Principes, 33(4), 1989, pp. 181–190

The Rise and Fall of Vegetable Ivory

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People of the older generation who lived during the pre-World War II period may remember vegetable ivory or ivory nut. To younger generations this natural material remains largely unknown. Exploitation grew quickly at the beginning of the 20th century and improved considerably the trade balance of several South American countries. About $5,000,000.00 worth of vegetable ivory were exported from South America annually at the beginning of the century (Barrett unpubl.). In the twenties, 20 percent of all buttons produced in the United States were made of vegetable ivory (Acosta Solís 1944). The major producing countries were Ecuador, Colombia, Brazil, Peru, and Panama. World trade of vegetable ivory increased until the outbreak of World War II. During the war, the buying countries decreased their import and afterwards vegetable ivory never again regained its influence. The plastic age had begun while the knowledge of a unique natural material has become lost.

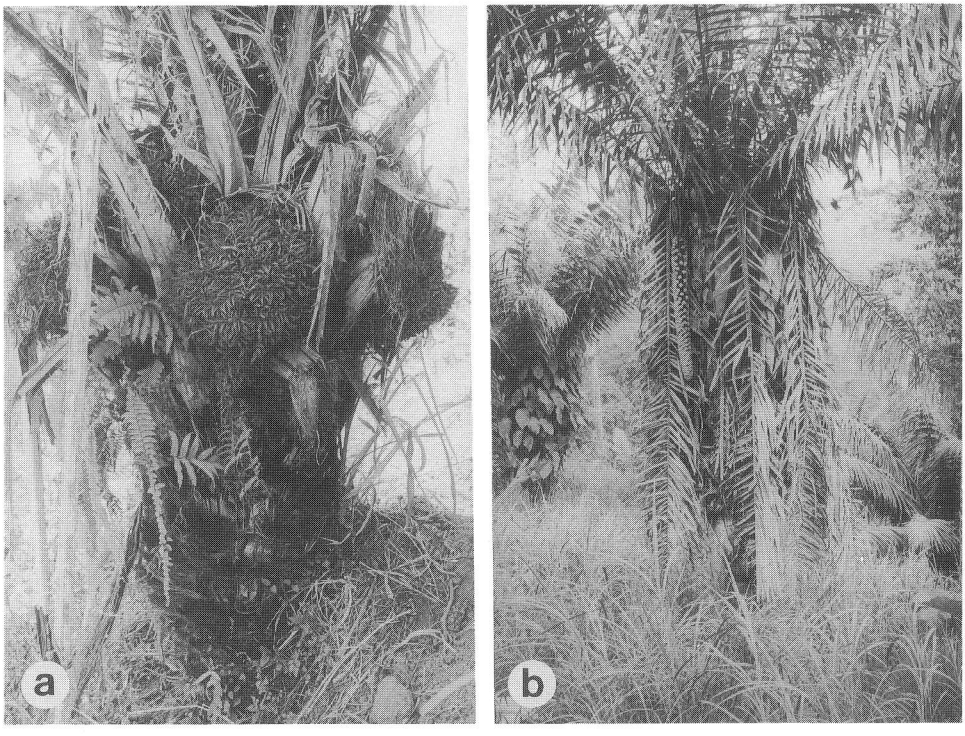
Vegetable Ivory Palms

The production of vegetable ivory has been based on five species of South American palms: *Phytelephas macrocarpa* distributed on the eastern Andean slopes of northern Peru, Ecuador, and southern Colombia, *Palandra aequatorialis* from the northern coastal plain of Ecuador (Fig. 1a, b), *Phytelephas schottii* distributed in the Río Magdalena Valley in Colombia, *Phytelephas tumacana* from Nariño in southern Colombia and finally *Phytelephas seemannii* which is found on both sides of the Panamanian-Colombian border. The genera, *Palandra* and *Phytelephas*, both belong to the phytelephantoid palms, which now have formal rank as subfamily of the palms according to Uhl and Dransfield (1987). This is a very distinct group of palms which, due to several unusual features and in particular the highly dimorphic flowers, have been placed in other more or less related families such as Pandanaceae, Typhaceae, and Cyclanthaceae. Today they are considered to represent a separate evolutionary line within the true palms.

