A Journey Along the Rio Napo

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1. *Bactris gasipaes* in a pasture on alluvial terrace of Rio Napo. This species has been domesticated by Amerindians and is still widely cultivated in the Amazon, especially for its edible fruits.

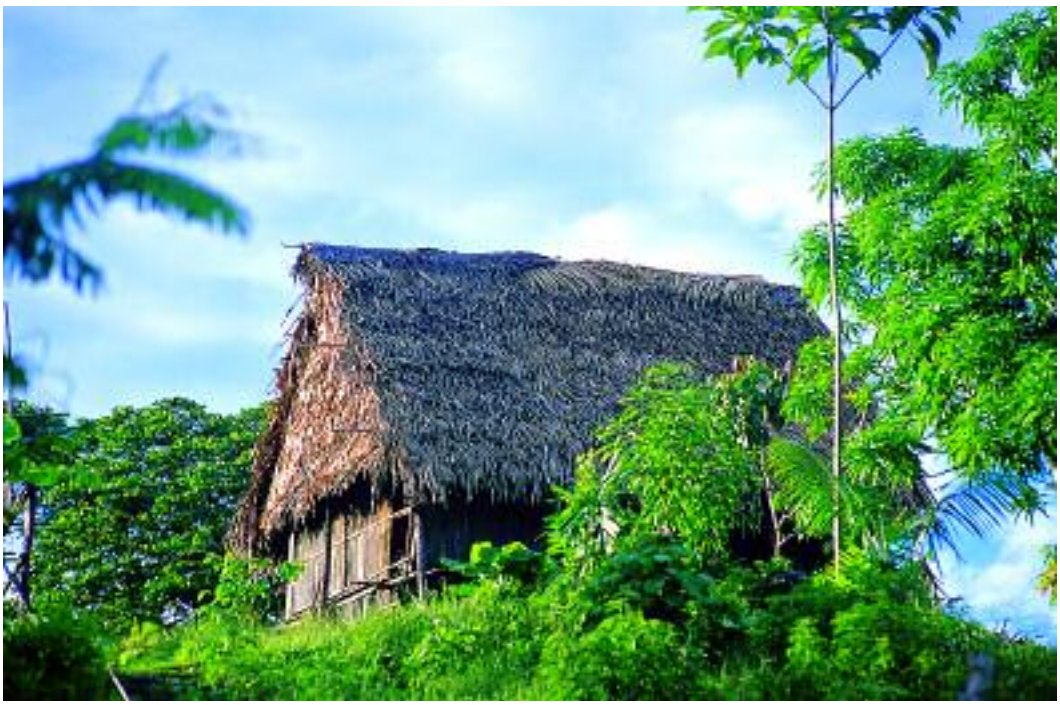
An expedition along the Rio Napo, a tributary of the Amazon that flows through Peru and Ecuador, revealed some of the area's palms, their specific habitats and their importance in the lives of the local people.

In October–November 2004, IRD (Institut de Recherche pour le Développement, France) organized an international, multidisciplinary expedition on Rio Napo, a major tributary of the Upper Amazon River. Rio Napo originates from the northern Andes in Ecuador. In its upper valley, located some 25 km to the SE of volcano Cotopaxi (5897 m) it is no more than a tumultuous stream. It quickly enlarges and become navigable from Puerto Napo, some 70 km to the east of its source. In its lower course, in Peru, it reaches nearly 5 km wide in some points, and finally merges with the Amazon, 75 km downstream from Iquitos. The expedition included more than 20 scientists from five nationalities, with research programs in hydrology, geology, palaeontology and botany. Many new discoveries were made, including spectacular macrofossils such as the teeth of a 15 m long crocodile. A complete topography of the river as well as a continuous stratigraphic sequence of the past 20 million years was achieved.

