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PRESENTATIONS TO THE CONSULTATION ON THE CROSS-CUTTING INITIATIVE ON BIODIVERSITY FOR FOOD AND NUTRITION
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Included here are the text versions of three of the five presentations made at the consultation on biodiversity for food and nutrition. Powerpoint versions of the two remaining presentations are available on the 'Meetings' web page (http://www.biodiv.org/doc/meeting.aspx?mtg=IBFN-01), as is a powerpoint version of A. Cordeiro's talk.

Analysis and Composition of Brazilian Foods

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In order to promote the use of biodiversity for food and nutrition, reliable compositional data of foods are necessary. The importance of food composition tables is finally recognized in Brazil. The first version of the Brazilian Food Composition Table, based on representative national sampling and actual analyses carried out by Brazilian laboratories approved in interlaboratory proficiency testing, was launched last year. This effort was financed by the Ministry of Health and executed by the Núcleo de Estudos e Pesquisa em Alimentos (NEPA) of the Universidade Estadual de Campinas. This first version consists of 198 most consumed foods in Brazil and includes proximate composition, minerals, vitamins, fatty acids and cholesterol. The next version will include regional foods, prepared foods and traditional recipes, this version being financed by the Ministries of Health and Social Development.

Another important food composition table is the updated Brazilian database on carotenoids, which has 259 food items, consisting of fruits (68), green vegetables (74), roots (17), fruit vegetables (25) and processed foods (75). The database reflects the wide diversity of Brazilian food sources of carotenoids and demonstrates variations due to variety, maturity, production technique, climate, type of processing and different brands. Many of these foods are not found in the US and European databases because they are indigenous Brazilian foods. Good sources (>20 μg/g) of β-carotene are: red palm oil, buriti, tucumã, sweetpotato (cvs. Acadian, Centennial, Heart Gold), caruru, mentruz, taioba, serralha, *Cucurbita moschata* (var. Baianinha and Brasileira), hybrid Tetsukabuto, carrot and carrot products, bocaiúva, parsley, mint leaves, kale, sweet basil, coriander leaves, cress, chicory leaves, sweet marjoram, mango (cv. Extreme), acerola (cv. Olivier), endive, New Zealand spinach, rucula, French lettuce, boiled and stir-fried broccoli, dried tomato, peach palm. Good sources of α-carotene are: red palm oil, *C.* moschata (var. Baianinha and Brasileira), carrot and carrot products. Although many fruits have β-cryptoxanthin as principal carotenoid (e.g. cashew-apple, caja, tangerine, orange, nectarine, peach, orange-fleshed papaya, loquat, tree tomato) only pitanga has >20 μg/g β-cryptoxanthin. Good sources of lycopene are tomato and tomato products, guava and guava products, pitanga and pitanga juice, watermelon, red-fleshed papaya. Good sources of lutein are: *Tropaeolum majus* flower and leaves, mint leaves, New Zealand spinach, broccoli, cress, chicory leaves, rucula, sweet basil, sweet marjoram, French lettuce. Only buriti has >20 μg/g zeaxanthin, although zeaxanthin is the principal carotenoid of piqui. The results

show that many indigenous fruits and vegetables have greater carotenoid content than commercial, well-known foods.

The atmosphere for promoting indigenous crops has become much better in recent years. Aside from government agencies, the private sector has come to recognize the importance of nutrients and bioactive phytochemicals beneficial to human health. Guava producers, for example, have chosen the cultivars for commercial production mainly on basis of the lycopene content and food processors have developed guava products as rich sources of lycopene. Acerola, which had been grown only in gardens, are now produced commercially by a cooperative of farmers, in recognition of the high nutrient content, especially vitamin C. The farmers had improved the fruit and now produce the Olivier variety which has double the β-carotene content of the garden acerola. Pitanga, e few years back, was also not a commercial product. It is now commercially produced and distributed throughout the country, especially as frozen pulp for preparing juice. Pitanga is a very rich source of lycopene, β-carotene and β-cryptoxanthin. The leafy vegetable rucula, a rich source of lutein and β-carotene, is also more widely commercialized and consumed.

