regarding natural resources, and an inadequate valuation of nature. If present tendencies continue, many of the species we consider safe will be in danger, and those that are threatened today may be extinct in their natural surroundings. It is virtually impossible to safeguard tropical forests with guards. Thus we should focus on what is possible. We should commit to concentrating resources currently dispersed among the scientific community, such as the IUCN World Conservation Union, botanic gardens, universities, orchid societies, orchid growers, environmental authorities, and conservation NGOs. By concentrating resources, we can elevate environmental awareness and the cultural level of the population, particularly the children, since the future resides in them. Even more urgent is the influence that we can place on decision-makers and policy-makers. Conservation is worth the effort of shaping public opinion through persuasive and emotional diffusion of knowledge based on solid research.

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APPENDIX 1. Endemic orchid centers of Colombia and some representative species (endemics in bold).

Code/region	Key habitats	Major threats	Area km²	Elevation m	Conservation priority	Representative orchid species
034 Eastern Andes (North)	Upper montane, elfin forest, paramo	Accelerated forest loss (agriculture, logging, fires)	85,000	1000–4000	Critical	Escobar and Luer (1981): *Masdevallia coriacea, M. amanda,* ***M. chloracea, M. arminii,*** *M. campyloglossa, M. picturata,* ***M. aenigma,*** *M. corniculata,* ***M. encephala, M. expansa,*** *M. hians, M. strumifera, M. tubulosa, M. nidifica, M. hieroglyphica, M. sororcula, M. sceptrum, M. macroglossa, M. klabochorum, M. leontoglossa, M. urceolaris, M. falcago, M. elephanticeps,* ***M. fragans*** (Jurisdicciones, Santander), ***M. auropurpurea, M. mastodon, M. lepida,*** *M. macropus, M. caudata,* ***M. amarilla, M. affinis,*** *M. ludibunda,* ***M. buccinator, M. coriacea, M. odontocera,*** *M. coccinea, M. melanoxantha, M. anachaeta,* ***M. aops, M. ignea, M. clandestina, M. militaris, M. medusa,*** *M. campyloglossa,* ***M. purpurella,*** *M. platyglossa, M. corniculata.* Other spp: ***Ada aurantiaca, Cattleya schroderae, Comparettia macroplectron, Masdevallia armini, M. coccinea, M. militaris, Miltoniopsis phalaenopsis, Odontoglossum crispum, O. nobile, Oncidium baldeviamae, Rodriguezia arevaloi, Telipogon bruchmuelleri.***
036 Sierra Nevada de Santa Marta	Lowland tropical to upper montane forests, paramo, highland savanna	Marked habitat loss: (agriculture legal & illicit, fires)	11,000	500–5200	Urgent	Orchid inventory deficient especially on distributions. Few definitive records.
040 Interandean Slopes	Montane forests	Habitat loss (colonization, crops, cattle)	48,000	1000–2500	Urgent	***Cattleya trianaei, Hormidium gilberto, Macradenia amandai, Masdevallia caudivolvula, Mendoncella colombiana, Miltoniopsis roezlii, Paphinia rugosa, Schomburgkia splendida.***
041 Choco/Andes	Tropical forests, premontane and montane, paramo	Accelerated forest loss (logging, colonization, agriculture, ranching)	100,000	0–3800	Urgent	***Bollea coelestis, Bollea lawrenceana, Cattleya chocoensis, C. warscewiczii, Chaubardiella, Dracula benedecti, D. chimerae, D. gorgona, D. trinema, D. wallisii, Huntleya gustavi, Lepanthes escobariana, Lycaste ciliata, Masdevallia stenorhynchus, Maxillaria huebschii, Mendoncella colombiana, Miltoniopsis roezlii, Porroglossum eduardii, Sievekingia shepeardii, Stanhopea reichenbachiana.***
042 Central Andes	Montane and elfin forests	Habitat loss (agriculture, ranching)	36,000	1500–3700	Critical	***Cattleya warscewiczii, Hormidium wallisii, Odontoglossum sceptrum, Sievekingia colombiana, Stanhopea shutleworthii, Telipogon acaimensis, T.* sp.** (del Nudo de los Pastos).

Source: Otiz-Valdivieso (1976); Escobar and Luer (1981) 47 spp. collected, 20 endemic (new spp. or rediscovered).

APPENDIX 2. Selected list of Colombian orchids in danger of extinction.

