

The Darien

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Positioning himself to start, Omar placed one hand lightly on my back and took up my right hand in his left. He hesitated, dropped his hands, and explained, “Look, in salsa, it’s the man who decides.” I stood in front of him in dirty pants, a sweaty T-shirt, and muddy rubber boots. I nodded. It was my first Latin dance lesson, and of course, I would let him lead me.

We were in a urine- and beer-stained bar in the village of Sambu, in the Darien of Panama with Lissy and Tom, wife-and-husband biologists who’d spent a good part of the last twenty years in the forests of Panama. We’d left our stifling, sub-hygienic accommodations at COPFA—the hoof and mouth clinic—to find food, but we’d only found the smelly bar perched on wooden stilts.

The music started, loud and fast. As the beat penetrated the heavy lowland air, I tried to pick up the cadence—I had not yet learned to distinguish a salsa from a merenge. Omar made it look easy. His feet moved slightly, his hips and torso even less, but his entire body was as sensuous and fluid as the curving Darien waterways we’d spent the last week exploring, the dancing as elusive as the tree we’d been searching for.



Two months before in Utah, Lissy and Tom had suggested I tag along with them, as well as Omar, a Panamanian who would soon be coming to the States for a PhD. “You can check out the *Prioria* forests as a potential dissertation topic,” Tom told me. Other than knowing it was a

tree, I didn’t have any sense of *Prioria*, or more importantly, what I’d do in graduate school, so I decided to go.

Five minutes after take-off from Panama City, we were flying towards a green horizon. Below us, brown rivers twisted through low-lying forest like giant earthworms crossing Kentucky bluegrass lawn. From the air, I was thrilled by the green below me, but found it hard to imagine how I’d be able to complete a dissertation in such a remote place. Known as the Darien Gap, eastern Panama is the only break in the Pan-American Highway between Alaska and Tierra del Fuego in Argentina. The enormous swath of low-lying land—some 16,000 km²—became exposed only in the last three million years, so colonization by plants has been relatively recent.

The Darien basin pulses daily as rivers, streams, and tributaries swell and ebb with the ocean tides. The water table is always high, and like a sponge, the ground soaks quickly in the rainy season. Rivers rush over their banks then, covering the lowest-lying land with brackish water. There are permanent swamps, intermittent swamps, and upland patches that never flood. *Prioria copaifera*, or cativo, is the most abundant tree, and unlike most tropical tree species that coexist with many other species, cativo forms large monodominant, or single-species, forests.

Cativo’s abundance suggests it’s better at coping with inundation than other flood-tolerant species, and Tom had heard that it also dominated on well-drained soils, which was odd. Not only are single-species stands on well-drained forests a rarity in the tropics, but dominating in both swamps and dry soils would make cativo a sort of super-species, but like Superman or Wonder Woman, not likely to be real. Still, Tom had been working in the tropics long enough to know that there are always surprises; he needed to look for those upland cativo trees himself.

The fifty-minute flight landed us on a grass runway at the outskirts of El Real, the frontier town where we began our search for upland cativo. Politically, the Darien has floated between Colombia and Panama, ignored first by one government and then the other, and for years now, it has been a well-known safe route for drug traffickers moving goods. El Real was particularly inhospitable. We all spoke Spanish and Omar was Panamanian, but as a long-haired, ear-pierced city boy, he was as much a foreigner as we.

The locals stared at us, but made no greeting. Instantly sticky with sweat, we stood in the hot sun and waited for someone to offer us a ride. When the plane took off on its return flight to Panama City, I couldn’t

help but feel we'd been left behind.

Tom had planned months in advance, but his planning disappeared as if written in ice, and we were cast into weeks of improvisation. Through the forestry officer in Panama City he'd arranged a meeting with the local chief, a short and exceedingly stout man named Chicho Bristán, but when we arrived in El Real, Chicho had gone to Panama City for Father's Day. No one knew when he was coming back.

We put up at the best hotel in town, "El Nazareno," named for the revered black Christ of Portobello. Each room hosted two ancient hospital cots with soft mattresses that folded like hammocks under any weight. As we sat on the cots, cockroaches dropped and scurried to the dark corners of the room. Lissy found a large dead rat floating in her toilet bowl. Without a sewage system, El Real relied on daily tides to cleanse the mucky canals that zigzagged across town. High tide fumes were dreadfully rank; low tide smelled marginally better.