Aside from obtaining compositional data and investigating the effects of influencing factors (e.g. variety, stage of maturity, climate, production technique, post-harvest handling, processing and storage), our laboratory has also been giving hands-on training courses, not only to Brazilian researchers but also to researchers from both developing and developed countries, particularly in the difficult and complicated carotenoid analysis.

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Rodriguez-Amaya, D.B., Kimura, M., Amaya-Farfan, J. (2004). Updated Brazilian database on food carotenoids. Paper presented at the XXII IVACG meeting, Lima, Peru. (This paper is being prepared for publication.)

Fruits of Amazonia

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Plants are the 2nd smallest portion (after vertebrates) of Amazonian biodiversity, with perhaps 15-20,000 spp. Nonetheless, this is the primary fraction that the first Amazonians learned to use (biological resources, numbering 3-5,000 spp, not counting use for firewood) and then domesticate (genetic resources, numbering perhaps 100 spp). The majority of the genetic resources produce fruits or nuts/seeds or both. As elsewhere in the tropical world, fruits are not necessarily juicy; they can be starchy or oily or both (Table).

Table. Comparison of the mean chemical compositions* of contrasting fruit groups (number of spp in parentheses) (From Clement, in press).

	water	Protein	fats	carbo.	fiber	energy
Group	g / 100 g					kcal
Nuts and seeds (8)	3.9	14.1	57.4	18.1	4.8	621
Palm fruits (7)	45.3	3.5	21.8	16.0	12.2	310
Starchy/oily fruits (8)	51.1	2.5	8.3	32.4	9.0	231
Juicy fruits (22)	82.8	0.9	0.8	11.9	2.9	63

* Fresh weights; the difference between the sum of these means and 100 is due to ash content.

Many of these spp are important sources of vitamins, as well as major nutrients. The palms are often rich in beta-carotene, as are some starchy/oily fruits; some of the succulent fruits are rich in vitamin C; most of those studied have B vitamins as well.

Nonetheless, most of these fruits are becoming less important in human diets, especially in the urban centers of Amazonia (which now contain 70% of the Brazilian Amazonian population). There are numerous reasons for this, but three stand out: poverty (most people in Amazonian urban centers are poor and can not afford to buy their traditional fruits, even when they want to and receive government handouts, e.g., Bolsa Familia); social pressure (none of these fruits are shown on television or radio, where exotic fruits dominate in commercials, soap operas etc., suggesting that the elite doesn't consume these types of "native" foods); deficient R&D (Brazil invests only 3% of federal R&D resources in Amazonia, although Amazonia generates 7% of the GNP, resulting in fragmented R&D that generally fails to complete production-to-commercialization systems (p-cs), leaving agroentrepreneurs with little or no support). A few examples will be instructive.

Peach palm (*Bactris gasipaes* Kunth): This southwestern Amazonian native was fully domesticated for its fruit, rich in energy (starch and oil) and beta-carotene. It is now more important for its heart-of-palm, which is an expanding agribusiness in Brazil and many other tropical American countries. Why is the fruit less important to modern society than it was to pre-Colombian indigenous societies, many of which considered it to be a stable as important as mandioc or maize? In reality, the fruit is a tree potato and must compete in a starch market dominated by annuals in a agro-economy dominated by industrial annual-crop agricultural production; in other words, it costs more to grow potatoes on trees than in the ground, even if tree-grown potatoes can be produced more sustainably (remember that the modern political economic system — that no one wanted to discuss at the meeting — does not pay for sustainability of commodities like starch). If we can get some of the

breweries interested (the native Amazonians used peach palm extensively to make chicha, their favorite alcoholic beverage!)...

