BARRIERS TO ADOPTING DIVERSITY OF NUS FRUIT TREES IN LATIN AMERICAN FOOD SYSTEMS

Chapter 7: Orphan crops for sustainable food and nutrition security: Promoting neglected and underutilized species

Chapter Author: Van Loon, K., Lagesse, E., Chichongue-Arroyo, F., Ewert, T., Wiederkehr Guerra, G., Gamarra, B., van Zonneveld, M., Kettle, C.J.

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Supplementary Material: Table S1

List of 150 Latin American fruit trees NUS along with their possible uses, current geographical distribution and recommended scale of market. The columns on the right describe the main barrier to adoption and the other barriers that the species is known to face.

Species name	Family	Common name	Edible part	Other Products	Current Distribution in Latin America	Recommended Scale of Market	Description of Primary Barrier(s) to Adoption
Acca sellowiana	Myrtaceae	Feijoa	Fresh fruit	Processed food products (fruit puree, jams, gels)	South America	International	Peculiar sulfoxaloyl-triterpenoid of the spinane, which requires specialized extraction and purification, and only under certain conditions of degraded physics (e.g. dry tropical forest and deforested highlands) required a solid cold chain
Allanblackia stuhlmannii, *A. edulis*, *A. floribunda*, *A. parviflora*	Clusiaceae	Bonji	Fresh fruit (directly into a refreshing drink)	Processed food products (fruit puree, jams)	South and Central America	International	Required taste of hydrofoulvalic, currently limited to regional appeal, lack of value added products (e.g. syrup, flavored beverages)
Annona cherimola	Annonaceae	Cuelo, Cherimoya, Cachiman, Ecuador	Seed, Edible fruit	Processed food products (fruit puree, jams)	Northern South America and Central America	National (fruit pulp) International (nuts)	Lack of research and development of value added products (sugar-free jams, yogurt, wine), lack of marketing and education on medicinal properties of fruit pulp
Annona squamosa	Annonaceae	Cuelo, Custard apple	Fresh fruit	Processed food products (fruit puree, jams)	South America (tropical highlands: Andean valleys)	Regional	Lack of research on medicinal properties, relatively expensive, relatively poor shelf life
Annona muricata, *A. glabra*, *A. reticulata*, *A. scleroderma*, *A. squamosa*, *A. cherimola*, *A. mucosa*, *A. diversifolia*, *A. macroprophyllata*	Annonaceae	Cuelo, Guanábana, etc	Fresh fruit	Processed food products (fruit puree, jams)	South and Central America, Mexico (varying by species)	Regional	Poor productivity for fruit that do not grow in dried conditions, perishability of fruit limits long-distance transportation and smoke flavoring of pulp is unpleasant to people who are not accustomed
Annona muricata	Annonaceae	Guanábana, Soursop, Graviola	Fresh fruit	Processed food products (fruit puree, jams)	Caribbean, Central America, South America	International	Lack of public knowledge about nutritional properties, underutilization of processed products, perishability limits extra-regional distribution
A. squamosa, *Annona squamosa* x *Annona cherimola*	Annonaceae	Custard apple, Atemoya	Fresh fruit	Processed food products (fruit puree, jams)	Caribbean, Central America, South America	International	Lack of public knowledge about nutritional properties, relatively expensive, relatively poor shelf life
Artocarpus altilis	Moraceae	Breadfruit, Breadnut	Seed, Fresh fruit	Processed food products (seed oil, pulp oil, flavoring, fermented)	Caribbean, Central America, South America	Regional	Lack of consumer familiarity, difficult to analyze the fruit oil
Artocarpus heterophyllus	Moraceae	Tsumadi	Fresh fruit	Processed food products (seed oil, pulp oil, flavoring, fermented)	South America, Trinidad	International	Underutilization of processed products, long travel and poly oil, as well as other products (e.g. wine)
Astrocaryum mexicanum	Arecaceae	Tuxtuno, Mexican Chonta	Seed oil (aceraola)	Processed seed-made with nacreated fruit pulp, processed food products (fresh pulp, jams) seeds used for fishing lines, seed oil used for lack consistency	Southeastern Amazonia	International	Thorns make it unattractive on farms or near farms, underdeveloped of aceraola products from seed oil, as well as other products (flavored alcohol, frozen fruit pulp or jam)