I happily participated in the Peruvian part of the expedition, although joining it in the middle of the trip was not so easy. I was supposed to come with a small plane taking three passengers from Quito to Tiputini in the far eastern Ecuadorean Amazon, and meet there with a TV team who had to make aerial views of the expedition and landscape. Everything began well; we took off from Quito airport and soon had magnificent views of the Andes, including the deep blue Mojanda Lake above Otavalo and various ice-capped volcanoes. Most spectacular was Cayambe (5790 m), of which we had a very close view. Then, as we descended toward the Amazon plain, the sky became more and more cloudy and when we reached the lowlands, we could hardly see more than tall yellow flames emerging from scattered oil fields, and the meanders of Rio Napo, in the middle of the mist and rain.

Approaching Tiputini, the rain became so heavy that water entered the plane from everywhere, and the only thing we could see was the lightning illuminating briefly the dense clouds all around the plane. It wasn't safe enough to spend more time in this area, and we had to go back to Coca airport, further up the Rio Napo. We waited desperately for several hours for better weather conditions, which never appeared on this unfortunate day. Since the plane had to go back to its base, I took my wet equipment and began to search for transportation to go down the Rio Napo and meet the expedition at Nuevo Rocafuerte, the last village before entering Peru. Unfortunately, it was a Saturday and there is little activity during the weekend in Coca. The next boat to Nuevo Rocafuerte was on Monday

2. A traditional house made of palm material at Campo Serio, Rio Napo.



3. A swamp forest dominated by tall *Attalea butyracea*, also with *Euterpe precatoria* and *Astrocaryum urostachys*.

and takes 12 hours to reach this village. By that time, the expedition would have been too far away downstream in Peru to be met. The only remaining option was to rent for myself alone a 20-seat powerful boat, which is normally contracted by oil companies. After having loaded nearly half a ton of fuel in tanks on the back seats, we departed late in the afternoon (me, my backpack and the three crew members) for a race down the river. We passed Pompeya after 34 minutes, while regular transport takes three hours to get there. As the day finished, it was more and more difficult to see the obstacles in the river, and after some slaloming among dead trunks at 70 km/h, the pilot decided it was safer to stay at night in the small village of Bañacocha. There we met a military hydrologist (unmistakable with his orange uniform) who was coming back from the Ecuadorean part of the expedition. He informed us that some members of the expedition were still in Nuevo Rocafuerte and that I was still in time to meet them early the next morning. We thus decided to depart as soon as daylight appeared.

We woke up at 4:45 a.m. and looked outside at the weather conditions. There was no longer rain but a fog so dense that we could hardly see anything 5 m away. By 6:00 a.m. the pilot decided it was possible to go on, although the fog persisted. It took us two hours to reach Nuevo Rocafuerte without major difficulty, despite the low visibility. There, an annex of the Peruvian boat on which the expedition embarked was waiting for me, and after a half-hour trip, I finally met the expedition in Pantoja, on the Peruvian side, and at last I could begin thinking about palms!

The main focus of the palm work was to understand where and how changes in palm species composition between Ecuador and Peru occurred. The palm flora is significantly different in northeastern Ecuador and in the region of Iquitos, while the distance between the two areas is not so great on the scale of the Amazon basin (500 km). For example, the most abundant palm species in the Iquitos-Pebas region of Peru, *Lepidocaryum tenue* (Vormisto et al. 2004) is totally absent (or at least unrecorded) from Ecuador (Borchsenius et al. 1998). Two other genera fairly abundant in the Iquitos region, *Iriartella* and *Wendlandiella*, are also absent from Ecuador, as well as a number of other interesting species such as *Chelyocarpus repens*, *Attalea ferruginea*, *Bactris halmoorei* and *Bactris killipii*. An especially interesting distribution pattern to study was that of *Astrocaryum urostachys*, which has been considered as endemic to Ecuador (Borchsenius et al. 1998) and *A. macrocalyx*, known only

Opposite page:

4. *Attalea butyracea* and *Euterpe precatoria* at sunset.

