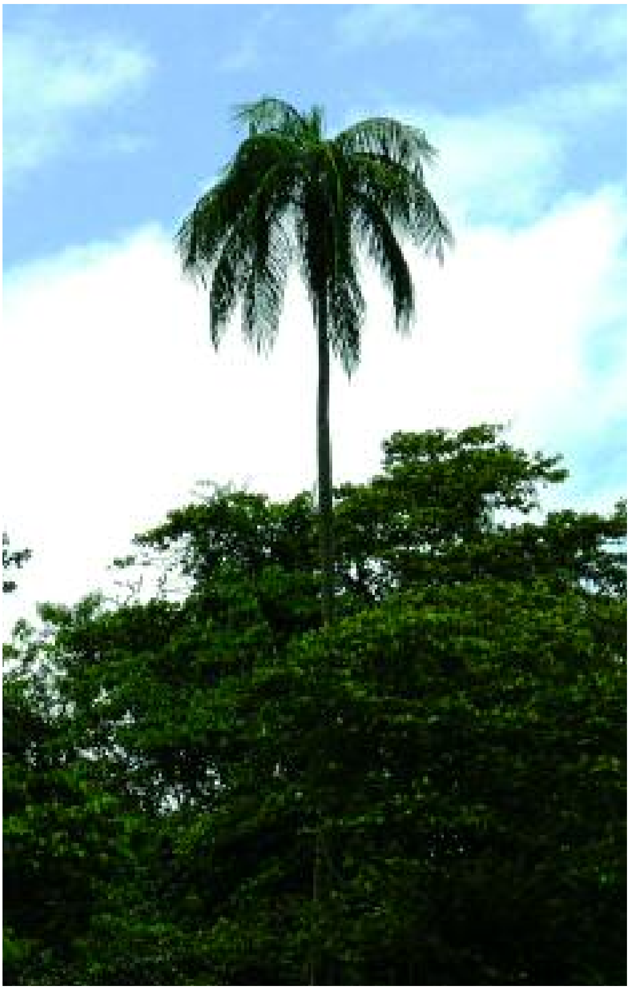
Ceroxylon echinulatum in an Agroforestry System of Northern Peru

JEAN-CHRISTOPHE PINTAUD

AND

FABIEN ANTHELME

IRD,
Whimper 442 y Coruña,
A.P. 17.12.857,
Quito, Ecuador



1. *Ceroxylon echinulatum*, slender habit and pendulous pinnae.

This paper records *Ceroxylon echinulatum* in northern Peru and describes its use in agroforestry.

The genus *Ceroxylon* currently comprises 11 species restricted to the Andes, from 800 m to 3500 m elevation but most common between 1500 and 3000 m, from Venezuela to Bolivia. *Ceroxylon* is still incompletely known in the southern part of its range (Peru and Bolivia). Henderson et al. (1995) reported four species of *Ceroxylon* from Peru (*C. parvifrons*, *C. parvum*, *C. vogelianum* and *C. weberbaueri*). However, recent field work in the Peruvian Andes has shown that the genus is much more diverse in this country and includes species previously known from Ecuador and possibly Colombia, as well as undescribed ones (Fig. 2). *Ceroxylon echinulatum* was considered to be endemic to Ecuador (Borchsenius et al. 1998), although it was collected in Zamora-Chinchipe province very close to the border with Peru. We encountered this species on the other side of the border, in Cajamarca region of Peru. Other fieldwork data (K. Mejía pers. com.) suggest that this species is relatively widespread but very patchily distributed in northern Peru. It is easily recognized by its tall and slender habit, regularly arranged pendulous pinnae and warty fruits (Figs. 1 & 2).