The Ivory Nut

It is the seed or nut that is the source of vegetable ivory. The Spanish name "Tagua" refers specifically to this part of the palm, although in some places "Tagua" is also used as a name of the palm itself. In areas where it is used for roofing, *Palandra aequatorialis* is often called "Cadi," which is the Quichua name for thatch in Peru. Local names given to palms in Quichua often reflect their uses or describe the part of the palm used. "Antá," which is the local name *Phytelephas seemannii*, means metal or copper in Quichua and may refer to the hardness of the seeds (Cook 1927).

The infructescence of phytelephantoid palms (Fig. 1a) is a large spherical structure up to 35 cm in diam. The mature fruits are obpyramidal and 4–6 sided because of mutual pressure. The epicarp and outer mesocarp, is fibrous. Inside this, there is a thin and fleshy inner mesocarp. The seed is contained in a thin stony shell, which is the endocarp. In between the seed



1. The Ecuadorean Tagua palm, *Palandra aequatorialis*. a, Female plant with head-shaped spiny infructescences containing the vegetable ivory. b, Male plant showing the pendent male inflorescence.

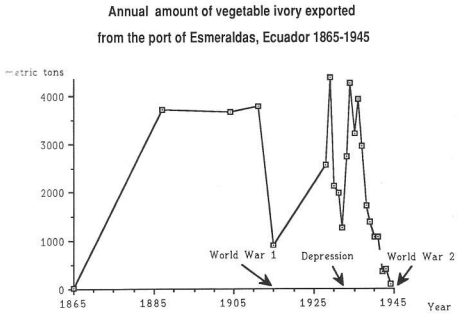
and this endocarp, a thin parchment-like brown seed testa is present which displays a conspicuous venation. The endosperm of immature seeds is fluid much like the milk of coconuts. This liquid gradually turns into a gelatinous substance and finally, in the mature seed, the endosperm is hard and white as ivory.

Chemical Composition

Ivory nut has been shown to be composed of two mannans. One is soluble in aqueous sodium hydroxide (mannan A), the other one is insoluble in this solution (mannan B) (Aspinall et al. 1953, 1958). In fact, vegetable ivory is the best source available for isolation of mannan polysaccharide, which constitutes 70 percent of the endosperm in the mature seed (Timell 1957). The mannans serve as storing material for the developing embryo. They are the major component of the thick walls of the endospermatic cells.

Other Ivory Nut Palms

According to Perez-Arbaleaz (1978) the seeds of *Mauritia flexuosa* have been a source of vegetable ivory. In Colombia, vegetable ivory is also obtained from *Dictyocaryum lamarckianum* Mart. This palm tree is also called "Tagua" in the northern parts of the eastern cordillera (Rodrigo Bernal, pers. comm.). In Africa, vegetable ivory is derived from the seeds of the Doum palms (*Hyphaene spp.*), and in Asia it is the hard endosperm of species of *Metroxylon* which is exploited.



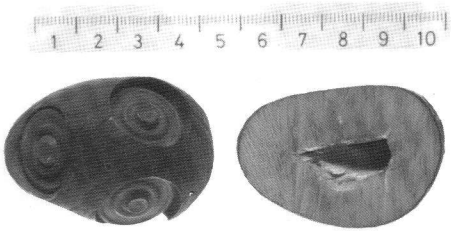
2. Years 1928–1944 based on figures compiled by Acosta Solís (1944). Years 1865–1928 based on Jácome B. and Martínez F. (1979).

Vegetable Ivory Versus True Ivory

The chemical composition of vegetable ivory makes it excellent for woodcrafts produced by hand or with a lathe. The term "vegetable ivory" suggests similarity to true ivory and it is correct that the two materials are much alike when they have been processed, however they differ in their basic properties. Vegetable ivory dissolves when soaked in water for long periods (more than a month), whereas true ivory does not. Moderate hydration will soften the vegetable ivory—a property that can be exploited in crafting—while drying will restore its hardness. Generally vegetable ivory is softer and much easier to craft than true ivory, provided that it has been harvested at the right time. If the seed is immature, it will crack when dried. The porosity of vegetable ivory makes it an excellent material to decorate, e.g., with drawing ink. Many ivory nuts have a cavity inside (Fig. 3) that makes using the entire seed difficult. However, seeds of *Palandra aequatorialis*, harvested at the right time, are usually solid, which is the reason they are considered to be of the highest quality.