Attalea butyracea, *A. phalerata*	Arecaceae	Shapaja, Bacaiuva, Bacaiuvi	Seed oil (aceraola)	Fresh fruit, processed food products (fresh pulp, jam)	Southern and Western Amazonia	Regional	Limited market for oil, fibrous, relatively tedious fruit-processing, lack of knowledge about nutritional properties
Bactris gasipaes	Arecaceae	Pijiaye, Pejibaye, Peach palm	Fruit, Edible stem	Fish-cabbage, Indian (for shells and fibers), processed food products (fresh pulp, jam), Skolled food, seed used as oil	South America, Central America	National (fruit) International (oil, heart of palm)	Lack of access to value added processing techniques and knowledge, and market for value added products, lack of familiar, standardized shelf-stable product, lack of knowledge about harvesting consumption of the nutrient-rich oil
Bertholletia excelsa	Lecythidaceae	Brazil nut, Castaña	Edible seeds	Seed oil (edible and cosmetic), seeds (illegal throughout most of the Amazon) used as a source of wood, seed cake	Southeastern Amazonia	International	Long growth before trading can be a disincentive for planting, pesticide or pollinator dependent, lack of market current production is from wild populations, low natural distribution
Brosimum alicastrum	Moraceae	Manicolango, Ramón, Breadnut, Mex. Breadnut	Edible seeds	Leaves (rich fodder in dry season), seed (flour), timber, medicinal products	Central and South America	National	Lack of awareness of the products' nutritional benefits, lack of knowledge about how to prepare the products, lack of access to processed products
Bunchosia argentea, *B. glandulifera*	Malpighiaceae	Ciruelillo	Fresh fruit	Processed food products (fruit puree)	South America	Regional	Perishability of fresh fruit, land agrosyne enclave, lack of fruit processing
B. armeniaca, *B. armeniaca* var. *argentea*, *B. emarginata*	Malpighiaceae	Ciruelillo	Fresh fruit	Processed food products (fruit puree, jam, gels, cakes)	South America	Regional	Lack of food geographic dispersion and of sufficient production base to scale up production
Byrsonima crassifolia, *B. coriacea*, *B. verbascifolia*	Malpighiaceae	Nance, Indiano	Fresh fruit	Processed food products (fruit puree, jam)	South America	Regional	Perishability of fresh fruit, lack of familiarity of the consumers with products
Calycophyllum spruceanum	Rubiaceae	Palo Balsa, Lanchillo, Guayabillo	Fresh fruit	Processed food products (fruit puree, jam), medicinal products	South America, and Caribbean	Regional	Lack of broad geographic dispersion and of sufficient production base to scale up production (some species are endangered) to scale up production
Campomanesia lineatifolia, *C. xanthocarpa*	Myrtaceae	Guabiroba, Sarandí	Fruit	Processed food products (fruit puree, jam)	South America	Regional	Lack of knowledge on production ecology (e.g. age of trees) to scale up production
Carapa guianensis	Meliaceae	Andiroba, Sarí	Seed oil (andiroba)	Edible seed and seed oil	Western Amazonia	International	Underdeveloped of markets for seed oil
Carica papaya	Caricaceae	Alexandria, Papaya, Papuda	Edible seeds	Seed oil (edible and cosmetic)	South America	Regional	Lack of knowledge on production ecology (e.g. age of trees) to scale up production
Carpotroche brasiliensis	Euphorbiaceae	Gerbaquara, Sacha Inchi, Sacha Inchi, Inca Peanut	Seed oil (edible)	Edible seed and seed oil	Western Amazonia	International	Underdeveloped of markets for seed oil
Casimiroa edulis	Rutaceae	Cocuite Blanco, Zapote Blanco, Mex. Sapote	Fresh fruit	Processed food products (fruit puree)	Mexico, Central America	Regional	Perishability and fragility of fresh fruit
Chrysophyllum cainito	Sapotaceae	Caimito, Star Apple	Fresh fruit	Edible seed (raw or roasted) used as edible, latex as chewing gum, wood (for fish food and bees)	South America, Mexico, Southern Florida, Caribbean	Regional	Lack of dispersion and sufficient production base to scale up production, lack of market and regional education relations fostering use