*	Taxon	Distribution**	Category***
E	*Acineta antioquiae*	Ant	
E	*Acineta arcuata*	?	
E	*Acineta beyrodtiana*	?	
E	*Acineta chrysantha*	?	
E	*Acineta cryptodonta*	?	
E	*Acineta erythroxantha*	?	
E	*Acineta gymnostele*	?	
E	*Acineta hennisiana*	?	
E	*Acineta hrubyana*	?	
E	*Acineta moorei*	?	
E	*Acineta schilleriana*	?	
	Acineta superba	?	
E	*Anguloa brevilabris*	?	EN/CR
E	*Anguloa cliftonii*	Val, Ris	CR
	Anguloa clowesii	Tol, Val	CR/EW
E	*Anguloa goldschmidtiana*	?	EX
E	*Anguloa macroglossa*	?	EX
	Anguloa ruckeri	Cun	VU/EN
	Anguloa uniflora	Ant, Nar, Val	
	Anguloa virginalis	Nar, Val	
	Bollea coelestis	Cau, Nar, Val	EN
	Bollea hemixantha	?	EN/CR
E	*Bollea lalindei*	San, Nar	CR/EW
E	*Bollea lawrenceana*	Cho, Val	VU
E	*Bollea pulvinaris*	Ant, Cho?	CR
	Bollea violacea	Caq?	
E	*Bollea whitei*	Nar?	CR/EW
E	*Cattleya deckeri*	Ant, Cho	
E	*Cattleya dowiana*	Ant, Cor, Cho, Ris	CR
E	*Cattleya mendelii*	Santander	EN/CR
E	*Cattleya percivaliana*	Nsa	CR/EW
	Cattleya rex	Amazonia?	
E	*Cattleya schroderae*	Ara, Cas, Met	CR
	Cattleya trianaei	Cun, Hui, Tol	
	Catleya violacea	Llanos	
E	*Cattleya warczewiczii*	Ant, Boy, Cal, Cun, Cho, Sant	CR
E	*Dracula alcithoe*	Nar	EN/CR
	Dracula andreetae	Va, Nar	EN/CR
E	*Dracula aphrodes*	Val	EN
E	*Dracula bella*	Ant, Cho, Ris	VU
E	*Dracula bellerophon*	Ant, Val	EN/CR
E	*Dracula berthae*	Boy	EN/CR
E	*Dracula brangeri*	Ant, Boy, San	CR/EW
E	*Dracula carcinopsis*	Val	EN
E	*Dracula chestertonii*	Ant, Cho, Ris, Val	VU
E	*Dracula chimera*	Ant, Cau, Nar, Cho, Ris, Val	VU
	Dracula chiroptera	Nar	VU
E	*Dracula citrina*	Ant	EN
E	*Dracula cochliops*	Put	EN
E	*Dracula cutis-bufonis*	Ant, Cal	EN
E	*Dracula decussata*	Cho, Val	VU
E	*Dracula diabola*	Boy	EN
E	*Dracula diana*	Val	VU/EN
E	*Dracula exasperata*	Put	VU
	Dracula gigas	Val, Nar	EN/CR
E	*Dracula gorgona*	Cal, Cho, Ris	VU

APPENDIX 2. Continued.