The Golden Age of Vegetable Ivory in Ecuador

In 1944 the Ecuadorean botanist and naturalist Acosta Solís wrote a booklet on



3. Partly manufactured sample of ivory nut kept at the British Museum showing how the seed was placed on a lathe and buttons were carved out of the superficial layers. Note also the cavity inside the nut that prevented larger objects from being produced from this piece.

the vegetable ivory production in Ecuador. He compiled much valuable information on the production and trade of vegetable ivory, which was based on the exploitation of a single species, *Palandra aequatorialis*. Ecuador was the major exporting country of ivory nut when production was at its highest point in the late twenties and the early thirties. In 1931, 92 percent of the ivory nut imported by the United States came from Ecuador (Fig. 8).

The Beginning

Germany was the first country to start importing vegetable ivory from Ecuador. According to Acosta Solís (1944), the first shipment of Tagua from Ecuador was exported around the middle of the 1860s simply because a German cargo-steamer, on its way back to Hamburg, had room in its hold.

The Germans quickly became aware of the potentials of this new and interesting raw material. Vegetable ivory became a popular material for making, first of all, various types of buttons, but also toys, canehandles, jewelry, figurines, etc. In 1865 ivory nut first appeared in statistics and a few years later it had already become one of Ecuador's major export products, along with rubber and cacao. In 1887 the export of vegetable ivory from Esmeraldas amounted to 76.2 percent of the earnings of this port. At that time, the export from the port of Esmeraldas was worth about 3

percent of the total export of Ecuador (Jácome and Martínez 1979).

Harvesting

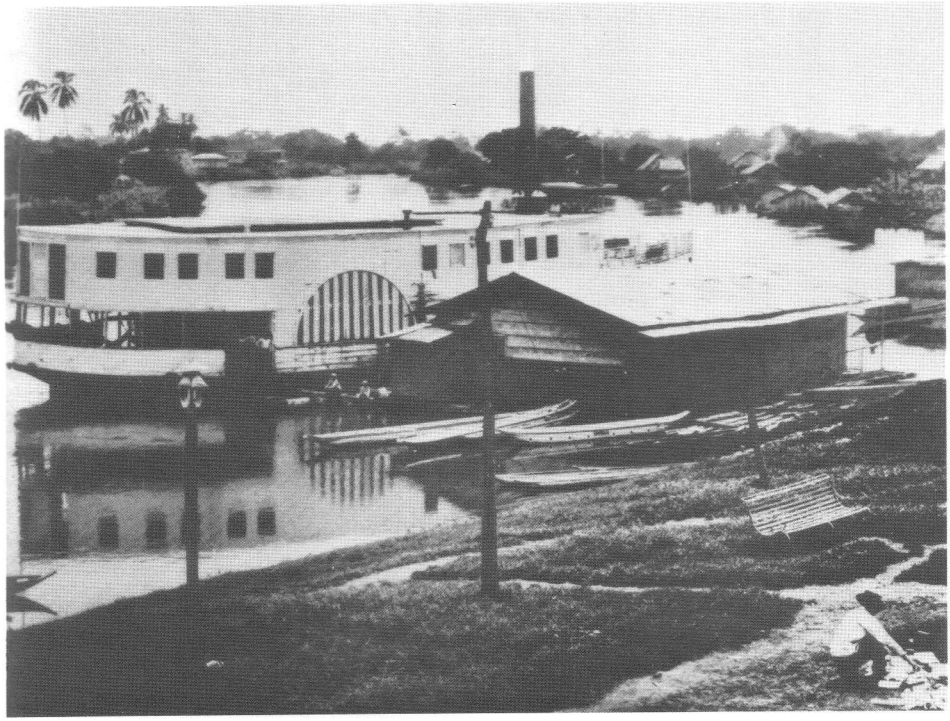
Production did not take place on plantations but was based on the harvesting of natural populations of palms by the rural inhabitants. Two species, *Palandra aequatorialis* and *Phytelephas seemannii*, were exploited more than any others. They combined two important qualities: large seed size and a usually solid endosperm. Seed size was an important criterion for determining the quality of the ivory nut when it was traded because small seeds limited the possibilities in crafting. Furthermore, both of the two species mentioned grew in dense populations adjacent to rivers on the coastal plains of Ecuador, Colombia, and Panama and could easily be reached by dugout canoe. Rich (1936) gave an account on the hard work which was done by the so-called "taguaros" gathering ivory-nut: "his outfit consists of a machete, an ax, gun and ammunition, a few cooking utensils, and such foods as rice, beans, flour. The taguaro may own his own canoe or raft. A few natives and, at times, several families work together. So after making ready, these diminutive expeditions proceed up-stream to the 'hunting grounds' or primeval solitudes. With their guns, the marksmen of the party shot a duck, hawk, squirrel or some other species of food; this together with supplies furnished by the merchant, may last for weeks or until the party returns with the first cargo of tagua." The biggest problem must have been transporting the heavy load. Rich estimated some of the rafts coming into the port of Guayaquil to have up to 10 tons of nuts aboard!

