The Archaeology of Anthropogenic Environments

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5. The Forest as a Fragmented ArchaeologicalArtifact

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Abstract: This chapter presents evidence that shows the selective processes that generate diversity in the rainforest. In conjunction with lowland tropical rainforest, tropical forests in the Andes are considered one of the major areas of plant diversity. The study area, the Upper Buritaca River drainage, indicates that the "natural" forest seen today is the product of past human selection. The activities of the Tairona people were the selective forces that shaped the physical characteristics, high species diversity, and structural composition present in the area. The data presented support the interpretation that we can look at the forest as an archaeological fragmented artifact. Similar processes took place in all of the tropical cloud forests of the Andes from Chile to Mexico.

My data suggest that even though tropical forests contain many different plant species, they are far from random assemblages... The overall message is that plant communities are put together in decidedly non random ways.


We can make the argument today that there are no pristine forests in the Andes or the neotropical lowlands (Willis et al. 2004). The plant distributions or plant communities that we observe today have been affected by millennia of indigenous human intervention; they are the remains of resilient communities of plants that humans selected and that have expanded into spaces that once were open grasslands or areas of intensive or shifting agriculture. This type of selection defines the structure of plant communities or assemblages.

This relationship means that when we look at a forest in the Andes, we should consider it an archaeological ecofact, because it yields information about the environment at the times of landscape management and occupation, including information on the use of plants by the inhabitants and on other natural resources utilized for various purposes. In archaeology, houses made of perishable materials do not survive, but forests of managed palms (used for thatching and other purposes) behave through time like the fragments of ceramics and artifacts made of rock and are distributed over space, giving meaning to archaeologists in their reconstruction of spatial activities. In this chapter I argue that modern tropical forests are likewise a product of human hands, so we can look at the forest today as an archaeological assemblage with patterns that can help us understand the use of the landscape in the past and the dynamics of the tropical forest as part of an indigenous human history (Balée 1998, 2006; Denevan 1992; Kirch 2005; Willis et al. 2004). Other researchers have studied neotropical vegetation in the present to understand archaeological past human actions in various forms. Case studies using this approach include those on hunter-gatherer mobility (Bonzani 1998) and the nature of the present forest as a product of the Maya mastery of the biota (Campbell et al. 2006), as well as those looking for the anthropogenic signature of forests and dark soils (Clement et al. 2003), the relationship of archaeofauna and forest fragmentation (Stahl 2000), and the history of landscape and archaeological mounds (Erickson and Balée 2006). This chapter establishes that prior to Spanish conquest, humans utilized economically important tree species and that these survive today, having expanded downslope after European contact from the fragmented forests of mountain ridges to engulf previously utilized agriculturally diverse lands.

The Sierra Nevada de Santa Marta as a Fragmented Artifact or Ecofact

The Sierra Nevada de Santa Marta (SNSM) is one of the most complex ecosystems of the world due to its northern location on the geological formation of the Andes. It is a massive mountain with a pyramidal shape that faces the Caribbean Sea. The highest seaside mountain in the world, it rises to a height of 5,775 m asl (Figure 5-1). Due to its vertical variability and endemism, it has been a focus of study since the nineteenth century (Allen 1900; Hooghiemstra and van der Hammen 2004; Reclus 1881; Simons 1879, 1881; Strewe and Navarro 2004; Todd and Carriker 1922; Van der Hammen and Ruiz 1984).

The variation of the SNSM is striking not only for the diversity of ecosystems that range from deep-sea bays to glaciers but also because of its horizontal variation that decreases with altitude, as in other parts of the Andes. This horizontal and vertical ecological variation is a consequence of climatic factors such as patterns of wind and marine currents that affect the area in an unequal manner. For example, the region of the lower Gaira River drainage is affected by Föhn-type winds that dry the area in the direction from the mountain to the sea (western side of the SNSM; Figure 5-2). In contrast, the Tairona Park region is affected by winds that run from the sea to the mountain (Herrmann 1984) or, in the case of the Upper
Buritaca, by mountain valley winds. This wind variation affects the precipitation of each area and, as a consequence, the vegetation formations. Precipitation data from the SNSM are very diverse as well, in terms of altitude and wind patterns. In regard to vegetation zones, for example, the region of Gaira is mainly characterized by tropical thorn woodland or semideciduous lowland forest (Cleef et al. 1984). Tairona Park has a gradual horizontal change from the west to the east at the same altitude (0–500 m asl) from tropical thorn woodland to very dry tropical forest to equatorial rainforest. In contrast, the Upper Buritaca has an Andean rainforest also known as upper montane rainforest (Cleef and Rangel 1984).

