

# Serranía de los Churumbelos: Physical Geography and Study Sites

Paul Salaman  
psalaman@proaves.org

---

## Physical geography

The eastern range of the Colombian Andes-the Cordillera Oriental-extends from Los Montes de Oca in Serranía del Perijá (10°30'N 75°45'W) 1,200 km southwards to Serranía de los Churumbelos (ca. 1°32'N 76°14'W), where the range bifurcates (**Figure 1**). The main ridge fuses with the Cordillera Central at Macizo Colombiano (ca. 1°56'N 76°40'W) and forms the headwaters to the Río Magdalena. A second ridge spurs southwards and ends abruptly at the Río Caquetá (ca. 1°10'N), to form the 60 km long Serranía de los Churumbelos. The Río Caquetá watershed penetrates into the Cordilleras Central and Oriental, which together form the beginning of the main Andean mountain range, extending 190 km southwards to the Ecuadorian frontier, and a further 6,850 km south to Tierra del Fuego.

Serranía de los Churumbelos is a 60 km long mountain range, 25-30 km wide at the base and rising to around 2,800 m, with an average ridgeline of 1,500 m. It is located entirely in the Department of Cauca, southern Colombia and was biologically unknown until these expeditions. The Churumbelos are characterised by their distinctive geology - a large anticline with a north-east to south-west axis, formed by various sedimentary rocks, principally limestone, conglomerates and shales, together with igneous intrusions and associated fringe metamorphic rocks. The resultant topography is spectacular, with rivers eroding along the weak points of the anticline axis to form steep linear drainage patterns, with the Río Fragua and Río Mandiyaco flowing from north to south. However, the most distinctive features are erosional remnants of limestone that form large flat "mesetas" or Table Mountains. Unlike most tabletop mountains, they have deep organic and underlying clay soils and a dense forest covering. The mesetas are surrounded by 50-200 m sheer cliffs overshadowing steep slopes, intersected by streams and scarred by numerous landslides of up to 400 metres length.

The western flank of the Churumbelos gently shelves into the Río Mandiyaco and Río Villalobos, where a sharp spine called Serranía de Otún rises, parallel to los Churumbelos. The eastern flank abruptly rises out of the vast flat Amazonian plain at 300 metres altitude and steeply climbs to almost 3,000 metres. This ridge receives high levels of rainfall from vast Amazonian convectional cloud formations. These cloud formations have formed steep valleys, which drop straight into the Amazonian plains, producing large alluvial fans at their bases. Extensive aerial photographs and video footage were taken of the southern half of the Serranía during a helicopter flight sponsored by Argosy International in 1998.

Exceptionally harsh physical relief along the eastern "wall" of the Cordillera Oriental and main Andean range has greatly deterred human colonisation and development. The eastern slope of the Andes in Colombia was until recently an unbroken continuum of moist to humid primary forest encompassing habitats from high-elevation páramo to the Orinoquian and Amazonian lowlands, and characterised by high precipitation levels from convectional cloud formations. However, since the 1970s, the Colombian government has undertaken massive infrastructural development through road construction projects with the aim of providing access to exploit the vast Amazonian region that comprises a third of Colombia's surface area. Presently, five main arterial routes penetrate the lowlands from the High Andean interior, with a further major highway currently being constructed along the entire eastern Andean foothills of Colombia that will connect Ecuador to Venezuela. Increased and improved access routes have stimulated the destruction of mature tropical forests for pasture, petroleum exploitation and coca plantations. Deforestation rates in lowland moist forest on the foothills of the eastern Andes of Colombia accelerated rapidly in the late 20<sup>th</sup> century from 1.4% (1961-1979) to 4.4% (1979-1988) correlating with increasing human population density (Viña & Cavelier 1999).