Chrysophyllum cainito	Sapotaceae	Caimito, Caimito, Star Apple	Fresh fruit	Processed food products (fruit puree)	Caribbean, Central America	Regional	Pests in the fresh fruit
Cordia polycephala, *C. subcordata*, *C. lutea*	Boraginaceae	Ciruelillo, Yellow Sapote	Fresh fruit	Processed food products (fruit puree)	Caribbean, Central America, South America, Mexico	Regional	Perishability of fresh fruit
Diospyros nigra	Ebenaceae	Black Sapote	Fresh fruit	Processed food products (fruit puree)	Mexico, Central America	Regional	Perishability of fresh fruit
Dipteryx alata, *D. odorata*, *D. lacunifera*	Fabaceae	Chiquitano, Tonka Bean	Timber	Edible seeds (nuts), medicinal products, chocolate like drinks	Amazonia, Chiquitano region	International	Complexity of processing (regular boiling, pestilation for spices), etc.), species increasingly endangered from timber harvesting, lack of knowledge about processing
Dipteryx odorata	Fabaceae	Tonka Bean	Seed (alcohol flavor, fragrance, medicinal)	Timber	Amazonia	International	Lack of knowledge of seed and processing (curing of seeds) to obtain the highest quality product (for flavoring and fragrance)
Elaphrium edulis	Fabaceae	Palosanto, Palo Santo	Edible seeds	Ornamental, long fence	Western South America, and Panama	International	Lack of knowledge about production ecology, lack of seed, seedling production, and of nurseries, affecting yields, lack of experiences with intensive cultivation
Eugenia biflora	Myrtaceae	Sacha Plumaje, Sacha Pitanga, Sacha Cherry	Fresh fruit	Processed food products (fruit puree)	South America	Regional	Relatively low yield of individual trees leads to underestimating of species as "non-cash crop"
Eugenia brasiliensis	Myrtaceae	Grumichama	Fresh fruit	Processed food products (fruit puree)	South America	Regional	Relatively low yield of individual trees leads to underestimating of species as "non-cash crop", fragile and perishable nature of fruit
Eugenia stipitata	Myrtaceae	Pulão	Fresh fruit	Processed food products (fruit puree)	South America	Regional	Relatively low yield of individual trees leads to underestimating of species as "non-cash crop", fragile and perishable nature of fruit
Eugenia involucrata, *E. uniflora*, *E. pitanga*, *E. pyriformis*	Myrtaceae	Cherry, Cerezo, Surinam Cherry, Pitanga	Fresh fruit	Fish-bait, timber (for tools), medicinal products	South America, Central America, Caribbean	Regional	Variability in the size and quality of the fruit
Eugenia stipitata	Myrtaceae	Arazá	Processed food products (fruit puree, jam)	Fresh fruit	South America	Regional	Relatively low yield of individual trees leads to underestimating of species as "non-cash crop", fragile and perishable nature of fruit
Eugenia uniflora	Myrtaceae	Surinam Cherry, Pitanga	Processed food products (fruit puree, jam)	Fresh fruit	South America (varied and southern)	Regional	Relatively low yield of individual trees leads to underestimating of species as "non-cash crop", lack of knowledge about processing
Euterpe edulis	Arecaceae	Jugara	Fresh fruit (juice)	Palm heart "cabbage"	South America	Regional	Difficulty to harvest without damage (high survival rate)
Euterpe oleracea	Arecaceae	Açaí, Assaí	Processed food products (fruit puree)	Palm heart "cabbage" (when the stem is cut), thatch (for roofs), medicinal products	Amazonia, Caribbean	International	Lack of access to value added processing equipment (solar dryer), complexity of harvesting (high canopy), underdeveloped of the product
Euterpe precatoria	Arecaceae	Huasai	Processed food products (fruit puree)	Palm heart "cabbage" (when the stem is cut), thatch (for roofs), medicinal products, handicrafts, medicine (roots)	Amazonia, Central America, South America, Mexico	Regional	Lack of access to value added processing equipment (solar dryer), complexity of harvesting (high canopy), underdeveloped of the product
Genipa americana	Rubiaceae	Huito, Jagua, Genipap	Processed food products (fruit puree)	Tattoo (fruit juice), medicinal products, undertaken by the Ayoreo and Guaraní people	South and Central America, Mexico, Caribbean	Regional	Lack of knowledge about nutritional properties, lack of processed products (traditional syrup, flavored beverages)