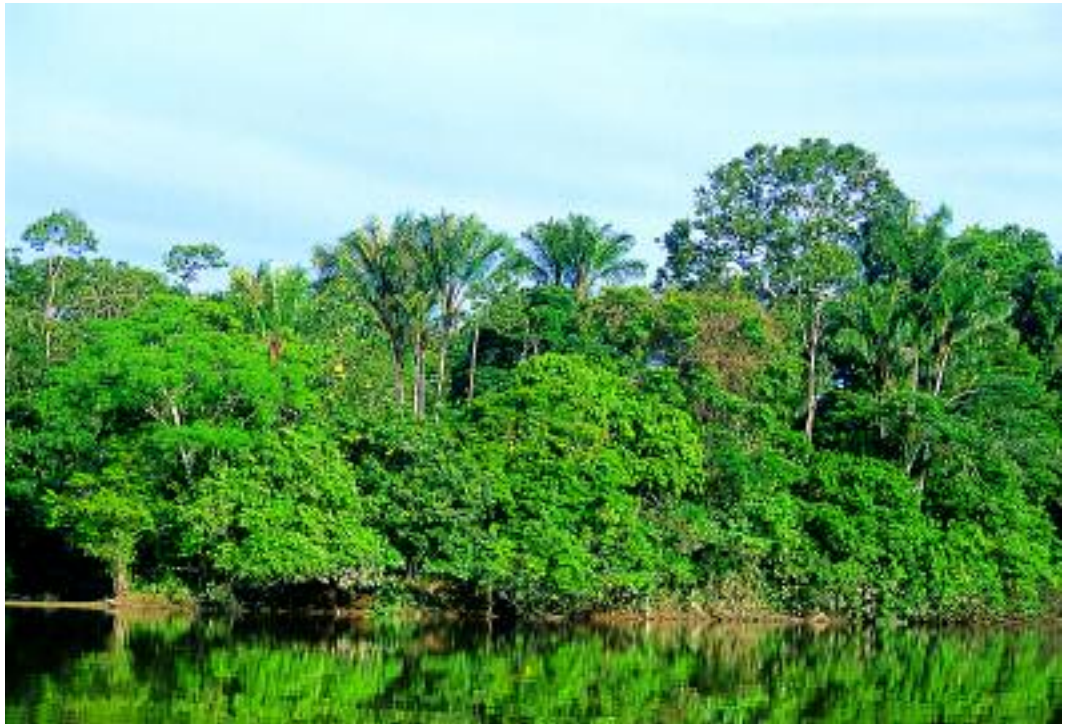
from the area of Iquitos (Kahn & Millán, 1992). The two species arose from a common ancestor (Pintaud & Kahn 2002) and are immediately distinguished by their habit. *Astrocaryum urostachys* is densely clustering while *A. macrocalyx* is always solitary. As these species occur in abundance in alluvial terraces, their distribution would be easy to trace during our trip. Are they meeting and mixing in some part or are their ranges totally separated? What, in fact, promoted their morphological differentiation? These were some of the questions I was eager to answer.

The Peruvian course of the Napo is still a very isolated region. It is mostly inhabited by Indian communities who cultivate a few crops for their subsistence, including the Peach palm, *Bactris gasipaes* (Fig. 1). Their houses are made entirely of palm material (Fig. 2). Walls are made with species of Iriarteeae (*pona*), mainly *Iriartea deltoidea* or *Wettinia maynensis*, depending on local availability, and roofs are thatched preferentially with *Lepidocaryum tenue* and *Attalea butyracea*.

Natural vegetation along Rio Napo is mostly composed of forests on Quaternary alluvial soils, the structure and floral composition of which depends on the frequency of flooding and quality of drainage. Palm composition is highly characteristic of each habitat type. In areas almost constantly inundated on river shores, only *Bactris riparia* is found. In slightly higher terraces, frequently flooded forests are rich in spiny palms (Bactridinae), the most characteristic of them being *Astrocaryum jauari*, associated with *Bactris concinna*, *B. bidentula*, *B. brongniartii*, *B. bifida* and the climbing species *Desmoncus orthacanthos*, which forms dense thickets. Higher terraces, seldom reached by the water, are the typical habitat of *Astrocaryum urostachys*, associated with *Attalea butyracea*, *Geonoma deversa* and *G. brongniartii*.