The morphological variations can be illustrated just by considering the variation in the slopes of the regions under analysis. For example, Gaira is characterized by having an inclination below 20 percent with the surrounding hills between 20 and 40 percent. In contrast, small floodplains and the end of the bays surrounded by hills with slopes between 60 and 80 percent characterize Tairona Park. The Upper Buritaca is located in a landscape where most of the terrain is from 60-percent to more than 80-percent sloped (Bartels 1984). Furthermore, the Gaira region is located in relation to the littoral in an area of open, deep bays of sandy and muddy floors, which is seasonally affected by Magdalena River sediments. Tairona Park is characterized by having several harbors with coral and rock floors affected by deep currents rich in phytoplankton, which makes it one of the richest fishing areas of northern Colombia (Hernandez 1986).

The only rainforest that currently exists is restricted to the northwest corner of this pyramid in valleys like those of the upper Guachaca, Buritaca, and Don
Figure 5-2. Regions of research. (Drawing by Alejandro Dever.)

Diego rivers (Figure 5-3). Most of the archaeological evidence of the hundreds of settlements of the Tairona culture also comes from the northwest area of the SNSM. These settlements are constructions of hundreds of terraces and a network of stone paved roads (Herrera 2000; Oyuela-Caycedo 1990). The rest of the SNSM is devastated (Cavelier et al. 1998) and reduced to small patches of fragmented rainforest where no complex evidence of archaeological infrastructure exists but where indigenous populations such as the Kogi and Ijka live today (Oyuela-Caycedo 1991, 1998; Reichel-Dolmatoff 1950, 1951a, 1951b).

The question is, how can we account for the existence of the rainforest in an area with previous heavy human occupation on a delicate environment of steep slopes and rapid processes of erosion? The understanding of the archaeological nature of the cloud forest can be established by examining the historical ecology of human occupation. The reduction of the rainforest to fragmented ridges in the indigenous territories can also be understood in the historical ecological context of its past; the archaeological nature of the rainforest in the northwest is the subject of this chapter. In order to understand the process of formation, I will first present a brief history of human occupation of the SNSM.

A History of Human Colonization, A.D. 600–1500

Our knowledge of the archaeology of the SNSM is limited to three regions. I have interpreted the expansion of the "Tairona culture" as being the product of a religious movement that included peoples with different languages and political units (Mason 1931, 1936, 1939; Oyuela-Caycedo 1986a; Reichel-Dolmatoff 1954a, 1954b; Reichel-Dolmatoff and Dussan de Reichel 1955). This
culture was developed around the foundation of religious cult centers that were gradually built from the lowlands to the highlands, creating a network of resource exchange and specialization that correlated with the particularities of climatic altitudinal variation and raw material availability (for a more detailed explanation see Hoopes 2005; Oyuela-Caycedo 2001). This pattern can be summarized as a frontier model of colonization whereby the rainforest became fragmented and restricted to some ridges of the mountain.

The best chronological sequence of archaeological artifacts and settlement pattern is available for the region of the lower Gaira (Oyuela-Caycedo 1987a, 1989, 1995). The sequence of occupation of the area goes from at least 500 B.C. up to the present with continual evidence of occupation. In the case of the region of Tairona Park, the available evidence supports a record of human occupation from around 500 B.C. to the present (see Dever 2007; Langebaek and Dever 2002; Oyuela-Caycedo 1986b). For the Upper Buritaca, the evidence of occupation begins in the tenth century A.D. and extends to the seventeenth century A.D. (Herrera de Turbay 1984, 1985; Oyuela-Caycedo 1986c, 1987b, 1995, 2001). The variation of the three sequences supports the argument for a process of colonization of the SNSM that expanded gradually from the lowlands to the highlands, reaching its highest impact at around 2000 m asl at the time of the conquest.