Gleditsia triacanthos	Fabaceae	Honey Locust	Seed	Tool, silk or similar product, medicinal products	Mexico, Central America	Regional	Need for detailed nutritional analysis of alg-viscosity for food, lack of knowledge about processing, lack of medicinal products, lack of knowledge about processing
Gymnanthes crenulata	Euphorbiaceae	Guayacán	Fresh fruit	Lakes (pulse) timber and medicinal products, processed food products (juice, jams)	South America (southeast and western)	Regional	Decline in dependent dispersers (e.g. dry-tropical forest and deforested highlands), the fruit needs to be very ripe and soft (often to the ground) to be free of any latex in the fruit
Hylocereus triangularis	Cactaceae	Mexico, Chinaco	Fresh fruit	Processed food products (fruit puree)	Mexico, Central America	Regional	Difficulty to harvest without damage (high survival rate) (spines), perishability and complexity
Hymenaea courbaril	Fabaceae	Guapinol, Stinking Toe, Jatobá	Fresh fruit, Seeds (for handicrafts), timber	Fresh fruit, seeds (for handicrafts), timber	Central America, South America	Regional	Lack of consumer familiarity with the products' acquired taste of the flour-like fruit pulp, lack of development of value added products (e.g. flavored beverages)
Inga edulis	Fabaceae	Guamo, Guaba, Guamo, Ice Cream Bean, Ice Cream Bean, Pacay, Jalcuit, Guaba, Pacai	Fresh fruit	Firewood, mulch and biomass	South America (southern and western)	Regional	Overall perishability, germinated seeds and insects in pulp make the fruit less attractive for direct consumption, lack of value added product alternative to consumption
Inga feuillei	Fabaceae	Inga, Guaba, Sin Ala	Fresh fruit pulp	Edible seeds, firewood, mulch and biomass	South America (western)	Regional	Overall perishability, germinated seeds and insects in pulp make the fruit less attractive for direct consumption, lack of value added product alternative to consumption
Inga spp.	Fabaceae	Inga, Guaba, Sin Ala	Fresh fruit pulp	Edible seeds, firewood, mulch and biomass	South America (Peru, Ecuador)	Regional	Overall perishability, germinated seeds and insects in pulp make the fruit less attractive for direct consumption, lack of value added product alternative to consumption
Inga oerstediana, *I. ruiziana*, *I. spectabilis*, *I. vera*, *I. ingoides*, *I. edulis*, *I. marginata*, *I. oerstediana*, *I. ruiziana*, *I. spectabilis*	Fabaceae	Guaba, Guamo, Ice Cream Bean	Fresh fruit pulp	Firewood, mulch and biomass	South America, and Caribbean, Mexico (varying by species)	Regional	Overall perishability, germinated seeds and insects in pulp make the fruit less attractive for direct consumption, lack of value added product alternative to consumption
Inga vera subsp. nobilis	Fabaceae	Guaba, Ice Cream Bean	Fresh fruit	Edible seeds	South America (southern and western)	Regional	Protection of planted seedlings requiring protection from cattle, lack of knowledge about nutritional properties
Jessenia oleracea	Arecaceae	Huayo Manaca	Flavored alcohol (fruit pulp), Edible seeds	Fresh fruit, processed food products (fruit puree, jam), thatch (for roofs), medicinal products	Western Amazonia	Regional	Underdevelopment of product and product's nutritional benefits, lack of knowledge about processing and of access to processed products
Mimosa emoreensis	Fabaceae	Mariway, Cumaru	Fresh fruit	Processed food products (fruit puree, jam)	Caribbean, Central America (Pacific coast), South America	International	Lack of consumer familiarity, difficult to anticipate moment of ripeness
Malpighia punicifolia, *Malpighia emarginata*	Malpighiaceae	Acerola, Barbados cherry, Cerezo, Cerezo, Barbados Cherry	Processed food products (fruit puree, jam)	Fresh fruit, ornamental	Mexico, Central America, Caribbean, South America	Regional	Lack of consumer familiarity with nutritional properties (high vitamin C content)