On the second day of our descent from Pantoja, in the vicinity of Campo Serio, we encountered vast areas of swamp dominated by *Attalea butyracea*, a kind of vegetation I had never previously seen in such extensive stands (Fig. 3). I decided to investigate the forest, accompanied by Emerson, a crew member who was to help me with most of the field work I made during the trip. The forest floor was damp and muddy, but many trails crossed the forest, paved with *Attalea* leaves. A surprising fact of the Peruvian Amazon is that there is human presence everywhere. Even in places such as these swamps, not very appealing nor

5. *Astrocarym jauari* in periodically flooded forest along lower Curaray River.



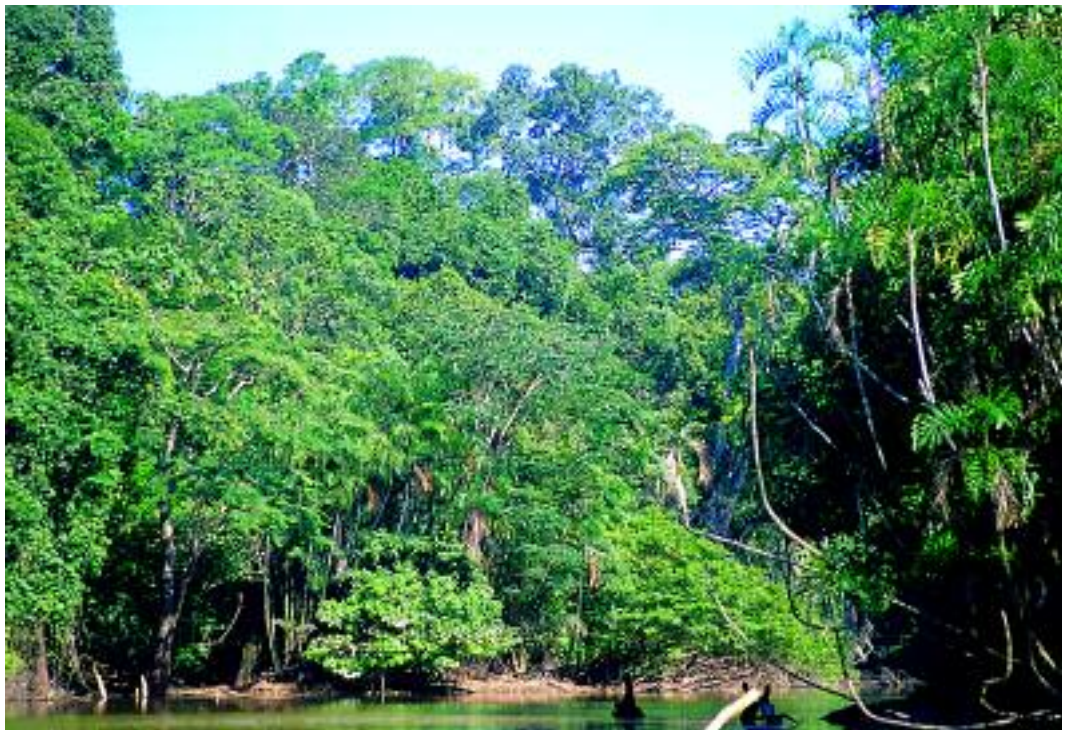
close to any settlement, people come and gather some products of the forest. Extractivism is indeed a very important aspect of Amazon life, and palms in particular provide many products, including palm-hearts, fruits, seeds, building material, fibers etc. I noticed an *Astrocaryum* off the trail and tried to approach it, but it was impossible to walk in the deep mud. Following the example of local people, we cut and put large *Attalea* leaves on the ground in order to reach the palm and make a herbarium collection. It proved to be *Astrocaryum urostachys*. This species was abundant in the swamp, but it had a somewhat different morphology from the populations I knew from Ecuador, with slender stems and narrow leaflets, probably because of the unusual habitat in which it was growing. Other common palms were *Socratea exorrhiza*, with its prominent stilt roots, *Euterpe precatoria* and *Geonoma brongniartii*, a set of species generally abundant in swamps. *Mauritia flexuosa*, the most typical swamp palm in the Amazon, was on the other hand scarce and basically replaced by *Attalea butyracea,* which reached unusual densities in this place. When we went back to the river, we discovered a breathtaking scenery – there was a sunset and moonrise at the same time. The palms were glowing in the orange light of the sun and the moon appeared behind them (Fig. 4). This was really an unforgettable sight.