The Andean East slope has been identified as containing very high concentrations of biological richness and moderately high levels of avian endemism. However, historical difficulties in access have resulted in very few biological studies being conducted on the Andean East slope of Colombia. The paucity of information for the Colombian Andean East slope is striking, even in birds (Salaman *et al.* 2002). Despite growing political instability caused by the government's ongoing conflict with insurgent guerrilla groups, studies have been increasingly conducted throughout the region in the 1990s, particularly during these expeditions, by expedition members in other parts of the region and by Instituto Alexander von Humboldt researchers (see Salaman *et al.* 2002).

## Vegetation

The Serranía de los Churumbelos encompasses several major vegetation zones rising from 250 m to c.2,800 m with various influences from the Amazon and Andes. These zones correspond closely to the prevailing climate and altitude change. The local conditions (temperature, humidity, and rainfall) vary considerably over the Serranía, but the principal life zones in the region are:

- Tropical Lowland humid forest (ca.3,000 mm rainfall/year, Amazonian lowlands at 250 m to ca.900 m)
- Foothill pluvial forest (>4,000 mm rainfall/year, foothills; ca.500-700 m)
- Tropical Premontane (subtropical) humid forest (ca.4,000 mm rainfall/year, ca.900-1,800 m)
- Tropical Montane humid [cloud] forest (>3,000 mm rainfall/year, ca.1,800 m-2,800 m)

Additionally, some riparian habitats are found bordering the Ríos Mandiyaco and Fragua. Further, a low number of degraded or secondary habitats are found at most elevations in the Churumbelos, largely on the fringes of the forest in areas bordering roads.



The most important forest ecosystems in the Serranía are Tropical Montane Cloud Forests (TMCF), which dominate the massif, but occur over a very narrow altitudinal zone nationwide. Whilst TMCF normally occurs above 2,000 m in the Andes, insular mountains such as Serranía de los Churumbelos, have an atmospheric environment characterised by persistent cloud cover at the vegetation level to as low as 1,200 m, and very high levels of biodiversity.

## Study site descriptions

The expedition established a total of seven study sites along an altitudinal transect at 300-400 metre elevation steps in largely primary forest in all of the major life zones. An itinerary is presented below, with a summary of study sites in **Table 1**.



## Expedition field itinerary

July 7 – 9 1998	DD and TD conduct reconnaissance to Churumbelos lowlands with CRC support
July 10 1998	Expedition group meets in Popayán
July 11 1998	Arrive in Mocoa, Dpto Putumayo (local base) by bus (14 hours)
July 13 1998	Depart Mocoa and arrive at SS1
<b>July 14-21 1998</b>	<b>Fieldwork at SS1: Puerto Bello Mpo Piamonte, Dpto Cauca; 350 m (8 days)</b>
July 23 1998	Moved to SS2 (4 hour trek),
<b>July 24-30 1998</b>	<b>Fieldwork at SS2: Río Nabueno, Mpo Piamonte, Dpto Cauca; 700 m (7 days)</b>
July 31 1998	Returned to Mocoa for supplies and helicopter survey
August 2 1998	Depart Mocoa and arrive at SS3 (7 hour trek)
<b>August 3-9 1998</b>	<b>Fieldwork at SS3: Alto Río Hornoyaco, Mpo Santa Rosa, Dpto Cauca; 1,100m (7 days)</b>
August 10 1998	Moved to SS4 (3 hours trek),
<b>August 11-17 1998</b>	<b>Fieldwork at SS4: Villa Iguana, Mpo Santa Rosa, Dpto Cauca; 1,450 m (7 days)</b>
August 18 1998	Returned to Mocoa
August 19 1998	Returned to Popayán. Finished expedition.