*	Taxon	Distribution**	Category***
E	*Dracula gorgonella*	Ant	EN
	Dracula hirtzii	Nar	VU
E	*Dracula inaequalis*	Ant, Cho, Val	VU
E	*Dracula incognita*	Ant	CR/EW
E	*Dracula insolita*	Val	EN/CR
E	*Dracula lehmanniana*	Cau	EN/CR
E	*Dracula lemurella*	Ant	EN/CR
	Dracula levii	Nar	EN
E	*Dracula ligiae*	Ant	CR
	Dracula mantissa	Nar	EN
E	*Dracula minax*	?	CR/EW
E	*Dracula nosferatu*	Ant	CR
E	*Dracula nycterina*	Ant	VU/EN
E	*Dracula octavioi*	Put	EN
E	*Dracula ophioceps*	Cau	CR/EW
E	*Dracula orientalis*	Nsa	EN/CR
E	*Dracula ortiziana*	Val	CR
E	*Dracula pholeodytes*	Boy	VU/EN
E	*Dracula posadorum*	Ant	VU/EN
E	*Dracula presbys*	Ant?	CR/EW
E	*Dracula robledorum*	Ant, Nar	VU/EN
E	*Dracula roezlii*	Ant, Ris	VU
E	*Dracula sergioi*	Ant	EN
E	*Dracula severa*	Ant	VU/EN
	Dracula sibundoyensis	Put	VU
E	*Dracula syndactyla*	Nar	VU
E	*Dracula velutina*	Ant	VU
E	*Dracula verticulosa*	Val	EN/CR
E	*Dracula vinacea*	Boy	EN/CR
E	*Dracula vlad-tepes*	San	EN/CR
E	*Dracula xenos*	VAl	EN/CR
	Embreea rodrigasiana	Ant, Cau, Cho, Val	VU
	Epidendrum ruizianum	Cun, San, Tol, Val	VU/EN
E	*Galeottia colombiana*	Cau, Cun, Val	EN/CR
	Galeottia grandiflora	Val	VU/EN
	Galeottia negrensis	Oriente, tepuis?	
E	*Huntleya apiculata*	Cau?, Nar?	EW/EX
E	*Huntleya citrina*	Val	VU/EN
E	*Huntleya gustavi*	Cal, Cau, Cho, Val	VU/EN
	Huntleya meleagris	Llanos, amazonia	VU/EN
E	*Huntleya waldvogeli*	Nar	CR/EW
E	*Huntleya wallisii*	Ant, Cal	VU/EN
	Lycaste andreeta	Nar?	VU
	Lycaste campbellii	Cho	VU
	Lycaste denningiana	?	VU/EN
	Lycaste fulvescens	Cun, Boy, Sa	EN/CR
	Lycaste grandis	?	EN
	Lycaste hirtzii	Nar?	VU/EN
	Lycaste longipetala	?	VU/EN
	Lycaste macrobulbon	?	EN/CR
	Lycaste macorphylla	Val	VU
	Lycaste schilleriana	Val	VU/EN
	Lycaste xytriophora	?	VU/EN
	Lycaste ciliata	Val	VU/EN
E	*Masdevallia aenigma*	Boy, Cun San	VU/EN
E	*Masdevallia alvaroi*	Ant	EN/CR
	Masdevallia angulata	Nar	EN
E	*Masdevallia angulifera*	Ant	VU/EN

APPENDIX 2. Continued.

*	Taxon	Distribution**	Category***
E	*Masdevallia apparitio*	Ant	CR/EW
E	*Masdevallia arangoi*	Ant	EN/CR
E	*Masdevallia arminii*	Boy, Cun, Nsa, San	VU
E	*Masdevallia assurgens*	Qui?, Tol	VU/EN
	Masdevallia auropurpurea	Cun, Met, Nsan	VU
E	*Masdevallia buccinator*	San	EN
E	*Masdevallia cacode*	Ant	CR
	Masdevallia caudata	Cun	CR
E	*Masdevallia cereastes*	Put	VU/EN
E	*Masdevallia coccinea*	Boy, Cun, San	EN/CR
	Masdevallia corniculata	Ant, Boy, San	EN
E	*Masdevallia cucullata*	Ant, Cun, Nar	EN
	Masdevallia crescenticola	Cho	
E	*Masdevallia discolor*	Boy, Cun	EN
E	*Masdevallia elephanticeps*	Nsa, San	VU/EN
E	*Masdevallia encephala*	San	EN/CR
E	*Masdevallia falcago*	Nsa	VU/EN
E	*Masdevallia foetens*	Ant	EN
E	*Masdevallia geminiflora*	Val	EN/CR
E	*Masdevallia gilbertoi*	Ris?	EW
E	*Masdevallia herradurae*	Ant. Ris	VU
E	*Madevallia heteroptera*	Ant	EN/CR
E	*Masdevallia hieroglyphica*	Nsa San	EN
E	*Masdevallia hortensis*	Ant	EN/CR
E	*Masdevallia hylodes*	Cau	EN/CR
E	*Masdevallia ignea*	Nsa, San	VU/EN
E	*Masdevallia impostor*	Ant	VU
E	*Masdevallia laevis*	Put	VU/EN
E	*Masdevallia macrura*	Ant	EN/CR
E	*Masdevallia marthae*	Ant?	CR/EW
E	*Masdevallia medusa*	Boy	EN/CR
E	*Masdevallia mejiana*	Ant	EN/CR
	Masdevallia melanoxantha	Boy, Nsa, San	VU
E	*Masdevallia misasii*	San	EN/CR
E	*Masdevallia mutica*	?	CR/EW
E	*Masdevallia nivea*	San	VU/EN
E	*Masdevallia odontocera*	Nsa	VU
E	*Masdevallia os-draconis*	Ris	EN
E	*Masdevallia oscarii*	Cho	EN/CR
E	*Masdevallia pescadoensis*	Ant	EN/CR
E	*Masdevallia planadensis*	Nar	VU
E	*Masdevallia posadae*	Ant	EN
E	*Masdevallia pteroglossa*	Cau	EX
E	*Masdevallia purpurella*	San	EN
E	*Masdevallia racemosa*	Cau	EN/CR
E	*Masdevallia saltatrix*	Ant	VU/EN
E	*Masdevallia sancta-rosae*	Ant	EN/CR
	Masdevallia schizopetala	Cal	EN
	Masdevallia schlimii	Nsa, San	VU/EN
E	*Masdevallia schmidt-mummii*	San	EN/CR
E	*Masdevallia scobina*	San	EN/CR
E	*Masdevallia segurae*	Ant	EN/CR
	Masdevallia sernae	Put	EN/CR
E	*Masdevallia sororcula*	Nsa, San	VU/CR
E	*Masdevallia stenorhynchus*	Ant	EN/CR
E	*Masdevallia sriatella*	Cau	EX
E	*Masdevallia strumifera*	Cau	EX
E	*Masdevallia sumapazensis*	Cun	VU/EN
E	*Masdevallia torta*	?	EW
	Masdevallia teaguei	Nar	VU/EN
	Masdevallia trigonopetala	Put	VU
	Masdevallia trochilus	Ant, Cau	VU/EN
E	*Masdevallia velifera*	Ant, Nsa	CR