It is likely that the SNSM had populations that were very dispersed in the highlands and even included hunter-gatherer groups. However, the evidence points to the existence of small villages in the bays and coastal lands that depended on agriculture and fishing. The settlement pattern shifted after a series of catastrophic environmental shifts that took place around A.D. 500–550, just before the occupation of the archaeological site of Mamoron (A.D. 550–800) as well as the site of Frontera in the middle Buritaca River. This time also seems to be related to a dry period that coincided with the desertification of the Guajira at the end of the El Horno ceramic complex (see Bray 1995; Oyuela-Caycedo 1996; Reichel-Dolmatoff and Dussan de Reichel 1951). Further, the evidence from bays
like Cinto indicates episodes of massive flooding that sealed with heavy colluvial materials some of the settlements on the coast such as Nahuange, Cinto, Gairaica, and lower Buritaca and destroyed early occupations. These locations were latter reoccupied and have continued to suffer similar processes since the conquest.

What happened after the catastrophic environmental crisis of the sixth century? One of the fastest processes of population growth and colonization of the northern and western drainage of the SNSM began. The building of small towns and a terrace system that permitted the occupation of the steep mountain and the creation of a vertical road network accompanied this growth. This period is also when the standardization process of the material culture appears to occur and it coincides with the rise of specialist centers of pottery production, salt production, and lithic ceremonial artifacts as well as metallurgy centers. These centers could supply the settlements of this colonization initiated on the coast of the sierra and between the lowland of the Cienaga Grande de Santa Marta and the west of the Sierra Nevada (Dever 2007; Oyuela-Caycedo 2001; Reichel-Dolmatoff 1953). There are also data to support a massive uplift of the SNSM around A.D. 950, this time related to the disappearance of an estuary located in the lower Gaira area and Rodadero Bay. We know that the shoreline became less stable, as indicated by the history of the estuarine environments (see Oyuela-Caycedo 1996) of the Cienaga de Santa Marta and the bay of Chenge (Dever 2007:167–182).

After A.D. 950, the settlement patterns of the lower Gaira, Tairona Park, and the Upper Buritaca are similar in content and the concentration of groups into nucleated settlements. Hundreds of these settlements have been discovered that date after the ninth century, all of them sharing the same religious icons in metallurgy, lithics, and ceramic works.

Two of the largest sites have urban characteristics (water canals, roads, terraces, clear urban planning). The first is Pueblito, located in Tairona Park. The other is Ciudad Perdida (Figure 5-4), located in the Upper Buritaca (Figure 5-5). Both sites are monumental stone-built settlements located in the humid tropical forest. The sequences of occupation in both are similar, dating from the tenth century and ending in the early seventeenth century. Both sites represent the highest technological achievement in terracing and road construction in a very difficult landscape, and both occupations shaped the forest that existed by manipulating it and selecting for specific species.

**The Archaeology of the Upper Buritaca River**

The Upper Buritaca was intensively studied as part of the ecological project of Ecohandes coordinated by Thomas van der Hammen and Pedro M. Ruiz (1984). As a result of this work, we have a detailed transect for the Buritaca ridge between 500 and 3,300 m asl, as well as a transect of the upper Frio River from 3,300 to 4,100 m asl. This research was successful in studying the ecology of the region and took into account the intervention of human populations, using palynological and settlement pattern data (Herrera de Turbay 1984; Van der Hammen 1984). Intensive surveys conducted later resulted in a mapping of the settlement
Figure 5-4. Ciudad Perdida architecture. (Photo Oyuela-Caycedo)

Figure 5-5. Settlement pattern of the Upper Buritaca River and Buritaca transect of Ecoandes project (after Serje de la Ossa 1984).
pattern of the Upper Buritaca, and the archaeological research of the sites creates a basic foundation of knowledge of the human intervention in the region.

Several urban settlements have been found in the Upper Buritaca, creating a network of terrace clusters that makes it difficult to define where a site begins and ends due to the fact that deep valleys cut one settlement from the other. The largest of the sites is Ciudad Perdida, built between 1,100 and 1,200 m asl (Figure 5-5). This carefully planned "city" is strategically located so as to dominate the Buritaca River valley. It has 120 terraces, each with one or more stone-built base level rings that indicate where houses once stood. These terraces are interconnected by a complex structure of flagstone stairs and pathways. All of the terraces have simple systems of water drainage, whereby water is led through designated channels to control its force down these steep slopes. In the drainage canals, the water runs slowly along the stone walls by the stairs and pathways and ends in streams that run past the site. In this way the Tairona were able to control erosion, one of the major problems that typically arise in steeply inclined environments (Serie de la Ossa 1984). If we estimate that a terrace represents one family unit, in contrast to the traditional Western assumption that one house or one foundation stone ring equals a family unit, then we can estimate that this site may have had a population of between 400 and 600 persons living in an area of 18 ha.

