An Orchid Hunting Journey Over The Peruvian Andes 2008

Title: Oxford University Expedition 2008: An orchid inventory along the transects II and IV of the InterOceanic Highway.

Destination: Andean sections (II & IV) of the InterOceanic Highway in Perú.

Date: 24th June- 15th August 2008

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The InterOceanic Highway (IOH) is a multi-country, multi-region, $1.3-billion project to create a paved highway, linking the Peruvian coast with the lowland Amazon Jungle and ultimately the Atlantic ports of Brazil. Peru is counting on the road as a means of opening up its long-neglected interior for development. Brazil is looking for access to the Pacific's commercial ports. The finished route, planned for 2011 will create the first paved roadway connecting the Atlantic and Pacific oceans on the South American Continent.

Travelling through Southern Peru, it is possible to wake in the early morning harsh chill of the high Andes, before spending the evening sweating it out in the jungle. From an engineering point of view, the IOH poses a legion of difficulties including extreme elevations, incessant downpours and dramatic geography. "It is an incredibly complex project" said Verónica Zavala, Peru's Minister of Transportation and Communications. From a social point of view the highway links a variety of interests and development hopes that are not always lined with environmental governance initiatives.

A key goal of this expedition was to develop a comprehensive inventory of as many orchids that were possible to identify in the dry season (out of the flowering season) in order to serve as a baseline for future comparisons, feed into local environmental initiatives as also promote eco-tourism. Orchids are excellent "indicator species" of habitat quality because their delicate, often soil-less existence can make them some of the most sensitive residents in a changing environment. We now posses a snapshot of the orchids in different ecosystems along transects II and IV from July-August 2008, which is ready to be compared to later snapshots so that an evaluation of how serious industrial road-building, climate and social pressures affect orchids.

Geographical Location

Embedded between Latitudes: 11º 16' to 17º 26' South and Longitudes: 67º 27' to 74º 47' West, our IOH journey crossed three different Peruvian Departments: Cusco, Madre de Dios and Puno, covering an elevation gradient of 4400m, from its lowest point: Inambari (300m) to its highest elevation at the Andean Plateau in Puno (4700m). The IOH crosses through several ecosystems within the Peruvian Andes, from Puna grasslands at its highest elevations (Ausangate icecap region), to cloud forests in the middle and upper eastern Andean slopes; where 80% of this expedition took place (e.g. Cusco, Marcapata, San Gaban), to sub-montane rainforests in the lowest section of the Andean slopes (e.g.Quince Mil), and finally the evergreen lowland Amazonian rainforests: Inambari-Iñapari. Our route started in Cusco (3400 m.a.s.l) and we followed transect II (Urcos, Ocontagate, Marcapata (3000m), Limpacpuncu (1800m), Quince Mil (900m), Inambari (300m), and transect IV (Inambari, San Gaban (1800m), Ollachea (2800m), Ayaviri (4200m), La Raya (4700m), Cusco) (Fig.1).

Background

In 2000, the IIRSA initiative (South-American Infrastructure Integrative Initiative) was launched by the 12 South American Governments, supported by several national and international financial bodies. This initiative included the promotion of 10 integration axes around 335 development projects with a total budget of 37.5 billion dollars. IIRSA's projects included energy and communication initiatives; however the majority focussed on transportation such as the building of the Inter-oceanic highway (IOH). This highway is a transcontinental roadway that crosses the Amazon Basin and links the Pacific and the Atlantic coasts of

South-America. The Peruvian part consists of three roads that link the port cities of Ilo, Matarani and San Juan de Marcona on the southern Pacific coast of Peru, with the Amazonian state of Acre in Brazil. These Peruvian roads will connect with two highways in Brazil, also linking Peru with the commercial ports on the Atlantic coast (Fig.1 & 2).

Main activities on the Peruvian side of the IOH consist of improving, paving, and/or new building of 2,586 km of roads between the small town of Iñapari on the Peruvian border with Brazil, and the ports on the Pacific coast. These improvements are being implemented over a 30 year old existing road network, which has been divided into five sections to ease its implementation (Fig.3 & 4).

Ecologically, the IOH traverses some of the best-preserved and most bio-diverse areas of Madre de Dios in the western Peruvian Amazon and also the well preserved ecosystems on the Eastern Peruvian Andes (yungas). With a strong representation of international conservation organizations, the Andean slopes overlooking the Amazon are a hotspot of biodiversity, hosting 15% of all plant species on Earth, half of them endemic (Myers et al. 2000). Moreover, the IOH traverses an Amazonian region that shelters a considerable number of indigenous groups living in voluntary isolation. Climatically, the Andean sections of the IOH respond to one of the world´s regions most threatened by climate change. Models project a 4 ºC temperature increase by 2100 (Still et al. 1999) and unprecedented challenges to the conservation of the region.

In spite of its key location, the IOH was approved, has been financed, and has been initiated with limited environmental and social impact assessments which have raised the voices of local environmentalists[1].

From a biological point of view, while the region's isolation has favoured its conservation, it has also jeopardized its research, making it one of the least study areas in Peru. In this sense, the IOH represents an opportunity as much as a challenge: making the region more accessible will help facilitate the inventory and understanding of its resources and its potentials, guiding the conservation efforts. Taking advantage of this opportunity, and in cooperation with Peruvian botanists, we visited the Andean sections of the Peruvian IOH (transects II and IV) to record some botanical diversity in the area, mainly concentrating on orchid species and their distribution along different ecosystems types and habitats.

