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Winners and Losers in Forest
Product Commercialisation
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Crabwood Literature Review

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Literature Review Guyana:

From the literature list of the Winners and Losers in Forest Product Commercialisation project on Guyana (appendix to this review) it emerges that the greatest number of texts are on Botanic and Timber issues, however, there are also quite a few interesting texts on Socio-Economic and Environmental issues as well as on the Medicinal and Cosmetic uses of Crabwood.

The review is organised into these above mentioned groups of text. Some of the texts may overlap between the groups due to the interaction present.

It is noted that Crabwood is being called Andiroba in Brazil and that this is often also referred to by its Latin name *Carapa guianensis*.

Botanic literature:

Fanshawe has done a number of studies of Crabwood during British colonial times in Guyana. His observations are mainly based on departmental records, but also other unpublished data concerning for instance tree description, and silvicultural characteristics (1947). 1950, Fanshawe mentions the use of Crabwood oil and its primitive extraction.

Kukachka (1962) discusses changes in nomenclature, mechanical and physical properties and identification of, among others, *Carapa guianensis*.

Whitmore et al (1969) followed taxonomy, nomenclature and distribution of 28 native and introduced species in Costa Rica, one of them being *Carapa guianensis*

Later, Brinkmann (1970) describes how an important fact of Crabwood trees is that they have scattered reflection and absorption of both surfaces and leaves. The Crabwood varies from pale pink to dark brown (Brunner et al, 1994).

Volpato et al (1972) saw results that *Carapa guianensis* can be grown in full light, e.g. for seed production and that it can be recommended for enrichment planting.

Reis (1972) measured the comparative decay resistance of, among others, *Carapa guianensis*, and states it as being moderately resistant.

Mchargue (1983) notes that *Carapa guianensis* is a sub-dominant tree species in mature swamp in north-eastern Costa Rica. The tree flowers in September and produce mature fruit the following May. Seed production of individual trees ranges from 754 to 3944 seeds having an average dry weight of 15.6 grams. Seeds germinate best in moist soil. In poorly-drained swamp soils, seeds on the surface or half-embedded had 90 % germination.

Janzen et al (1983) conclude that *Carapa guianensis* has a high viscosity and a bitter taste.

Plotkin et al (1991) clarifies that in Brazil, Europe and North America *Carapa guianensis* is traded under *Andiroba* oil and in the Guianas as *Carapa* oil. Again, as with Janzen, its high viscosity and bitter taste is mentioned. Instruments employed to crush the kernels vary from stones, to pestel and mortal and tipiti.

Polak, similar to Plotkin, notes that oil derived from the seeds of Crabwood is known throughout the Amazon region by various names. In the indigenous languages of the Arawak, Patamona and Akawaio populations of Guyana it is known as Kara oil. Flowering occurs mainly in the November-February period and fruiting between April-July, similar to Mchargue, but a slightly different season. The wood varies in colour along the spectrum of pale pink to dark brown with black streaks with the sapwood falling at the lighter end of the spectrum and the heartwood at the darker.

Reinders mentions that an alternative approach employed in the production of *Karapa* oil involves the drying and peeling of the seeds which are then grated and soaked in boiling water. The boiled seeds are squeezed with the bare hands and the remaining oily liquid is then boiled. The oil which floats to the top, is scooped off and bottled.

Lachman-White et al (1992) notes that *Carapa guianensis* has large compound leaves and the main vein is prominent on the underside. Immature branches are course and "rofous-brown".

Clement (1993) notes that fresh Crabwood oil contains 9 % of glycerine and is extremely bitter, in line with Janzen and Plotkin.

Hall et al (1994) studies genetic variability and population differentiation of 9 populations of Crabwood in Costa Rica. The genetic characteristics indicate that *Carapa guianensis* is suitable for natural forest management where it occurs at high density.

Johnston et al (1996) carried out an assessment of how to utilise plant species in an Amerindian community in Guyana. 120 plant species were identified and put into 6 different categories such as medicinal, timber and others. Within the 20 species used for timber, 5 species also had some form of non-timber product use which underlines how the species are not being used to their full ability. Furthermore the simultaneous use of both timber and non-timber resources from the same tree is also being discussed.