In the bar we talked about what to do. Lissy, Omar, and I were content to sit with the locals, unfriendly as they were, and drink beer, but Tom was hungry and anxious to get into the forest. He and Lissy set off to find a boatman and lunch. An hour later, they still hadn't found food, but they'd enlisted Jesús, a slow-moving elderly local, to take us to see a *cativo* forest the next day.

I lay in bed that night and tried to sleep despite a mattress that engulfed me like a hotdog in an oversized bun, but the suffocating humidity kept me awake. Lowland rainforest is the most humid place on earth, the thickness of the air like a steam shower, and every movement—from walking to dressing to lying in bed and just breathing—is cumbersome. At sunrise the next morning, we dragged ourselves from bed and went to meet Jesús under a sprawling fig tree.

In the Darien, highways are made of water and a canoe with an outboard motor is the vehicle of choice. We stepped carefully into the canoe and sat down on short-legged wooden chairs. With each additional person, the canoe sunk lower until its sides were just above the water's surface. Jesús jerked on the starter cord, the motor roared, coughed up black smoke and then settled into a loud hum. We zipped down the waterway to a forest on the opposite bank.

I was at the end of my first year in graduate school and exceedingly naïve. Later I realized that students choose their dissertation advisors carefully, but I'd fortuitously landed in Lissy and Tom's laboratory the previous August. Between their research in Panama and San Diego

and mine in Mexico and Costa Rica, we'd only overlapped a few weeks that first year. I didn't know them well and couldn't have predicted their behavior when we arrived at the forest. Lissy, with the body and energy of a twenty-five year old, jumped out of the boat followed by an equally fit Tom. They scrambled up the muddy bank and began to identify plant species. Like two children on an Easter egg hunt, they called out names of plant families to one another: Maranthaceae, Anacardiaceae, Myristicaceae, Solanaceae. They debated plant genera. Was it *Viola* or *Iryanthera*? I could immediately see the strength of their partnership and how they'd become such a force in tropical ecology. Lissy had the eyes of an ecologist, whereas Tom was more of a biochemist and physiologist, and over the past twenty years their complementary ways of looking at the world had triggered many novel ideas.

My purpose on the trip, besides looking for a research project, was to collect *cativo* roots, which I planned to check later for mycorrhizae—ancient, microscopic symbiotic partnerships between plants and fungi. The fungi live in the plant's roots and from there, cast out their root-like hyphae, which take up nutrients and bring them back to the plant. In return, the plant gives the fungi carbohydrates. For many species, the partnership is obligatory—fungi can't survive without the plants and the plants don't grow well without the fungi. Virtually all plant species on earth form mycorrhizae and those that don't are thought to have lost them over time, but debate existed as to whether a flood-tolerant tree standing in oxygen-poor water could associate with the beneficial fungi, which require oxygen. I was going to find out.

We hiked inward from the river, past species that could deal with the salty water until we came to *cativo* forest and waited while our eyes adjusted to the dimness. The water, stained reddish-black from the slow decomposition of tannin-rich *cativo* leaves, shimmered, reflecting the bit of light filtering through the dense canopy, creating a coffee-colored shade of darkness. We walked deeper into the water, which soon spilled over my knee-high rubber boots and flooded my feet.

Lissy plunged her hands into the dark, gunky water. Reaching into layers of slimy leaves, she felt around and pulled up masses of black *cativo* roots. I'd never been a fan of mucky things, but Lissy didn't seem turned off by the slime and so, not wanting to seem wimpy, I pushed past my repulsion and forced my hands into the black water as well.

Tom asked Jesús about *cativo* growing on upland sites that didn't flood. "Pues, sí," he knew of a *seco*, or dry place.

“Would he be willing to take us?” Tom asked.

“*Pues, sí.*” If Chicho Bristán didn’t arrive on the next morning’s flight, he’d take us to the dry site.