Manilkara zapota, *Manilkara sp.*	Sapotaceae	Sapote, Nispero, Chicozapote	Processed food products (fruit puree, jam)	Chicle (gum), Chicozapote	Central America, Caribbean	Regional	Difficulty to harvest makes fruits precious of snacks in fruit
Mauritia flexuosa	Arecaceae	Aguaje, Buriti	Fresh fruit, fresh pulp	Processed food products (fruit puree), seed used as oil	South America (western)	International	Limited amounts of fruit pulp per weight of fruit, consumers unfamiliarity with the fruit and dessert products, traditional harvesting practices (cutting down the tree) and of seed and pulp oil
Mellonoxylon lilopatense	Zygophyllaceae	Maracaibo Lignum Vitae, Guayacán	Fresh fruit	Processed food products (fruit puree)	South America (western and southern), Caribbean, Mexico and Central America	Regional	Unfamiliarity outside of production areas, lack of experimentation with value added products
Moringa oleifolia	Moringaceae	Tumarinos, Tumarinos, Tuna	Fresh fruit	Processed food products (fruit puree)	South America (western), Mexico, and Caribbean	Regional	Small fruit with short window of ripeness, lack of value added products
Myrciaria dubia	Myrtaceae	Camu Camu	Fresh juice	Processed food products (fruit puree), medicinal products (leaves tea)	South America (western) Mexico, and Caribbean	Regional	Premature harvest leads to low quality and products, incomplete domestication leads to irregular, heterogeneous fruit, lack of knowledge about nutritional benefits to understanding of species as "non-cash crop"
Myrciaria jaboticaba, *M. trunciflora*	Myrtaceae	Jaboticaba, Cambuci	Fresh fruit	Processed food products (fruit puree, jam)	South America	Regional	Knowledge, reliability, and production barriers at the local and national markets, relatively small yield of individual trees leads to underestimating of species as "non-cash crop"
Dermosperma Salicae	Myrtaceae	Uñaguachu, Sauce, Sauce Colorado	Fresh fruit, fresh pulp	Processed food products (fruit puree, jam), medicinal products	South America, Paraguay, and Trinidad and Tobago	International	Slow growth, difficult harvest (high canopy), perishability of fruit, lack of knowledge about the fruit's nutritional benefits, lack of value added products (e.g. flavored beverages)
Dermosperma Sandwicense, *D. Sandwicense* var. *Sandwicense*, *D. Sandwicense* var. *Sandwicense*, *D. Sandwicense* var. *Sandwicense*	Myrtaceae	Revalse, Revalse, Revalse, Revalse	Fresh fruit, fresh pulp, Seed oil	Processed food products (fruit puree), seed used and pulp oil	South America (southern), Central America (southern: C. rosyana and D. sessa)	Regional	Lack of basic knowledge of productive ecology, difficult harvest (high canopy)
Pachira aquatica	Malvaceae	Manguilar	Edible seed, fresh pulp	Seed oil (edible & potential for cosmetics)	South and Central America	Regional	Similarity and lack of differentiation with European chestnuts
Paraphysanthus cornifolius	Boraginaceae	Tigua, Tigua, Quito Palos	Edible seed	Ornamental, seed oil (edible)	South America (Andean valley)	Regional	Lack of value added product processing knowledge: lack of basic knowledge of productive ecology
Passiflora quadrangularis	Passifloraceae	Granadilla, Giant Granadilla	Fresh fruit	Processed food products (fruit puree)	Caribbean, Central America, South America	Regional	Lack of consumer awareness outside of production region, relatively small yield of individual trees leads to underestimating of species as "non-cash crop"
Passiflora tarminiana	Passifloraceae	Banana Poro	Fresh fruit	Processed food products (fruit puree)	South America (western Amazonia)	Regional	Lack of consumer awareness outside of production region, relatively small yield of individual trees leads to underestimating of species as "non-cash crop"
Pouteria caimito, *Pouteria obovata*	Sapotaceae	Caimito	Fresh fruit	Processed food products (fruit puree)	South America (western Brazil and Bolivia)	Regional	Lack of knowledge about nutritional benefits
Pouteria sapota	Sapotaceae	Mamey Sapote	Fresh fruit	Processed food products (fruit puree)	South America (western)	Regional	Lack of knowledge about nutritional benefits
Prosopis flexuosa, *P. pallida*	Fabaceae	Algarrobo, Algarrobo, Algarrobo,