Later in 1998 Johnston compares two forest localities to assess availability of NTFP's (Non-Timber Forest Products) within the low-diversity forests of Guyana. 152 species were recorded with 236 uses and 33 of the species were known commercial timber species and 106 species had potential non-timber product utilisation. The utilisation criteria is based upon richness, tree density, number of uses per species and the percentage of trees represented by each utilisable species. The article suggests that low-diversity types of forests should be given higher priority for conservation in order to ensure future use of NTFP's. In low-species forests, one or two NTFP make up over 50 % of canopy trees and therefore increase potential sustainable extraction for single-species harvesting.

Connor, K.F (1998) et al have done tests on whether the seeds of Crabwood are desiccation sensitive.

Finally, Thomas et al (2000) mentions Crabwood produced in Guyana and its characteristics. It has familial associations with *Swietenia* and African

mahoganies. Considered a hardwood, it is of medium to coarse texture, usually with straight grains.

Timber literature:

Fanshawe in 1947 mentions the use of Crabwood for timber, but also mentions exploitation.

How Crabwood fruits were attacked by a shootborer is described by Becker (1973), however Fanshawe already noted in 1961 that the Crabwood tree is termite and fire resistant.

Gilmore et al (1974) did a report on the results of machining, gluing and strengthening Andiroba and other species. In general, strength of glue bonds, static bending strength and toughness decreased with decreasing species groups of the wood.

Chudnoff (1984) describes how Crabwood is comparable to mahogany in weathering properties and that it is usable for all types of construction where durability is NOT a factor, like furniture and flooring, but Crabwood is described as harder than mahogany and has a tendency to split when nailed. Its durability varies a lot and both high and low resistance towards fungi has been reported. It is very vulnerable towards dry-wood termite attack and to powder-post beetle attack according to Chudnoff, despite earlier suggestions by Fanshawe to the contrary.

Crabwood trees are recommended to produce high-quality timber (Bauch et al, 1999) in response to the demand for recultivation of degraded land areas in Central Amazonia..

Clements et al (1993) notes that Andiroba has the ability to accept a finish very well and that it is quite popular on the local market for furniture. However it is difficult to impregnate due to a very low absorption rate and superficial penetration.

Dunisch et al (1998) have done a study on environment-tree growth relationships of high quality native tree species like Crabwood. It was done as part of the development of sustainable land use systems on sites in the Central Amazon. The study concluded that *Carapa guianensis* was a better competitor for sustainable growth than *Swietenia*, with which it has familiar associations according to Thomas et al.

Dayanandan et al (1999) mentions that deforestation and selective logging in the tropics may have serious consequences on genetic processes in tropical tree populations, affecting long-term survival of a given species as well as tropical forest communities.

Payne (2001) mentions that there are log export restrictions on *Carapa guianensis* due to shortage on the local market.

Socio-Economic literature:

Glerum (1960) saw small sawmills, relying mainly on Crabwood, as an economic possibility, but not veneer or paper mills.

Many years then pass and the approach towards developing countries starts to change before we go to the next step of literature.

Plotkin et al (1992) mentions that a large and growing body of ethnobotanical knowledge demonstrates the variety of botanical sources supplying the material, nutritional, medicinal and spiritual benefits to human societies. Until the 1980's this knowledge was insufficiently applied to the process of socio-economic development. Ethnobotanical knowledge of indigenous people and other long-term forest dwellers, however laid the cornerstone of a new form of socioeconomic development in tropical rain forests, but the value of this knowledge will be lost if issues, like intellectual property rights to forest dwellers, the easing of trade barriers and product marketing campaigns that educate consumers, are not addressed.

Tangley (1993) makes us aware of the Tagua Initiative of marketing "vegetable ivory" from Ecuador and Colombia to the United States for use as buttons. Tagua is being promoted as high-quality material and some lessons were learned: The conservation impact is greatest when production is integrated within community development, scientific research, education and policy work. Also, to succeed a project must be carefully designed to accommodate the needs of two very different cultures and economies. The products must be profitable for every player in the economic chain and local enterprises should be supported with loans and grants, wherever possible, to encourage a sense of ownership and responsibility.