---

July 1 1999	Expedition group meets in Pitalito, Dept. Huila. Preparations take place.
July 3 1999	Depart Pitalito (1 hour bus ride and 2 hour trek) and arrive at SS5.
<b>July 4 1999</b>	<b>Fieldwork at SS5: Nabú, Mpo Santa Rosa, Dpto. Cauca; 1,900 m (6 days)</b>
July 9 1999	Packed camp and moved to SS2 (2 hour trek). Set up camp at SS6.
<b>July 10 1999</b>	<b>Fieldwork at SS6: Tatauí, Mpo Santa Rosa, Dpto. Cauca; 2,200 m (5 days)</b>
July 14 1999	Packed camp and returned to Pitalito for supplies
July 15 1999	Depart Pitalito (1 hour bus ride) and arrive at SS7.
<b>July 16 1999</b>	<b>Fieldwork at SS7: El Dorón, Mpo Santa Rosa, Dpto. Cauca; 2,450 m (5 days)</b>
July 20 1999	Packed camp and returned to Pitalito.
July 21 1999	Regional TV and radio interviews with team members about project
July 22 1999	Depart for Medellín, Antioquia for studies in Serranía de San Lucas.

---

July 30 2000	Expedition team leave Medellín, Colombia
July 31 2000	Leave Mocoa for field
<b>August 1-7 2000</b>	<b>Further Fieldwork at SS1: Puerto Bello, Mpo Piamonte, Dpto Cauca; 350 m (6 days)</b>
August 8 2000	Return to Mocoa and end expedition

---

## Study sites

Whilst aerial photographs and LANDSAT maps had assisted our site allocation, terrain and vegetation meant that it was necessary to cut new trails to study primary forest at certain elevations. All seven study sites were within one continuous tract of primary forest on the eastern and southern slope of the mountain range. Forest classification follows Holdridge (1967). Additional details are presented in Salaman & Donegan (1998) and Donegan & Salaman (1999).

### SS1: Lowland humid forest 350 m person-days; 108 in 1998 and 24 in 2000

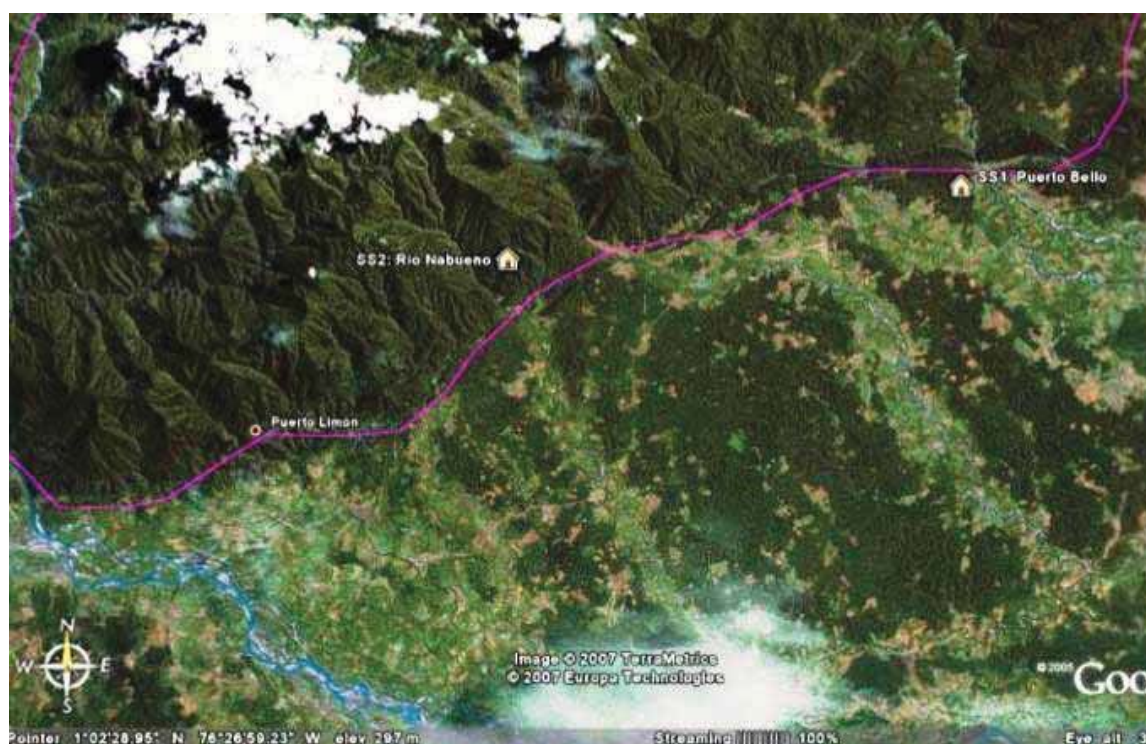
This site was situated where the Amazonian lowlands meet the base of the Churumbelos foothills. Annual rainfall is estimated as moderately high (3,000-4,000 mm/annum). A new road had been constructed to the hamlet of Puerto Bello in the last five years and deforestation was very evident along the roadside, although it had not yet penetrated deeply away from the road. The expedition was based in a house beside the Río Fragua, but within 300 m of closed canopy forest. A transect of 1,200 metres leading from the forest edge was used and intensively studied by all the team. The first 100 metres was made up of heavily intervened forest, being largely tall (10 year old) secondary growth. From 100-500 metres, mature canopy trees were dominant, with a dense undergrowth encouraged by the selective logging of economically viable species and younger trees by local people. Despite evidence of selective logging up to a stream at 550 m, the forest had attained primary forest morphology by this point, characterized by:

- i) very high canopy, with emergent species to 35 metres,
- ii) majority of evergreen trees with smooth bark and buttresses,
- iii) high cover of climbers, such as lianas,
- iv) large number of forest stratifications,
- v) lower density of vascular epiphytes,
- vi) very poor understorey layer.

The combination of open areas and predominantly young secondary grading to primary forest was ideal for studying certain groups (e.g. birds, bats). In 2000, further selective logging had led to more frequent clearings



and a deterioration in the state of the forest along some parts of the transect.



**Table 1:** Summary of location and field effort information for each study site in Serranía de los Churumbelos.

Location	Days at Person-site	Person-days	Co-ordinates	Altitude	Forest type	Soil	Expedition
SS1: Puerto Bello (1998): (2000):	8 6	108 24	01°08'14 N 76°16'55 W	350 m	Lowland humid forest	Arenoso-arcilloso pH 5.8	Colombia 98 EBA 2000
SS2: Río Nabueno	7	88	01°06'48 N 76°24'86 W	700 m	Foothill humid forest	Arenoso-arcilloso pH 6.4	Colombia 98
SS3: Alto Río Hornoyaco	7	71	01°13'59 N 76°31'58 W	1,100 m	Premontane very humid forest	Arcilloso pH 6.5	Colombia 98
SS4: Villa Iguana	7	77	01°14'18 N 76°31'11 W	1,450 m	Upper Premontane humid [cloud] forest	Franco-mezclado pH 6.8	Colombia 98
SS5: Nabú	6	20	1°36'71N 76°16'23 W	1,900 m	Lower Montane humid forest	-	EBA 99
SS6: Tatauí	5	20	1°36'892 N 76°15'91 W	2,200 m	Montane cloud forest	-	EBA 99
SS7: El Dorón	5	20	1°40'41 N 76°14'21 W	2,450 m	Upper montane cloud-forest	-	EBA 99

**SS2: Lower premontane humid forest 700 m 88 person-days**

Steep slopes rising abruptly from the Amazonian plain make access to the Serranía difficult. A trail on the eastern slope of the Churumbelos follows the Río Nabueno to the base of the mountains. Our base camp (400 m) was situated beside the Río Nabueno (a useful water source). A hunters' trail climbed steeply up to a roughly flat knife-back ridge for 1 km at 650-700 m altitude. A campsite was cut adjacent to a 1,000 m transect. The site was virgin forest with no signs of logging, and with limited hunting taking place in the area.