The sociopolitical organization of the Tairona culture during the early part of the sixteenth century consisted of relatively independent chiefdoms, each including a priestly class and a hierarchy of chiefs as well as arts-and-crafts specialists (e.g., gold workers, semiprecious stone engravers, and merchants). This arts-and-crafts specialization, coupled with intensive agricultural product exchange, was made possible because of the regional ecological diversity found in the SNSM. The diversity encouraged the development of centers of specialization and regions of production for such items as ceramics, lithic artifacts, and agricultural products, which are now beginning to be outlined and understood through the reconstruction of the pathway-grid system that connects all of the sites.

To facilitate the redistribution of products, the different regional chiefdoms of the northeast of the SNSM built an extensive network of paths, bridges, and paved stairs. Centralized political complexes coordinated the whole commercial mechanism for one or more of the mountainous valleys, such as did Ciudad Perdida. The basic products of exchange from the coastlands to those valleys were fish, salt, shells, cotton, tobacco, and manioc. From the hot-moderate climates came beans, avocados, and fruits and from the moderate-cold climate came coca leaves, potatoes, and sweet potatoes. The exchange of squash and corn occurred at different altitudinal levels as did the exchange of craft items (Herrera de Turbay 1985). Corn constituted the basic staple in Ciudad Perdida to which numerous grinding stones scattered throughout the settlement attest. The presence of irrigation canals along the coast and garden terraces in the mountain areas indicates that the Tairona cultivated the land intensively; even areas beside the sea were exploited for the seasonal production of salt, and in the case of a low yield of fish due to ecological factors, agriculture also could be intensified along the coast.

The pollen studies conducted by the Ecoandes project have shown that the whole area of Upper Buritaca had been covered by rainforest prior to the ninth
century and that around the end of the tenth century a process of occupation and deforestation had begun. Carbon 14 dates obtained from an excavation I conducted in 1982 have confirmed that the early occupation of Ciudad Perdida began around 950 ± 60 years before the present. The site was occupied until the sixteenth century when the Spanish conquest began its process of war and destruction. The Spanish conquest had catastrophic consequences for the native population, reducing it to less than 1 percent of its original numbers in a hundred years of continuous battles. After the conquest, the region was completely abandoned around A.D. 1630 ± 55 (based on $^{14}$C dating associated with collapsed structures and garbage; Oyuela-Caycedo 1986c, 1987b), and soon vegetation expanded from the Buritaca ridge and secondary ridges and covered the remains of the settlement. The surviving indigenous population, who were not absorbed by the Spanish culture in the indigenous "resguardos" of the coast, found refuge in the northeast of the SNSM in the upper parts of other rivers like the Palominos and San Miguel, where they continue to live with their religious belief system. This current occupation has not allowed the forest to recover and expand as in the Buritaca region (Figure 5-6).

The Archaeological Rainforest of the Upper Buritaca

The Buritaca transect of the Ecoandes project (van der Hammen and Ruiz 1984) illustrates the diversity of species and its relationship to altitude. However, it can be recognized in the data that there is a significant decrease in diversity from 1,500 m to the upper limits of rainforest above 3,000 m. One aspect that is noticeable in the transect is that data on the characteristics of the lower parts of the Buritaca in the floodplain valley are not presented (<500 m). In this region where forest is preserved today between the Buritaca and Don Diego rivers is found a large density of avocado trees growing in a mature rainforest, as well as large clusters of cacao trees where there are no signs of human occupation in recent times. However, archaeological sites are present. Cacao (Theobroma cacao) trees have been identified at least since 1742 in Nicolas de la Rosa’s chronicle, where he reports “their forest is fertile, in the Pasos de Rodrigo and the Piedras river. There are large trees of Cacao that produce without cultivation, even if for more than one hundred years the area has been depopulated. Previously, haciendas of some sort or the other existed” (De la Rosa 1975 [1742]:183). The origin of these cacao trees is not clear because there is no evidence that the Tairona used this plant. Therefore, it is difficult to account for its presence, though it is mentioned to have existed from the beginning of the Spanish occupation in different regions around the SNSM (De la Rosa 1975 [1742]:312). The characteristics of these cacao trees have been intriguing to botanists (Bartley 2005) and require further research.