Clement et al (1993) discusses the necessity to develop and manage income-generating forests and what is required to successfully market the many products that can be obtained from the forests. They both mention Crabwood for timber use and its popularity on the local market for furniture and they also mention Crabwoods secondary use which is extracting oil from its seeds. The external market outside Brazil for Andiroba kernels is said to be quite small. Clement et al also mention some further experiences made on green marketing, including the idea that one should start with product types already known to the market and also monitor the sustainability of production, since green consumers are interested in protecting ecosystems, not the people who live in them.

A FAO (1995) report mentions the increasing recognition of NWFP (Non-Wood Forest Products) and the different ways in which they can improve livelihoods in developing countries.

Kainer et al mentions that in Acre, Brazil women have responsibility for processing all plants intended for human and animal consumption. The women use over 50 plants for medicines. More than half of a group of women interviewed, replied enthusiastically that if a market existed, they would make time to regularly prepare items for sale.

Silva et al (1995) concludes that the international market for essential oils is dominated by a few countries. Some of these countries import oils from developing countries and the market is quite competitive and protected. Hence, the developing countries have to develop strong market strategies for promotion of their products. Marketing problems often beset the industrial development of NWFP's in developing countries (Plotkin also mentioned the importance of marketing) as it is a function of two groups, the rich buyers and the poor producers. The prices are dictated by the buyers who control the market. Therefore the investment in and promotion of industrial processing of NWFP's has to carefully consider marketability and the use of these as products for import substitution.

Sizer (1996) mentions that governments in Suriname, Guyana and many other tropical countries are under pressure to make quick cash by selling their forest resources to foreign firms. In 1993 Suriname, its economy near collapse, took the step of inviting foreign investors to explore possibilities for establishing multi-million hectare logging concessions for the country's interior. After reading a World Resources Institute Report about Suriname, Guyana's president Dr. Cheddi Jagan, invited WRI to help him find ways of reforming forest policy in Guyana (later, according to Payne, log restrictions were imposed). Sizer also reflects upon how environmentally sound logging and timber processing can boost the economy and explains how non-timber forest products can contribute more to development by building sustainable communities around non-timber values.

Shanley (1998) writes, that rural communities who make their living within regions beset by logging and fire are increasingly faced with biotically impoverished forests. Although a multitude of scientific research has been undertaken, little of this has direct immediate relevance for forest communities, so the communities start to look for for NWFP's (Non-Wood Forest Products) to sell instead of timber, in line with Sizer's reflections.

Sullivan (1999) discusses how valuations of resources in tropical forest ecosystems often fail to take account of the full spectrum of forest products and services, since many of these have traditionally been ignored as insignificant and non-marketed. Then it is being demonstrated, by using a method of assessing the use-value of non-timber forest products (NTFP's) and using an income accounting framework, that by focusing research on certain NTFP's, like Crabwood, and their use by Amerindians, it is possible to demonstrate an extra dimension to forest valuation.

Pattanyak et al (1999) develops a conceptual model of tropical forests as natural insurance for households on the forest margin. The model hinges on the observation that forests are highly diverse, offering a wide range of products, some of which are available to households when other income or subsistence sources fail. Also this is in line with the suggestions of Shanley, Sizer and others.

Finally Van Andel (2000) mentions that communities of rural Guyana have deemed Crabwood oil a worthwhile income-generating commodity, one of only a few herbal medicines sold in the interior of the country.

Cosmetic/Medicinal literature:

The literature interest in Crabwood as a cosmetic/medicine starts much later than the interest in botany and timber.

Fouquet (1990) has written a paper on 19 forest species in French Guiana and their cosmetic and pharmaceutical uses.

Clement et al (1993) notes that in Northern Brazil, Andiroba is being used for making sodium soaps. Also small quantities of oil are used to sooth muscular distentions, skin tumors and other superficial skin ailments. The Amerindians use it as an insect repellent.

Hammer et al (1993) review the ethnopharmaceutical significance of *Carapa guianensis* used by the Caboclo communities in the Amazon delta. It shows

low bioactivity. The main active principles, medical uses and activities identified by previous literature searches compared well with both field survey and laboratory results.

Krompegel surveyed plant species from eight families and mentions chemical ingredients and their importance in culture, for instance alkaloids in hunting and in religious ceremonies.