According to Acosta Solís (1944) one of the ways to harvest ivory nut was to collect the uppermost infructescences which contained seeds that were not yet mature. The seeds were then matured artificially by burying the fruits either below the ground, or below a pile of trash. The surrounding fibrous husk was later removed with a wooden hammer. The ivory nuts extracted in this manner were called "tagua rubia" or red ivory nut. If the trunks were tall, the palm trees were felled in order to facilitate collection and thus, harvesting often became very destructive. Another less destructive method produced "tagua negra" or black ivory nut. Here the seeds were allowed to mature naturally on the palm tree.

It is unclear from Acosta Solís' account which part of the seed the "black" and "red" relate to. He probably referred to the color of endosperm that varies according to the method of extraction. Acosta Solís wrote: "both red ivory nut and black ivory nut are in general sold and exported in a peeled condition ("Tagua pelada"), that is, with the shell or perisperm (=endocarp) removed."

It is interesting to read Acosta Solís' warnings in 1944 against the destructive exploitation of vegetable ivory and the ruining of an important natural resource. Decreasing trade later saved the vegetable ivory from being destroyed although today, deterioration of the habitat of the ivory nut palm, *Palandra aequatorialis*, represents a more serious threat.

Claès (1925) gave a rough estimate of the production of *Phytelephas schottii* of the Río Magdalena Valley in Colombia. The figures related to large and dense populations on alluvial sands in the lower parts of the valley. Some of these populations still exist today. Claès observed an average distance of 6 m between the mature individuals in fructification, which corresponds to about 250 individuals per hectare. He further calculated that a single individual produces at least 8 inflorescences every year and that one inflorescence yields a total of 250 to 300 ivory nuts, each weighing 35 grams on the average. Multiplying all these figures he deduced that the total annual production was 2.25 metric tons



4. General view of the Port of Babahoyo in 1900. The ivory nut was transported from this place to Guayaquil by cargo-steamers like the one in this photo. (Reproduced from Vásquez G. 1984)

of ivory nuts from one hectare of a natural population.

Transportation

From the sites of collection upstream along the rivers, the vegetable ivory was transported in dugout canoes or on rafts to centers of commerce on the coast, such as Babahoya in Ecuador (Fig. 4). Large cargo-steamers shipped the vegetable ivory from these ports to the buying countries along with cacao, rubber, and other products.

Transport to the United States was nearly monopolized by a British company named Pacific Steam Navigation Co. and by the Pacific Railroad Co. in Panama, who transported the cargo across the Isthmus of Panama by train (Fig. 5). The customers often protested about bad service and high prices and they seemed to have good reason. Transport costs in 1896 were more expensive from Ecuador to New York via Panama ($80 per metric ton) than to Europe via the Strait of Magellan ($30–60 per metric ton) (Dueñas de Anthalzer 1986). In 1914 transportation costs constituted nearly 30 percent of the price of the vegetable ivory sold in Hamburg, Germany (Fig. 6).

Still there was a lot of money to be earned from vegetable ivory and especially by the importing companies. Dueñas de Anthalzer (1986) estimates that the net profit of the dealers in Hamburg was around 40 percent of the final price (Fig. 6).