Many *Ceroxylon* species are considered endangered due to habitat loss and destructive use throughout the range of the genus (Galeano & Bernal 2005). However, these beautiful and useful palms are often cultivated or managed in some way, preventing local extinction in many places. Documented threats on the species and sustainable uses are summarized in table 1. *Ceroxylon echinulatum* in northern Cajamarca is a good example of both the destructive and sustainable use of these Andean palms. The region has been heavily deforested during past decades so that the only remnants of the original *Ceroxylon* populations are tall, old specimens left in pasture, where they cannot regenerate and progressively die (Back Cover). However, *Ceroxylon echinulatum* is now integrated in coffee agroforestry as a cultivated component, allowing its survival despite the progressive extinction of the natural populations.

The agroforestry system of the upper Urumba valley

According to local farmers, this sector of northern Cajamarca was almost pristine 50 years ago. People, especially from the city of Huancabamba and other localities of the north-western Andes of Peru, began to move in search of new income sources, establishing pastures and coffee plantations, and progressively developing San Ignacio from a small village to a significant urban centre. During the process, they ended up cutting almost all primary forest. By the end of the 1980s, the upper Urumba valley was facing serious problems of loss of soil fertility and widespread erosion, so that the future of agriculture in the area seemed bleak. However, a conjunction of institutional and non-governmental initiatives since the early 1990s allowed a spectacular move toward long-term sustainability of agriculture and land management in the valley (Gallo 2005). This was largely achieved through participative programs managed by the inhabitant

Table 1. Threats and uses of *Ceroxylon* species.

Species	Habitat loss (including forest clearance leaving adult palms in pastures)	Destructive use (stem and young leaves)	Non-destructive uses (a: fruits; b: inflorescences)	Cultivation (a: in agroforests; b: as ornamental)
C. alpinum	severe	severe	a	a, b
C. amazonicum	low	minor uses	minor uses	not cultivated
C. ceriferum	moderate to severe	severe	a	b
C. echinulatum	severe	severe	a, b	a
C. parvifrons	moderate	moderate to high	minor uses	b
C. parvum	moderate	severe	minor uses	not cultivated
C. quindiuense	severe	moderate	a	b
C. sasaimae	habitat destroyed	low	minor uses	a, b
C. ventricosum	severe	severe	a	b
C. vogelianum	moderate	moderate to high	a	b (rarely)
C. weberbaueri	severe	not documented	not documented	not cultivated

2. Small verrucose fruits of *Ceroxylon echinulatum* (left) compared with the larger and smooth ones of another, undetermined species growing in the same region (right).

themselves, in the form of cooperatives, mothers' and students' clubs, agroforestry commities etc. The diversity of action implemented is astounding. Some of them aim at biodiversity conservation, such as the protection of the spectacled bear (previously hunted) and of remnant patches of cloud forests, while others are more directly profit-oriented such as timber plantations of *Schizolobium amazonicum* (fast-growing legume tree). However, what really reshaped the landscape is the evolution of coffee production, which reached new international markets, especially that of high-quality organic fair-trade coffee, resulting in a continuous need for new cultivation space. With the disappearance of natural forests, organic coffee cultivation developed finally at the expense of pasture. Such cultivation is established under the cover of *Inga edulis*, a legume tree that provides the appropriate shade while occupying limited space at ground level thanks