[1]Among these voices is Marc Dougojeanni, the environmental advisor for the Inter-American Development Bank

Fieldwork and methodology

While we originally relied on the use of standardized transects for orchid inventorying (Krebs 1989). We soon had to change the system to something more flexible in order to cover the whole orchid elevation gradient and different orchid habitats along the IOH, during the assigned days. The idea of developing a statistical balanced sampling design felt apart due to difficulties in replicating enough number of transects in similar habitats, at similar elevations. Moreover, reaching the desired habitats frequently took a lot of machete work and time (Fig 5 & 6). For these reasons we decided to concentrate on species richness (diversity of orchid species) rather than species abundance (number of individuals of each species) since orchid richness was of premium importance for the development of an orchid inventory. We gave priority to scouting the maximum area possible rather than intensively sub-surveying regions of it (Fig 7).

Our sampling program was divided into *two different dynamics*:

- *Orchid sampling intensive stays*: Our botanists selected three main orchid hotspots based on previous collections, floristic inventories, local knowledge of potential orchid habitats, and logistic facilities (e.g. existence of nearby hostals and food supplies). These sites were: Marcapata (-70.964,-13.586, 3200 masl) and Quince Mil (-70.755,-13.230, 800masl) (both in transect II), and Ollachea (-70.4785,-13.766, 2800m, transect IV). We stayed between 4-5 days in each site
- *On-track sampling*: We searched for orchids while travelling from one destination to another along the IOH, stopping to check for orchids at any interesting site based on our botanists' choices (e.g. roadside stabilisation slopes, recently downed trees, nearby forest fragments and ravines, etc).

Our sampling mainly focused on three major orchid habitats and orchid life-styles (Fig. 8a,b,c):

- *Fragmented forests (epiphytes):* Several forests along the IOH were known to be orchid-hotspots in the 60's (Vargas Herbarium, National Autonomous University of Cusco). Marcapata's and Ollachea's remaining fragmented forests were surveyed intensively. So was any reachable tree canopy along the road-side.
- *Rocky cliffs (lithophytes):* There exists a diversity of specialised orchids that grow on

rocky habitats (e.g. rocky cliffs and riparian ecosystems are frequent in the Andean sections of the IOH).

- *River-banks and sandy habitats (terrestrial):* while not the most abundant life-style, terrestrial orchids were not rare in the abundant sandy rocky floodplains in the piedmont Andean sections (submontane region: 1800-900 masl), in some road-side slopes, and in the lowland sections of transect IV (e.g. Inambari River, 300m).

The team walked together to each site and dispersed within view-distance to survey the maximum area. Most tropical orchids are epiphytic, living in tree canopies, therefore we relied strongly on the use of binoculars and telescopic scissors to locate and collect the orchids from the relatively short montane cloud forest canopies (ca. 10-12m), and much taller lowland evergreen rainforests (ca. 20-30m) (Fig. 9).

Several variables were written down when orchids were found: GPS readings and location description, habitat identification, on the ground species identification -if possible-, orchid and habitat pictures, collectors' names and date (Fig. 10).

Results and implications for local conservation

We found ca. 102 different orchid species from 41 genera during our dry season 2008 inventory (see annex). Many of our inventoried species correspond to new registers for Southern Peru (e.g. *Lepanthes megalocephala* had only been reported in Bolivia). Hence, although not new species, many of our orchids had never been collected at these latitudes, most likely due to the lack of botanical campaigns in the area. Since most orchid families bloom in the wet season, the species richness (number of orchid species) along transects II & IV of the IOH might have easily doubled, had the inventory been done from March to May. This increase in species richness would exclusively respond to an improved taxonomical identification ability based on the observation of the flowers and fruits (e.g. more orchids would not be present, plants would simply be taxonomically easier to identify). From our orchid inventory we have found three species whose pictures and drawings were sent for review to several specialists (Fig 11). In a countdown race to publish it, we discovered that Fig 11a had recently been published as *Stelislabium cuscoensis* (Christenson & Repasky 2008). Fig 11b has been confirmed to be a rare orchid but not a new species and Fig 11c is still under review.

Out of the scope of this expedition but as its legacy, the orchid data gathered in this proposal will be the starting point of three initiatives:

a. An orchid vulnerability map along transects II & IV of the IOH that will take into consideration the orchids' endangered levels in international conservation lists (e.g. IUCN-Red list of protected flora), the environmental and human factors that influence their distribution and survival, and the projected future scenarios that will affect these last two factors. The goal is to use this vulnerability map to direct conservation priorities in the area, with special interest on highly threatened orchids such as the large wild populations of *Phragmipedium* we encountered, and to design orchid conservation plans for the regions where orchids still thrive.

b. The promotion of an orchid ecotouristic route along the IOH. In connection with an initiative launched by personnel at Duke University we will help in the promotion of green tourism along the IOH, offering a visual field-guide of the orchids in transects II & IV.

c. As a commitment to share our data with the scientific community, our records are being entered at the Oxford's Virtual Field Herbarium, and will also be transformed into Rapid Colour Guides at the Chicago Field Museum's website.

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