Prices depended on the quality of the ivory nuts and in particular on their size, their shape, and if they were solid. In New York in 1931 ivory nuts from Esmeraldas that were not peeled were quoted at $1.75

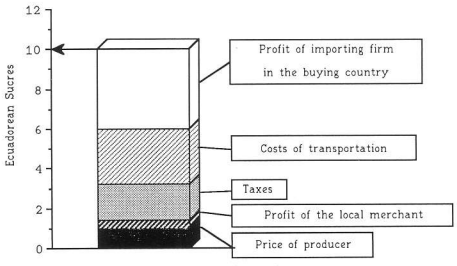
5. Very large amounts of vegetable ivory passed through the port of Panama City during the golden age of this material. Today, only 50 years later, there is no trace of vegetable ivory in the port of Panama City here photographed and the material is unknown to most inhabitants.

to $2.00 per quintal (=112 pounds) and ivory nut from Manta without the shell ("Tagua pelada") was quoted at $2.00 to $2.50 per quintal (Acosta Solís 1944) (Fig. 9).

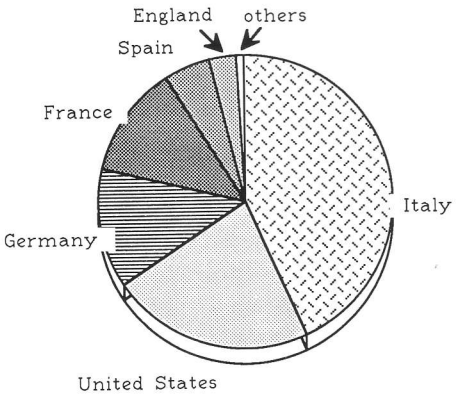
Button Production

A few years after Germany had started the import of vegetable ivory, it could be found all over Europe. The United States already imported great quantities of this item. When production was at its highest point in 1929 and 1930, just before the outbreak of the Depression, Italy and the United States bought more than ⅔ of the total annual production from Ecuador (Fig. 7, 8), which is a reflection of the distribution of the global textile industry at that time.

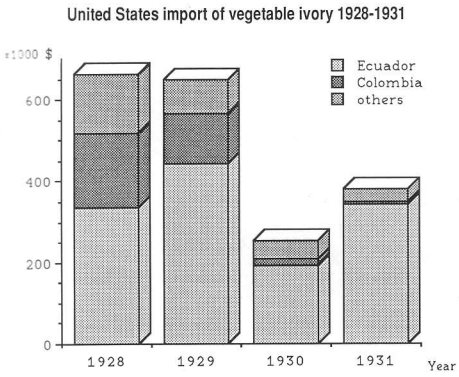
In the United States more than 25 factories manufacturing buttons from vegetable ivory were concentrated in the New York area (Acosta Solís 1944). Buttons of vegetable ivory were typically produced by hand using a lathe. A partially manufac-