Back at El Nazareno late that afternoon, we hadn’t eaten all day, but Lissy wanted to use the remaining daylight to identify the indistinct leaf samples she’d collected. She took a couple of swigs from her plastic Nalgene bottle of rum and went to work with Gentry’s *A Field Guide to the Families and Genera of Woody Plants of Northwest South America*, the tropical botanist’s bible. I watched the day turn from blue to black and thought about how it was that plants, let alone people, survived in this place. Tropical soils are short on nutrients, high in clay. Compost from dead plants and animals that we count on in the temperate zones to enrich our soils every fall is immediately recycled in the tropics or washed away by torrential rains. And lowland Darien suffered the extra difficulty of daily tides, seasonal rains, and extended periods of flooding.

Chicho returned, but the celebration of his prolific fatherhood continued, so the next day we went out with Jesús again, hoping to see cativo growing on well-drained soils. After a few moments in the canoe, it was possible to ignore the motor. I reached out and let my fingers skim across the water, patting my face from time to time to cool myself. Tall grass banked the wide river and occasionally, a single, towering ceiba tree hinted at forest that no longer existed. We passed only one person, an indigenous Embera man, standing almost-naked in his long, hand-carved canoe. He glanced briefly at our boat and went back to maneuvering around the shore with a wooden pole. Smoke puffed behind the grass on the bank above him, suggesting a house and family. Thirty minutes later Jesús guided the canoe up against a steep bank, and we climbed out onto a fallen tree and pulled ourselves up the muddy slope. We followed Jesús into the forest to a large patch of cativo trees, whose roots were covered by a three-inch cap of water, the soil spongy under our boots.

“*Seco,*” announced Jesús.

“¿*Seco?*” Tom responded incredulously.

The next day we tried again. After a long discussion between Chicho and Jesús, during which Chicho explicated at length and Jesús mumbled yeses, we were taken up a small tributary to a supposedly dry site, which turned out to be dry indeed, but instead of cativo we found only a cornfield. As we had traveled up the narrow tributary on our way there, Omar turned to me and said, “I don’t know how we’re going to get out of here.” I laughed, but I didn’t know what he was referring to until a few hours later when we tried to leave the cornfield. Omar had been talking

about the tide. When we’d motored up that morning, I hadn’t noticed that the tide was flowing in and so I didn’t realize, like Omar had, that by the time we left, it would have changed directions and gone out. The water level in the stream had fallen precipitously.

This would be the first of many times that Omar articulated the opposite of what he saw, the way things might go, a skill that would later prove useful as a biologist, not to mention dance teacher. Logs and vegetation, previously hidden under red-brown water, were exposed so that we had to repeatedly climb out and haul the canoe over land in order to proceed. Every time we stopped to carry the canoe, Tom became more frustrated. “Another day wasted,” he muttered. His strained face told me that he was tired and hungry. The shortage of a balanced diet, coupled with no success in finding upland cativo and the general difficulty of the Darien, was getting to him. Lissy whispered something in his ear and he seemed to relax. Lissy and Tom’s scientific collaboration and marriage, I started to see, was really a long-term dance partnership.

After three days in El Real, without finding cativo on well-drained soils, we traveled east by dugout to Yaviza and then hitched a ride to the regional forestry station in Meteti. The forest service office was empty, but a dim light flickered in a room above. Upstairs we found a thin, young man watching the first round of the 1994 World Cup. He invited us to sleep at the forestry station.

The next day he took us to a large forest reserve still mostly free of squatters and corn plantations. We hiked past huts and through fields, greeting the local people. The forester showed us the cativo swamp and the saplings he studied. Again, Lissy and I lowered our hands into the deep brown muck to lift out black cativo roots. I heard Tom asking the by-now proverbial question about cativo on well-drained soils.

“*Pues sí,* of course there are dry sites,” the forester said.

“Could we go there?”

“*Pues sí.*” He would arrange someone to take us the next day.

The next day we were taken to a “dry site” where water didn’t quite top my knee-high rubber boots. Day after day, we were taken out to cativo forests that ranged from *seco* to *humido*, but the amount of water never seemed to concur with words used to describe them. Sometimes, *seco* was sappy wet, other times, it was calf-deep. In one site, described as “not inundated, but humid,” we waded in thigh-deep water. We wondered why people kept telling us that there were stands of cativo on well-drained soils. Was it politeness that restricted them from saying no, or had they

purposely misled us? Maybe such behavior had begun long ago with the Spanish who tortured and burned local people who did not promise food, gold, and cinnamon ahead.