3. Material from *Ceroxylon* sp. trunks prepared for sale at Ocol village, Peru.

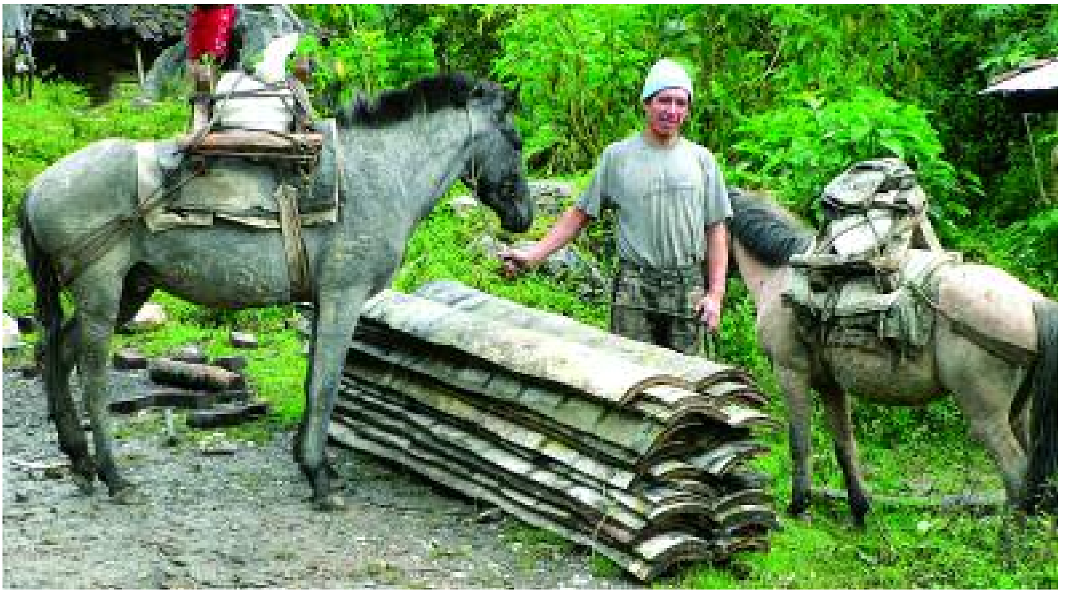
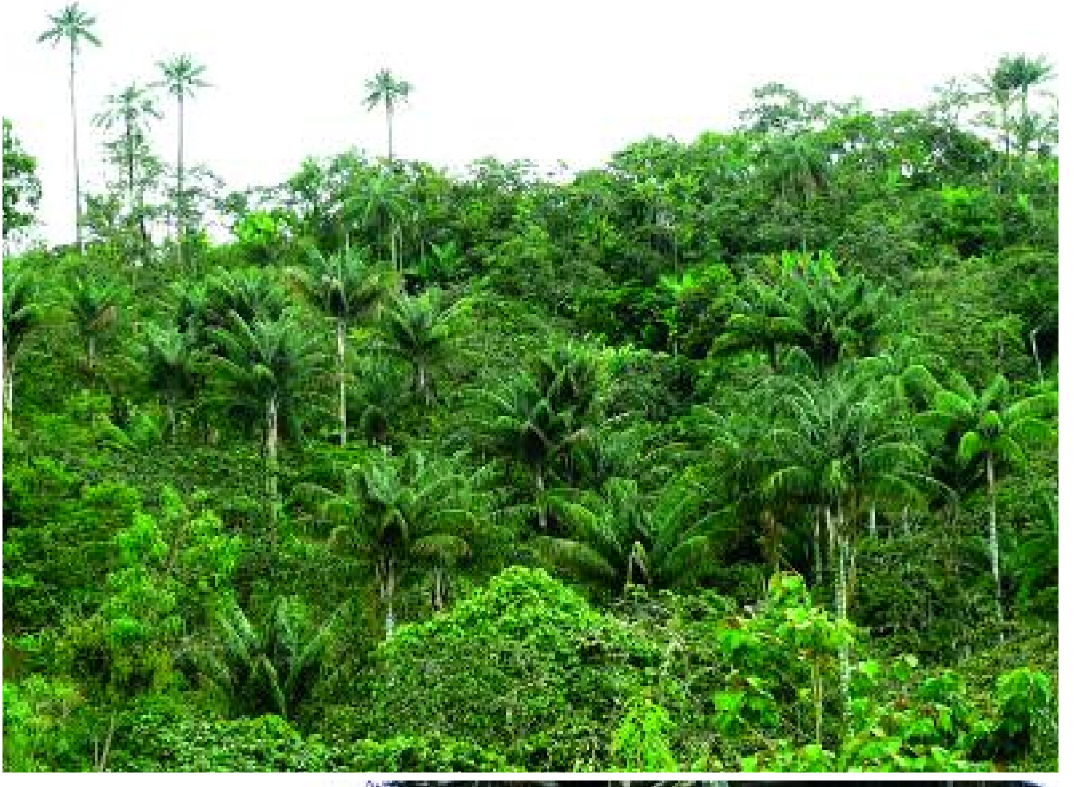


Table 2. Main components of the agroforestry system at San Ignacio, Peru. (C = cash crop, D = domestic use).