This east-facing slope of the Churumbelos has a vegetation physiology influenced by high levels of rainfall (3,000-4,000 mm/annum), very steep terrain and nutrient-poor soils, resulting in:

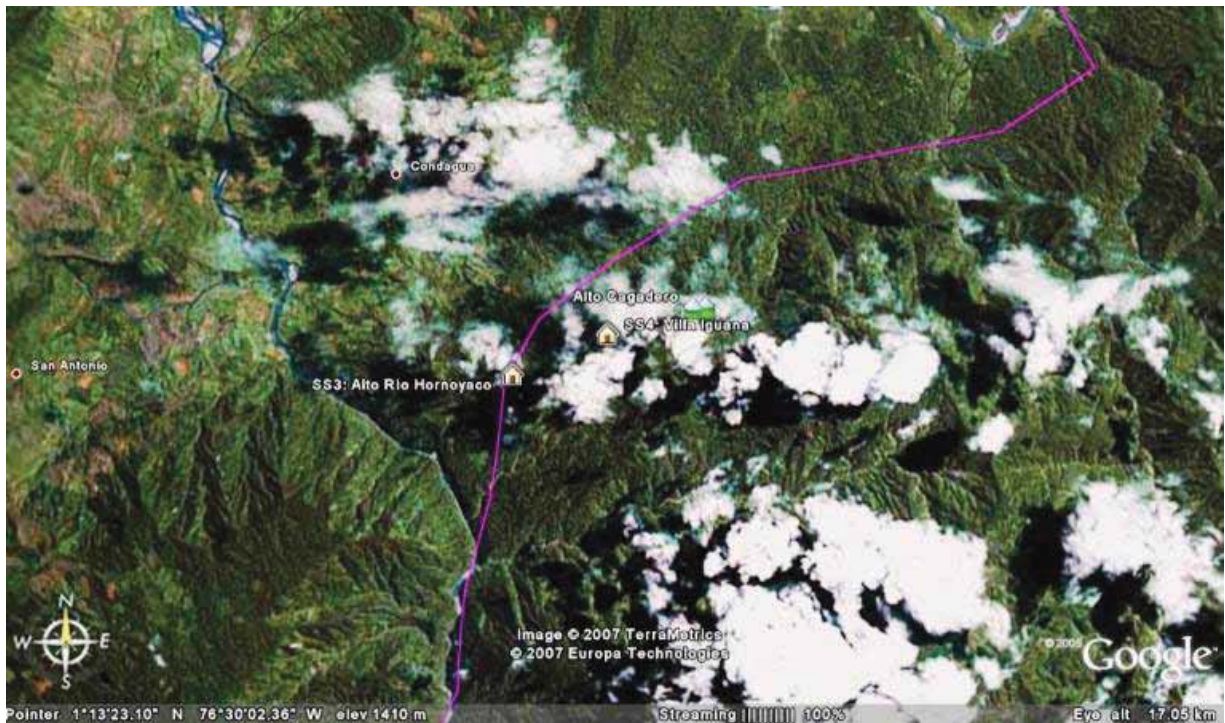
- i) moderate to average trunk diameters and height,
- ii) moderately high density and diversity of trees with small trunks,
- iii) moderately dense understorey with young trees, mosses and lianas,
- iv) free-climbing lianas uncommon, replaced by hemi-epiphytic climbers,
- v) palms numerically common in understorey.

**SS3: Premontane very humid forest 1,100 m 71 person-days**

The southern base of the Churumbelos steeply rises out of the mighty Río Caquetá and is traversed by several southward flowing streams, including the Río Hornoyaco. Several villages and towns are situated along the Mocoa - Pitalito highway which serve a patchwork of small farms. A trail was taken to a distant clearing (for grazing cattle) otherwise in the middle of the forest, over-shadowed by a meseta (table-top mountain). A campsite was established beside the trail (occasionally used for moving cattle between two remote pastures) in virgin forest, 7 hours' trek from the road. The trail formed a 700 m transect, through 400 m of primary forest to a stream, then into dense young secondary forest (3-5 years growth) that once formed an enlarged pasture. After a further 200 m the path emerged into a 4 ha pasture clearing. The path wound along steep slopes with natural clearings created by landslides which provided ideal conditions for diversity.