6. Breakdown of the final price of 112 lbs. of vegetable ivory sold in Hamburg in 1914.



7. Destination of vegetable ivory exported from Ecuador in 1930.

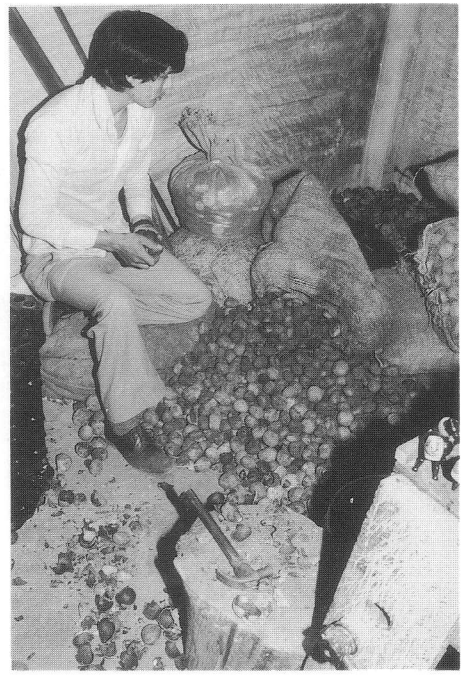


8. Based on Acosta Solís (1944).

tured ivory nut kept at the herbarium of the British Museum in London illustrates one way this could be done (Fig. 3). Several buttons from the same seed were carved with a profile cutter. Cheaper buttons were produced in great quantities at large factories, where the seeds where prepared for carving by a partly automatized process. Rich (1936) described how buttons were made in one of the largest factories in the United States. The entire endocarps were first dried at about 100° F. They were then separated mechanically from the nut in tumbling iron barrels with knockers inside. After removal of every vestige of endocarp, slices of vegetable ivory were cut from the sides by small circular saws leaving the hollow core. These pieces were dried on sieves for eight to ten days and subjected to a higher temperature than at the previous drying. After this treatment the slices of ivory nut are ready to be manufactured on a lathe. Rich continued: "Each piece of ivory is now as hard and dry as bone, and no matter how much it may be soaked or swollen in the subsequent processes of manufacture it always returns to its present state of hardness."

The Fall

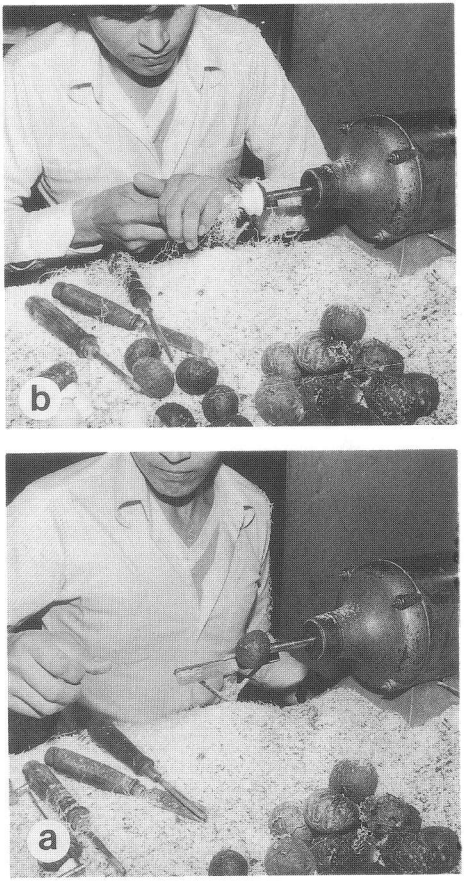
By the beginning of World War II the demand for vegetable ivory had already started to decline (Fig. 2). The war resulted



9. Most ivory nut was delivered as "Tagua pelada." The endocarp was removed from the seed with a wooden hammer. In this souvenir factory it is removed with a steel hammer previous to manufacturing. Colombia, Dept. of Boyaca, Chiquinquirá.

in many technical innovations and among others the invention of Bakelite and plastics. These new synthetic materials were inexpensive alternatives to vegetable ivory and were better suited to modern production modes involving fewer people and more machines. The raw material came from the petrochemical industry which meant relative independence from unstable supplies and oscillating prices.

Throughout World War II instability prevailed on the world market for raw materials. Trade with previously important products such as vegetable ivory declined rapidly whereas other products such as rubber and balsa were in great demand, compensating to some extent for the losses. However, after the war, world trade with both rubber and balsa decreased. Rubber was gradually replaced by plastics in west-



10. a, The ivory nut is placed on the lathe and b, carved into the foot of a salt shaker. Colombia, Dept. of Boyaca, Chiquinquirá.

ern countries and thus suffered the same destiny as vegetable ivory.

The economic situation in many of the raw material producing countries was critical. In Ecuador, a large part of the population was involved in the production of vegetable ivory and rubber. In 1938 about half of the export earnings from the province of Esmeraldas came from the production of vegetable ivory; one third of the earnings came from rubber production (Jácome B. and Martínez F. 1979). It was crucial to find new products to replace the ones that had been lost and banana production was attempted. The North American company, Standard Fruits, that had suffered severe lossees on their banana plantations in the Caribbean due to pest attacks, decided to stimulate the production of bananas in Ecuador. Only a few years after this initiative, a considerable export of bananas took place. Ecuador had found its successor to vegetable ivory and rubber. Enormous areas covered by forest were cleared in order to establish banana plantations. Many of the natural habitats of the vegetable ivory palms, *Palandra aequatorialis*, gave way to banana plantations. Within a few years this species was threatened more by banana cultivation than by the previously destructive exploitation of vegetable ivory that Acosta Solís had warned against in 1944.