The third day I explored a hill above the lower Aushiri river, a tributary of Rio Napo. Many emerging crowns of *Astrocaryum chambira* and *Iriartea deltoidea* caught my attention, but the understory proved to be very poor in palms, with only *Hyospathe elegans*, *Chamaedorea pauciflora* and a couple of *Geonoma* and *Bactris*.

The fourth day we awoke at the mouth of Rio Curaray, the largest tributary of Rio Napo. Again the light was very special, and we decided to explore the lower course of the Curaray in the morning, taking many photographs. *Astrocaryum jauari* was abundant along the river, on the lower terraces (Fig. 5). In some places, the shores were lined with clumps of *Bactris riparia*, which was also a spectacular sight (Fig. 6). *Astrocaryum urostachys* was still abundant in these forests, now far from the Ecuadorean border (200 km). Just 5 km downstream of its confluence with Rio Curaray, Rio Napo makes a curve at 90° to the east as it follows the northeastern limit of a major hill system, the Iquitos arch. Since *Astrocaryum macrocalyx* is known from other sectors of the arch, it was important to document what species grew in these hills. We stopped at the small settlement of Copal Urco, a toponym meaning "hill of the copal tree" (copal is a name applied to various resiniferous Burseraceae species). There we looked for someone who could guide us in the forested hills. Local people in the Amazon are always happy to help visitors. We just asked if someone could show us some *huicungos* (the vernacular name of *Astrocaryum* species with leaflets arranged in one plane) and a man immediately volunteered to accompany us. We soon found the palms, which turned out to be *Astrocaryum macrocalyx*. We asked our guide if these palms were always solitary, and he confirmed this important point. So the boundary between the two *Astrocaryum* species was clear. *Astrocaryum urostachys* grows in the alluvial plain and *A. macrocalyx* in the hills of the Iquitos arch. Where these geomorphological structures meet, as here near the mouth of Rio Curaray, there is a contact between the two species. There is thus a sharp boundary between a species previously known from Ecuador and another described from Iquitos, exactly what we were looking for.

But what happened with the other species having a similar distribution pattern? So far we had not seen any of them. Interestingly however, the house of our guide had a roof thatched with *Lepidocaryum tenue* leaves, one of the species abundant in the Iquitos arch. We asked the man where he gathered these leaves and he said the palm grew rather far away from the river, three hours walk from Copal Urco. Then we realized that the areas we were visiting in the immediate vicinity of Rio Napo did not represent all the diversity of habitats found in the region and that we were missing some important palm communities. Unfortunately, there was no time to conduct field study away from the river and we had not the opportunity to document other species limits during that trip. It took three more days to reach Iquitos. All along the lower Napo, we saw *Astrocaryum macrocalyx* abundantly on alluvial terraces, just as *A. urostachys* grew in the upper Napo, but we no longer saw the latter. This gave us further information: there is no ecological differentiation between the two species, and the contact encountered at the base of Iquitos arch may represent the point were the colonization fronts of the two species meet.

This expedition was therefore very informative, as it contributed towards bridging the gap in our knowledge between areas of



6. *Bactris riparia* on the banks of a small tributary of Rio Curaray.

palm inventories showing different species composition. However, much more remains to be learned before we can fully understand the distribution patterns of palms in the western Amazon.

Acknowledgments

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