This forest was similar in floristic composition and stratifications to both SS2 and SS4. The major factors influencing this zone are cooler temperatures, steep terrain, high rainfall (estimated at >4,000 mm/annum), and increasingly humid conditions. The significant features of this forest type are:

- i) moderately open understorey,
- ii) primarily vascular epiphytic composition,
- iii) no buttress trunks and stilt roots,
- iv) very high flora diversity and local endemism.



**SS4: Lower Montane humid (cloud) forests 1,450 m 77 person-days**

After locating the largest table-top mountain (or meseta), Alto Cagadero, during the helicopter survey and with aerial photographs, our guides cut a c. 5 km trail from SS3 to a large plateau (300 x 500 m) at 1,450 m, between two mesetas. The forested area above the last pasture to Villa Iguana plateau had never been accessed before. A campsite and 800 m transect was established, which continued for a further 1000m to the base of Alto Cagadero meseta. A 30 m cliff was climbed and ropes installed with jummers to scale the Alto Cagadero meseta. A 300 m trail was cut on the meseta. The forest character and composition at SS4 is remarkable in containing many elements characteristic of a forest over 600 m higher in altitude. The forests here is characterized by:

- i) very high abundance and diversity of arboreal and terrestrial epiphytes,
- ii) low canopy level (c.12 m)
- iii) dense shrub layer not above 5 m,
- iv) two tree layers: canopy (c.12 m) and sub-canopy (c.6 m).

Although only 50 metres higher than Villa Iguana, the forest at Alto Cagadero (1,500 m) is very different:

- i) stunted trees with low canopy height (7-10 m),
- ii) extremely high abundance of arboreal and terrestrial epiphytes and bryophytes, including mosses,



- ferns, orchids and bromeliads.
- iii) large herbaceous plants and bushes form a well defined very dense undergrowth,
- iv) presence of single tree layer.

**SS5: Lower Montane humid forest      1,900 m      20 person-days**

To access higher elevations of Serranía de los Churumbelos, we explored the northwestern flank of the mountain range close to Alto Fragua (the other side of the ridge from SS1-2). From La Petrolera at Km 90 along the Mocoa-Pitalito road, a trail crosses the Río Villalobos and provides access to the northwestern edge of the Serranía. SS5 and SS6 were located on a heavily forested ridge above the Río Villalobos and Mocoa-Pitalito highway. Our base camp was located beside the ridge in a small clearing, called Nabú in Finca Playon (Vereda La Petrolera, Mpo of Santa Rosa). Our transect extended 800 m along a ridge of primary forest (ca.2,500 mm rainfall/year) above the base camp. The significant characteristics of this forest type are:

- i) a dense understorey,
- ii) dense arboreal epiphytes,
- iii) canopy height of ca.20-25 m dominated by white oak (*Quercus* spp.).