The other plant that is reported and has the same characteristics of being "wild" and difficult to account for unless we accept the archaeological nature of the rainforest is the avocado tree (*Persea americana*). These trees are predominant in the Buritaca Valley, and when they ripen, the abundance of the fruits is signifi-
cant. The production of fruits begins in the lowlands and gradually moves up the valley. *Persea americana* (Kopp 1966) was found in densities of 28 percent in the arboreal strata above 10 m in height in an area of 600 m² studied at 520 m asl (inclination 30–35 percent) on the ridge (Figure 5-7). However, *Persea americana* has been observed above the altitude of Ciudad Perdida in patchy distributions on the hillsides and in large densities probably ranging up to 25 percent in some places (Table 5-1). The characteristically large fruit has an edible creamy pulp eaten by white-lipped peccary (*Tayassu pecari*) that concentrate close to this forest when the fruit is available. The *Persea caerulea* is a wild avocado, as is the *Persea ferruginea*.

Other species are found in the transect that are related to human activity of the Tairona. They have a patchy distribution, as for example at around 700 m asl with *Ficus trigona*, a well-known antidiarrheic. Another patchy distribution of *Calathea insignis* is found in the bush strata (1–3 m in height) at 520 m asl and covers 7 percent of the examined area. This species was detected up to 920 m asl. Its distribution relates to archaeological sites and past human use. The leaves are used to wrap foods for cooking (Carbonó 1987; Cuadros 1990:81).

Cleef and colleagues (1984:288–289, 384) recognizes that the rainforest of the Upper Buritaca is the result of 400 years of abandonment since the collapse of indigenous cultures and the richness of palms is probably the result of human action in the past. An examination of the data seems to support the close relationship of palms and direct areas of human action in the archaeological past. This relationship is borne out in the case of the area close to Ciudad Perdida, where
Equatorial forest or lowland rainforest

S. MARTA, Buritaca
500 m

Van der Hammen and Ruiz 1984

Figure 5-7. Equatorial forest or lowland rainforest at 500 m, Buritaca transect. The circles mark Persea trees and the square Virola trees (after Cleef et al. 1984:306).

Dictyocaryum schultzei (ivory-nut palm) is predominant in the rainforest growing by the site. This palm is an important source of construction material for roofs and walls (Table 5-2).

The dense population of Bactris sp. at 920 m asl is also related to the archaeological site of Ciudad Perdida. This palm, known as “chonta,” is important for the manufacture of artifacts such as bows. The spines also are economically important, as are the edible fruits (on archaeological recovery of palms in the New World see Morcote-Rios and Bernal 2001).

The transect of Buritaca not only reveals populations of species that can be considered artifacts of past use by the Tairona and whose distributions have been a product of human selection, but also indicates the potential of building hypotheses about plant populations that were potentially used in the past but whose uses have been abandoned by the descendants of the Tairona. This is the case with Virola sebifera, a well-known Amazonian plant from which is extracted a hallucinogenic alkaloid used as a juice/gum or dried powder and consumed as snuff or smoked as a drug (MacRae and Towers 1994; Smet 1985). The alkaloid is obtained from the bark. The plant’s resins are also used as arrow poison in some Amazonian groups. We do not have ethnographic evidence of the use of any alkaloid-based drug, be-
Table 5-1. Persea Species and Their Coverage in the Buritaca Transect Between 500 and 3,300 m alt

<table>
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<tr>
<th>Species</th>
<th>Altitude (m asl)</th>
<th>Area of Collection (m²)</th>
<th>Inclination (degrees)</th>
<th>% of Arboreal Strata &gt;10 m</th>
<th>% of Arbitreal Strata &gt;15 m</th>
<th>% of Arboreal Strata &gt;8 m</th>
<th>% of Subarboreal Strata (4–8 m)</th>
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Note: Data extracted from Cleef et al. 1984.
Table 5-2. Palmae Species and Their Coverage in the Buritaca Transect Between 500 and 3,300 m alt

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Note: Data extracted from Cleef et al. 1984.
sides coca, by the Kogi or Ijka of the SNSM today. However, it is possible that these were used previously. In the transect this plant occurred at 3-percent coverage. In context, *Persea americana* covers 28 percent of the area at 520 m asl and is less frequent (1 percent) in some areas up to 1,125 m asl. *Virola sebifera* is a tree found growing on the archaeological site of Ciudad Perdida (Figure 5-8).