Species	Familly	Vernacular name	Use
Canopy and emergent trees			
Inga edulis	Fabaceae	Guabo, huabo	Shade, nitrogen fixation, edible fruits, wood (C, D)
Erythrina edulis	Fabaceae	Pajuro	Shade, nitrogen fixation, edible fruits, wood (C, D)
Cedrela odorata	Meliaceae	Cedro	Timber (C & D)
Ceiba sp.	Bombacaceae	Ceibo	Not recorded
Ochroma pyramidale	Bombacaceae	Balsa	Timber (C & D)
Mangifera indica	Anacardiaceae	Mango	Fruits (C & D)
Bactris gasipaes	Arecaceae	Chonta	Fruits, palm-hearts, wood (C & D)
Bactris setulosa	Arecaceae	Chontilla	Not recorded
Ceroxylon echinulatum	Arecaceae	Palma	Wood (construction, C, D)
Guadua angustifolia	Poaceae	Guadua	Wood (construction, C, D)
Upper understory (large shrubs and small trees, vines)			
Coffea arabica	Rubiaceae	Café	Fruits (C)
Bixa orellana	Bixaceae	Achiote	Stain, food color, D
Psidium guayava	Myrtaceae	Guyava	Fruits (C & D)
Caesalpinia spinosa	Fabaceae	Tara	Fruits (gum & tannins), C
Passiflora sp.	Passifloraceae	Granadilla	Fruits (C, D)
Lower understorey (small shrubs and herbs)			
Solanum sessiliflorum	Solanaceae	Cocona	Fruits (C, D)
Solanum quitoense	Solanaceae	Naranjilla	Fruits (C, D)
Saccharum officinarum	Poaceae	Caña azucar	Stem juice (sugar, D)
Ananas comosus	Bromeliaceae	Piña	Fruits (C, D)
Nicolaia elatior	Zingiberaceae	Not recorded	Stem juice (medicinal, D)
Colocasia esculenta	Araceae	Vituca	Arrow root (C, D)
Xanthosoma sagittifolium	Araceae	Songo Jivaro	Arrow root (D)
Musa × paradisiaca	Musaceae	Platano	Fruits (C, D)
Musa acuminata × balbisiana	Musaceae	Guineo grano de oro	Fruits (C, D)

to its spreading habit, and simultaneously enriching the soil as a nitrogen-fixing plant. Moreover, it produces edible fruits and useful wood. The result is an almost complete reforestation of the area, but in the form of a totally artificial and carefully managed agroforestry system (Perfecto et al. 2005). While the system is basically two-layered with a monodominant canopy of *Inga edulis* and an understorey of coffee trees, there is a multitude of minor species distributed from the herbaceous to the emergent layers of the agroforest, each one having a specific use, but also contributing to ecosystem functioning by restoring the diversity of life forms of a natural forest. This complex organization ultimately controls pests naturally and maintains soil fertility, while providing many domestic



4 (top). Young plantation of *Ceroxylon echinulatum* for domestic use in an agroforestry plot, established from the seeds of the mature individuals visible in the background. 5 (bottom). Farm house showing the use of material from the outer part of the trunk of *Ceroxylon echinulatum*.

resources to the farmers and a variety of year-round side incomes (Table 2). Nowadays, the management of the upper Urumba valley, which began as an ecological disaster, is regarded as a model of sustainable development.