Silva et al (1995) focus on the processing potential of commercially important NWFP's (Non-Wood Forest Products) particularly for essential oils and medicinal products and other related products. It mentions that the yields of essential oils obtained from aromatic plants will depend on the harvesting stage and post-harvest treatment. Silva et al notes that about 80 per cent of the world population still depend on medicinal plants for their health care. Around 20 per cent of the drugs in modern pharmacopoeias are also plant derived, either as pure phytopharmaceuticals extracted from plants or as synthetic derivatives of them.

Sullivan (1999) mentions that data collected from the study of three villages reveals how NTFP's contribute to the household as a source of, among others, food and medicinal treatments. In this context it is noted that *Carapa guianensis* has medicinal use for ulcers, rheumatism, diarrhoea, thrush and swellings.

Finally, Van Andel (2000) mentions that *Carapa guianensis* is among the most widely used of the medicinal plants in Guyana and is employed to cure as many as 15 ailments, like coughs and cold, whooping cough, groin rupture, hemorrhoids, skin problems (i.e. insect bites, sores thrush in babies, wounds and bruises, dry cracked skin, itching, skin diseases and painful swellings), malaria, pneumonia and asthma. It is also used as insect repellent.

Environmental literature: (including the influence upon animals)

Henriques et al (1989) showed that seedling and juvenile per capita recruitment was negatively correlated with the numbers and basal area of adult trees. This was attributed to high mortality caused by predators, pathogens or adult interference

Hammond et al (1994) present preliminary results from a study on the effect of logging on the abundance and behaviour of animals and on seed dispersal and seedlings of *Carapa guianensis*.

The FAO report (1995) mentions indigenous knowledge and how indigenous systems of management provide interesting possibilities. For instance low-intensity management, light canopy opening, enrichment planting of preferred species and selective thinning in line with Sizer and Shanley.

Silva et al (1995) in their paper note that the green product market is increasing and it is expected that some industrialized countries will insist on eco-labelling of products as a condition of import. However green consumers might be more interested in ecosystems than the people who live in them, see Clement et al.

Smith et al (1995) discuss pressure linked to rapid ecological, cultural and economic change in Amazonia. The ecological issues include soil erosion, changes in fertility, shift in rainfall patterns and loss of biodiversity. A major

focus of the report focuses on resource management in agroforestry as a useful tool for sustainable development. The report concludes that the survival of forests is critical for the long-term development in the Amazon and it is not enough to rely on national parks to safeguard the diversity of the forests. Only 2 % of the Brazilian Amazon is within natural parks or reserves and as in other developing countries, areas designed for protection have been used for logging. What happens outside of parks and reserves will decide the future of the forest. The yield on farms and plantations in the Amazon should be raised and sustained in order to secure the survival of the forest. The likelihood of the forest surviving will be improved if ways can be found to harvest resources without destroying them. Again see Sizer.

Steege et al (1996) did 4 years of research at Mabura Hill in Guyana generating a substantial amount of results. Research concentrated on patterns and processes in natural and logged forest. The following major conclusions for forest management were drawn: Forestry with low intensity of exploitation appears to be the best land use option, low intensity logging appears to have fairly little impact, logging should not occur along creeks, silvicultural treatments are necessary to ensure future commercial potential use of the forest, uncontrolled skidding is a main cause for damage to the ecosystem, and gap size should be kept small and gaps should be evenly spaced over the exploited area. Well in line with Sizer's recommendations.

Conclusion:

Environmentally sound logging and timber processing can boost the economy and also explains how non-timber forest products can contribute more to development by building sustainable communities around non-timber values.

Environmentally sound logging and commercialisation of non-timber forest products really go hand in hand together.

Before environmental and social awareness became important in the post-modernist era (meaning people becoming aware of the degrading of the environment and the divide between North and South) from around the 1970's, logging was the only tool focused on in the economic development of forests. The Botanic Literature, which can be found from the 1940's onwards, was used as basis for logging, but later also it could be used for the commercialisation of non-timber forest products into for instance cosmetic and medicinal products. The Botanic Literature had now become Ethnobotany.

First, from around the 1990s Socio-Economic and Environmental Literature really started to emerge, the scholars of the post-modernist era had become active in research resulting in recommendations for environmentally sound logging and at the same time commercialisation of non-timber forest products and this is where the Winners and Losers project comes into the framework.

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