There are other examples of plants that seem to be distributed in relation to archaeological settlements and that point to their archaeological nature as being promoted or selected for by the human populations that occupied the Upper Buritaca. Some of these plants are important economically for the Kogi. This is the case with *Weinmannia pinnata*, found at an altitude close to Ciudad Perdida (1,125 m asl) in concentrations of 18 percent of the coverage. This plant is important for construction materials and medicine and is one of the 12 dyes that the Kogi Indians use today (Carbonó 1987). There are other plants that we can recognize in communities and patches that seem to be more a product of human selection than a random process of dispersion and natural selection.

What we learn by looking at the data from the Buritaca transect and the settlement pattern of the Tairona is that the main impact of human selection was strong up to probably 2,000 m asl. This favored a later recovery of the forest that moved down the landscape integrating the gardens of avocados, palms, and many other plants in an archaeologically structured rainforest.

**Final Comments**

The main objective of this essay has been to stress that the tropical forest can provide us with information on past landscape use. Further, it can produce hypotheses to be tested with the macrobotanical remains of carbonized wood and seeds found in the excavations of archaeological sites. In the future we expect to obtain more data that confirm the human selection of this forest.

The case of the Sierra Nevada de Santa Marta is important in that it was a marginal area to the processes of intensive human population compared to other areas of the Andes or Mesoamerica, where the impact was even greater than what we can observe in the SNSM. That is the case, for example, in the Peruvian Andes, or the Maya area, where the rainforest covers hundreds of archaeological sites going back for more than four millennia of intensive use. The depopulation created by the conquest favored the expansion of the fragmented forest with managed and cultivated fruit trees, which has brought about the perception of these areas as being pristine rainforests not altered by humans (Willis et al. 2004). None of the rainforests that grow in the Andes or in Mesoamerica have escaped the selection of human populations. As a consequence, we have to start looking at them as a product of human history with remains of forest populations that make them archaeological artifacts of the past.

One of the major problems that we have in understanding the Andes is the lack of archaeological knowledge of the region in terms of the history of human occupation and its impact before the depopulation of the area due to the Spanish conquest and pandemics. In some regions, demographic decline on a scale
estimated at 85 to 100 percent of the indigenous peoples occurred. The lowlands were the areas most affected by the epidemics introduced in 1492. The impact of such depopulation favored the expansion of the forest over ancient cultivated lands or forests that had been managed before the conquest (Cook 1998; Denevan 1976, 2001; Newson 1995:25–79). I would argue that it was the depopulation of large regions of the tropical Americas that has allowed the forest to expand over managed agro-diverse landscapes, which have maintained even after abandonment a signature of their past uses. More important, the multiplicative effect of past human activities of selecting plant distributions has had a strong effect on the structure and characteristics of all of the forests that exist today in the Americas. The forest’s past before the conquest was one of fragmentation and constant change in the lowlands and the Andes. The Spanish did not conquer a continuously forested continent, but one that was probably enriched in diversity by human selection and management. However, it is in the cloud forest where this impact was probably most significant in the past, as is illustrated with the case of the SNSM.
Notes

1. "It was here, about two miles from the base of the hills, that I first observed the Cacao tree . . . The important fact with regards to these trees is that they are of spontaneous growth, and therefore wild cacao, the original Theobroma cacao . . . At Don Diego and still further to the west, a distance of about 40 miles from Dibulla, cacao is found in the forest under precisely the same conditions as those described. And I am informed that all along the base of the Cordillera to Treinta, where the eastern extension of the Sierra Nevada disappears, cacao equally abounds. Thus a continuous distribution from beyond Don Diego to Treinta of about 100 miles. This great cacao zone is entirely uninhabited, and the lands, though obtainable for a few reals per hectare . . . Under the dense shade of the forest trees 80 feet high, with trunks 5 and 6 feet in diameter, the cacao presents an aspect totally unlike its cultivated congeneres. The mature cacao trees attain a height of from 35 to 45 feet, with slender trunks devoid of branches to within a few feet of the top, and these trunks are as straight as those of a palm tree" (Thomson 1894; this information was extracted from notes provided by Basil G. Bartley, letters of July 16, 1997, and January 13, 1998).

2. The earliest mention of avocado forest is found in De la Rosa (1975 [1742]:312), where he indicates that close to Santa Marta (a town located on the coast below the SNSM) there are large forests of avocado.

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