APPENDIX 2. Continued.

*	Taxon	Distribution**	Category***
	Mesospinidium incantans	Val	VU/EN
E	*Mesospinidium lehmannii*	Nar	VU/EN
E	*Miltoniopsis phalaenopsis*	Boy, Cun, San	CR/EW
	Miltoniopsis roezlii	Cho, Ris, Val	CR/EW
	Miltoniopsis vexillaria	Ant, Cal, Nar, Qui, Val	EN/CR
	Miltoniopsis warszewiczii	Ant, Val	VU/EN
	Neomoorea wallisii	Ant, Cho	VU/EN
E	*Odontoglossum auriculatum*	Mag, Nsa	VU/EN
	Odontoglossum blandum	Nsa, San	CR/EW
E	*Odontoglossum crispum*	Boy, Cau, Cun Nar, Put, San	EN/CR
E	*Odontoglossum harryanum*	Ant	CR/EW
E	*Odontoglossum ioplocon*	?	VU
	Odontoglossum nevadense	Mag	VU/EN
E	*Odontoglossum nobile*	Nsa, San	CR/EW
E	*Odontoglossum rhynchanthum*	Ant	EN
E	*Odontoglossum tripudians*	Boy, Nsa, San	VU/EN
E	*Odontoglossum wallisii*	Ant, Cun	CR/EW
E	*Paphinia neudeckeri*	Put	VU/EN
	Peristeria elata	Ant, Val	EN/CR
E	*Pescatorea bella*	?	EX
E	*Pescatorea coronaria*	Cho	?
E	*Pescatorea lamellosa*	Ant	EN/CR
	Pescatorea lehmannii	Nar	VU/EN
E	*Pescatorea triumphans*	?	EX
	Phragmipedium hirtzii	Nar, Val	EN/CR
E	*Phragmipedium lindenii*	Put	EN/CR
E	*Phragmipedium schlimii*	Val, Nar	EN/CR
	Phragmipedium wallisii	?	EN/CR
	Psychopsis krameriana	Cho, Val	EN
	Psychopsis papilio	Tol	EN
	Psychopsis sanderae	Tol	EN
E	*Restrepia chocoensis*	Cho	EN
E	*Restrepia robledorum*	Cau	EN
E	*Rodriguezia lehmannii*	Cau	EN
	Schlimia alpina	Ant, San	EN/CR
E	*Schlimia jazminodora*	Nsa	EN/CR
E	*Schlimia trifida*	Ant, San, Val	VU/EN
E	*Stanhopea platyceras*	Ant, Nar	EN

Source: Calderón (1996).

* In danger of extinction (E).

** Distribution by political subdivisions (departments): Antioquia (Ant); Caldas (Cal); Chocó (Cho); Valle del Cauca (Val); Cauca (Cau); Nariño (Nar); Putumayo (Put); Caquetá (Caq); Huila (Hui); Tolima (Tol); Cundinamarca (Cun); Boyacá (Boy); Santander (San); Norte de Santander (Nsa); Magdalena (Mag); Risaralda (Ris); Quindío (Qui); Meta (Met); Meta, Arauca, Casanare, and Vichada (Llanos); Putumayo, Caquetá, Amazonas, Vaupés, Guaviare, and Guainía (Amazonas).

*** Critical (CR), endangered (EN), extinct in the wild (EW), extinct (EX), vulnerable (VU).