**SS6: Montane cloud forest      2,200 m      20 person-days**

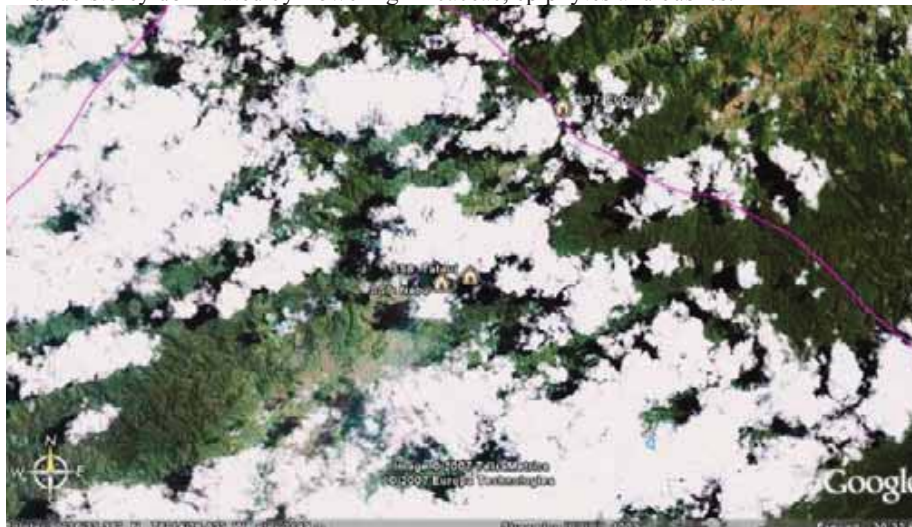
2 km to the north and above SS5 is a 600 m flat razorback ridge, with very steep slopes on either side. A base camp was situated at the head of the flat ridge, called Tatauí in Finca Playon (Vereda La Petrolera, Mpo Santa Rosa), and the 600 m transect was studied. This very stunted forest physiognomy, similar to treeline elfin forest, is influenced by the steep slopes shrouded in perpetual mists and exposed to strong lateral winds (ca.2,500 mm rainfall/year). There had been no previous human activity at this site. The significant characteristics of this site are similar to those of the meseta, Alto Cagadero, as strong lateral winds have reduced opportunities for taller tree growth:

- i) dense low understorey (ca.3 m high),
- ii) dominated by terrestrial bromeliads and *Sphagnum* spp. mosses,
- iii) canopy height of ca.7 m on the ridge and ca.12 m on lower slopes.

**SS7: Upper Montane cloud forest      2,450 m 20 person-days**

El Dorón (Mpo. Santa Rosa) was located along a ridge above two telecommunication towers (El Cable telecom station) at Km 100 along the Mocoa-Pitalito road on the Cauca / Huila department border. The ridge formed the watershed of the Río Villalobos and tributaries of the Río Magdalena (ca.2,000 mm rainfall/year). Our transect ran from an abandoned military installation clearing along the ridge through primary forest for ca.500 m. Although the military had disturbed the site substantially, their activities there ceased two years ago and were localised to ca.3 ha on the ridge, with some additional selective logging creating smaller clearings. The military installation was destroyed and abandoned two years previously following an attack by the FARC guerrilla. Some additional observations were undertaken in forest along the road and in secondary growth around the Telecom installation. The forest physiognomy is summarised as follows:

- i) forest dominated by large white oaks (*Quercus* spp.),
- ii) canopy height of ca.15 m,
- iii) large canopy epiphyte burdens,
- iv) understorey dominated by flowering Ericaceae, epiphytes and bushes.



**References:**

Donegan, T.M. & Salaman, P. (eds.) (1999) Colombian EBA Project Report: Rapid biodiversity assessments and conservation evaluations in the Colombian Andes: northeast Antioquia and highlands of Serranía de los Churumbelos. *Colombian EBA Project Report Series 2*. Fundación ProAves, Colombia. URL: [www.proaves.org](http://www.proaves.org), 41 pp.

Holdridge, L. R. (1967) *Life zone ecology*. San José, Costa Rica: Tropical Science Center.

Salaman, P. and Donegan, T.M. (eds.) (1998) Colombia '98 expedition to Serranía de los Churumbelos: preliminary report. *Colombian EBA Project Report Series 1*. Published online by Fundación ProAves, Colombia. URL: [www.proaves.org](http://www.proaves.org), 45 pp.

Salaman, P., Stiles, F.G., Bohórquez, C., Álvarez, M., Donegan, T.M., and Cuervo, A.M. (2002) New and noteworthy bird records from the Andean East slope of Colombia. *Caldasia* 24(1): 157-189.

Viña, A. & Cavelier, J. (1999) Deforestation rates 1939-1988 of tropical lowland forests on the Andean foothills of Colombia. *Biotropica* 31: 31-36.