Vegetable Ivory Today and in the Future

Today vegetable ivory is largely unknown to people in the industrialized part of the world. In the former major exporting countries, Ecuador and Colombia, small factories processing the material can still be found (Fig. 10). The objects made are mostly souvenirs that are sold locally and at a very low price.

In Ecuador figurines 4 to 6 inches tall and assembled from several pieces of ivory nut can be purchased in most souvenir ships in the capital Quito (Fig. 11). These are mainly produced in the small Andean town Riobamba. The ivory nut used in the production comes from *Palandra aequatorialis*. Near Manabí on the coastal plain of Ecuador, a few factories, founded before World War II, still produce buttons from vegetable ivory. The production is mainly exported to Japan, West Germany, and Italy where demand is steadily increasing. Wastes from the production are ground into a flour used as cattle or pig fodder.

In Colombia, small factories that manufacture souvenirs of vegetable ivory are situated in several villages in the department of Boyacá such as Ráquira and Chi-

11. Small statues ca. 15 cm tall made of ivory nut from *Palandra aequatorialis*. Due to the porous structure of the ivory nut they are very suitable for decoration with water stable colors and in particular drawing ink. Ecuador, Quito.

quinquirá. The ivory nut used in the production originates from different populations in the central part of the Río Magdalena Valley (Puerto Boyacá, San Vicente de Chucurí, Otanche and Belleza) and from the eastern part of Colombia. One metric ton of ivory nut is worth between $18 and $20 (Feb 1987). *Phytelephas schottii* and *P. seemannii* are probably the source of the ivory nut.

During the last five years the trade of souvenirs made from tagua has increased both in Colombia and Ecuador. It is too early to tell if this is the beginning of a renaissance for the ivory nut. Fashion is completely unpredictable but on the other hand many designers prefer natural materials to plastics. Another positive aspect is that it is a nondestructive exploitation of a renewable resource in contrast to the way the true ivory is obtained. In order to enhance the export of ivory nut, production should be based on elaborated objects such as jewelry (in particular necklaces and bracelets) chess pieces, dice, etc. In Bogotá, Colombia such refined craft-works are sold at a local market (G. Galeano-Garcés, pers. comm.).

Many uses of vegetable ivory probably remain to be discovered. The polymerized polysaccharides may eventually be used for their chemical and physical properties in products such as food additives.

Is there any future for the ivory nut? Ivory nut will probably never again regain its former position as one of South America's major products of export, but on a microeconomic level it may turn into an important raw material in the cottage industry, thus helping to stabilize the economy of small farmers.

Acknowledgments

The Danish Natural Science Research Council supported the study financially. Director Oluf Holm, Museo Antropológico del Banco Central del Ecuador, Guayaquil and Rodrigo Bernal Gloria Galeano-Garcés, Universidad Nacional de Colombia, Bogotá provided much valuable information.

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LETTERS (*Continued from p. 179*)

Bob Wilson, with the help of many others, carried out extensive explorations of Costa Rica and introduced new palm species into cultivation. Some of the original populations of these palms in the wild have been destroyed, and the Garden remains the ultimate repository for the natural variation found in these native species. Because of this, it seems to me that it is to the advantage of all members of the Palm Society to ensure that the Wilson collections flourish and expand. This facility is currently being operated by The Organization for Tropical Studies. Unfortunately, only about one-half the budget can be met with current funding—the rest must be raised each year from gifts and grants. An important consideration about funding facilities in the tropics is that each dollar obtained for that country goes 10–100 times as far as it would in the U.S. If a handful of palm devotees would donate funds to the Wilson Garden, this would have a tremendous impact on the palm and other native plant collections. I invite other Palm Society members to join me in sending a few dollars to the Wilson Garden (% Luis D. Gomez, Director, Jardin Botanico, Robert and Catherine Wilson, Apartado 35, San Vito de Java, Coto Brus, Costa Rica—make check payable to Organization for Tropical Studies, Inc.) to help with the maintenance and proliferation of the living collections. The OTS is a charitable organization, and donors will receive receipts documenting their tax-deductible contributions.

MIKE BALICK