Management of *Ceroxylon echinulatum* in coffee agroforestry systems

With the disappearance of natural forest, the need for wood, especially for construction became acute in the upper Urumba valley. In order to supply wood, timber species were introduced (*Cedrela odorata*, *Schizolobium amazonicum*, *Eucalyptus* spp.), but local wild species, in particular *Ceroxylon echinulatum*, were also put into cultivation. *Ceroxylon* species are very much appreciated for construction in the Andes, but are most often used destructively for this purpose, eventually eliminating natural populations. Only when this happens, the option of cultivation sounds attractive to local people. The rarity of *Ceroxylon* plants also means an important increase in stem price, which makes cultivation a good business. In San Ignacio, one stem from a cultivated plant is sold for $50, while in Ocol, another place where there are still extensive natural populations, the stem price from wild plants is only $10 (Fig. 3). In the upper Urumba valley (1600–1800 m elevation), farmers have an interesting way of managing *Ceroxylon echinulatum*. Their dilemma is that they need the wood to build their houses, but the root system of the palm is extensive, absorbs much of the soil water and is ultimately detrimental to coffee cultivation, the basic source of income. As *Ceroxylon echinulatum* is a fast growing species, farmers tend to cultivate it temporarily for their specific needs; it needs to be planned at least 15 years in advance. Such long term planning is not widespread in the rural Andes. For example, if a farmer needs 30 *Ceroxylon* trees to build a new, larger house, he will plant them in a plot (Fig. 4), accepting a decrease of coffee yield, until cutting them and increasing again the coffee's productivity. A few adult specimens are however conserved as seed source for future uses (Fig. 4). The palm is mainly propagated by transplanting the seedlings that grow spontaneously in the agroforest. Alternatively, the seeds are sown after digestion of the fruits by parrots that live and feed in the agrosystem. Some aspects of the use of trunk material can be seen in Figs. 5 and 6.

6. Wall made of *Ceroxylon* material.

In conclusion, we confirmed the presence of *Ceroxylon echinulatum* in Peru and documented its inclusion in agroforestry systems. As with other Andean palms (Svenning 1998), the genus *Ceroxylon* in general is endangered because its distribution is restricted to a region of South America that has suffered a high level of human pressure for a long time. A large part of the natural habitat of *Ceroxylon* has been converted into agricultural systems, and thus its survival relies increasingly on propagation by farmers, and several species have already been included in coffee agroforestry systems (Galeano & Bernal 2005).

Acknowledgments

We thank Betty Millán (San Marcos University, Lima) for her help and participation with field work on *Ceroxylon* in northern Peru, and Kember Mejía (IIAP, Iquitos) for sharing information about *Ceroxylon* populations in Amazonas and San Martin regions.

Literature Cited

Borchsenius F., H. Borgtoft Pedersen and H. Balslev. 1998. Manual to the Palms of Ecuador. AAU Reports 37. Aarhus University and PUCE. 217 p.

Galeano G. and R. Bernal. 2005. Palmas. *In*: Calderon E., G. Galeano and N. Garcia eds. Libro rojo de plantas de Colombia Vol. 2: Palmas, frailejones y zamias. Instituto Alexander von Humboldt, Bogota, Colombia.

Gallo L. M. 2005. La institucionalidad regional en el corredor económico Jaen–San Ignacio–Condorcanquí, Perú. Tésis de grado de magister en gestión de desarrollo rural y agricultura sustentable. Universidad Católica de Temuco, Chile, 61 p.

Henderson A., G. Galeano and R. Bernal. 1995. Field guide to the palms of the Americas. Princeton University Press, USA.

Perfecto J., J. Vendermeer, M. Mas and L.S. Pinto. 2005. Biodiversity, yield, and shade coffee certification. Ecological Economics 54: 435–446.

Svenning J.C. 1998. The effect of land use on the local distribution of palm species in an Andean rain forest fragment in northwestern Ecuador. Biodiversity and Conservation 7: 1529–1537.