After two more days in Meteti, the forester arranged for us to travel to La Palma with a boatman named El Lechero, the milk man. We buzzed up the wide river, pushed along by the incoming tide. As El Lechero was telling us that the water was higher than normal because of recent heavy rains, a loud crackling overtook his voice. Without hesitation, he swerved to the left bank. The crackling sound turned into a deafening explosion as a tree on the opposite river edge broke away, slipped down the eroding mud bank and crashed into the water behind us. I'd been thinking about mycorrhizae, physiology and competition among species, and how these could be related to the dominance of *cativo*, but in that instant, my perspective shifted and I was left pondering the role of chance in forest dynamics.

On the last day we visited an Embera community near Pavarandó that hosted gorgeous cospes of *cativo*. A young boy met our canoe and accompanied us to his village, a grass clearing of thatched open-sided houses built on stilts. The boy summoned a man who took us into a virgin forest of immense *cativo* trees, the largest we'd seen on the trip. Off on my own, I took a break from root collecting and stood straight. The black water settled around my boots. There was a quietness, not even the leaves made noise as they fell. The darkness engulfed and settled me, a silence so intense it felt like peace.

I heard someone wading toward me and looked around to see Tom, head down, moving slowly through the water. When he had almost passed by, he noticed me and stopped. "This is amazing." I knew he was thinking about *cativo* and trying to figure out how it dominated the Darien so successfully when there were many flood-tolerant tree species that should have been there as well. We walked back to meet Omar and Lissy.

"Omar has an interesting hypothesis," Lissy said.

"I don't think it's the floods," Omar explained. "I've been thinking about how people keep calling these places *seco*, so I think they must be dry during the dry season. We're just here at the wrong time. And I bet *cativo* is so common because its saplings are better at dealing with the drought that comes after the rainy season."

Tom didn't jump at Omar's explanation. Flooding was known to be a challenge for plants, and we had no evidence that the water table ever got so low so as to stress *cativo*, but the idea made him think.

Back in La Palma, we embarked once again with El Lechero. As we motored along, I considered the confusion surrounding *seco*. Those sites might be truly dry, just at different times of the year. It was a matter of temporal scale. What was dry at one time of one day could be wet the next. It required consideration of the tides and multiple seasons at once. Ultimately, the idea that *cativo* saplings tolerated the alternation of flood and drought conditions better than other tree species became Omar's dissertation project, and years later he defended his doctorate with physiological data supporting his hypothesis.

Late that afternoon we arrived back once again at Meteti and opted to stay at the Hotel La Felicidad instead of the forestry station. Omar and I spent the evening practicing dancing. We danced one way, and quickly without noticing, he turned us around the other way. Subtle changes of pressure in his right hand on my back were meant to warn me of the directional change to come, but I was out-of-tune and didn't understand until it was too late. He stopped dancing, and began a lecture. "*Mira*, salsa has to look effortless. The man listens to the music. You go with him. Your bodies are one. There's no predicting or planning. *¿Entiendes?*" Understanding was easy, but allowing myself to be a passive partner, letting my body be led by him and the music, was strange and difficult.



I did find mycorrhizal fungi in the roots of the *cativo* tree, but I didn't end up working on *cativo* for my dissertation. Twenty years later, though, I still think about the Darien and those first dance lessons. I feel the squishy, sopping ground beneath my rubber boots, and I think of the sheer difficulty of that place, the precariousness of life imparted by low-lying tropical land, tides, stifling humidity and a scarcity of resources. I see coffee-colored water and the massive, straight-trunked *cativo* trees rising from the swamp. I sense that the trees there have achieved something profound. They've figured out how to make a living by a kind of passive partnering, accepting the movement and rhythm of the rains, tides, and floods that occasionally overtake them and then the dry times that come later.

I can also still feel Omar's hands on my back, encouraging me to understand his touch, trying to get me to move without effort or resistance. I realize now that Omar had been describing more than the rhythm of a

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salsa dance. Intuitively, he knew all about predicting which way to go based on his senses, feeling what he couldn't see. He understood it was a matter of looking at the world as partner and then imagining it turned around.