Assai palm (*Euterpe oleracea* Martius): This eastern Amazonian native may contain a few populations with signs of domestication, but most populations are wild. These wild populations are oligarchic forests (forests dominated by one spp) and cover thousands of km^2 in the Amazon River estuary and elsewhere in the basin. These populations were being decimated by extractive heart-of-palm businesses until the mid-1990s, when the popular fruit drink (assai wine — not a fermented drink — is rich in energy (starch and oil), anthocyanins and occasionally iron) gained national attention through display in a soap opera on the TV Globo network, where it was highlighted as a tonic for the yuppy fitness set in Rio de Janeiro. Since then entrepreneurs have been stimulating fruit production (heart-of-palm extraction is declining) and the important Embrapa Amazonia Oriental station in Belém, Pará, has been completing the p-cs rapidly. While this appears to be a success story, agroentrepreneurs are already planting in Bahia (which has already taken over chocolate and guaraná production, both once dominated by Amazonia) and have found that the *E. edulis* native to the Atlantic Forest makes just as good a wine as the assai.

Camu-camu (*Myrciaria dubia* McVaugh, Myrtaceae): This pan-Amazonian native grows in small oligarchic populations in the black water floodplains, lakes and rivers of most of Amazonia. The native peoples recognized it as an important fish food, especially for the tambaqui, one of Amazonia's three most popular fish spp. The succulent fruit contains moderate to high levels of vitamin C, ranging from 800 to 3000 mg/100 g of pulp with skin (an accession with 6000 mg has been found in Roraima, Brazil). While the vitamin C has attracted great attention, wild species tend to be difficult to cultivate as horticultural crops; hence, current production is based on management of wild populations in Peru, Colombia and Brazil. There is R&D to adapt camu-camu to horticultural orchard systems underway in both Peru and Brazil. This species has not yet "taken off", as most entrepreneurs are unwilling (or incompetent) to work with traditional human populations scattered through the floodplains, lakes and rivers of Amazonia.

Cupuassu (*Theobroma grandiflorum* Schumman, Sterculiaceae): This eastern Amazonian native is a relative of the chocolate tree, and is used both for its exotically flavored, sweet-soar succulent pulp and its starchy/oily seed, that can be fermented like the chocolate seed. Native peoples had started to domesticate cupuassu in eastern Amazonia, but it was most widely distributed after it became popular in the 2^{nd} half of the 20^{th} century. Embrapa-lead R&D offered acceptable production systems for small and mid-scale farmers and the 1980-90s saw a boom in planting. Unfortunately, the R&D did not resolve all of the processing problems, and the market was not strongly attracted to a pulp rich in fecal coliforms. Hence, sales have stagnated. New interest in the seed, as well as processing centered R&D, may change this in the near future.

Tucumã palm (*Astrocaryum tucuma* Martius): This Central Amazonian native has a few signs of domestication in some populations, but is principally a camp-follower that has gained popularity in Manaus with the rise of the Cafés Regionais (breakfast restaurants that specialize in native Amazonian foods, especially starchy roots, starchy/oily fruits (like tucumã and peach palm) and fruit drinks). Demand for this spp is being driven by restauranteurs, not by agroentrepreneurs, which have only just started to plant. R&D is starting, but is still timid compared to the demand for information.

What can we learn from these examples? (1) Native American priorities (as seen by domestication efforts) have little to do with importance in modern markets. (2) Entrepreneurs drive markets for these fruits when they can create a difference, and R&D must run to back them up. (3) All markets created thus far are for middle and upper class consumers, and often create enough demand to force

price rises that take the product out of the buying power of poor consumers — we won't even mention the destitute. (4) Government agencies have been relatively ineffectual in the face of market forces, since government agencies tend not to be entrepreneurial in nature. (5) Hence, Amazonian fruits are unlikely to contribute to food and nutritional security of Amazonia's urban poor (they do contribute strongly to both types of security in the interior, where 30% of the population still lives).

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Food Diversity in Brazil: Constraints and Opportunities

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Lack of food security is not an "urban issue" in Brazil. Even families living in rural areas face the problem of food shortage due several reasons. A participatory appraisal carried out with farmers living in land reform settlement areas resulted in lower scores for "food supply" parameter, especially in areas where natural resources have been deployed. Farmers mentioned that they suffer both on quantity and food quality, stressing that loss of food diversity is a big challenge in land-reform settlements. Pressures on food diversity in Brazil come from different sides, including cultural erosion, market system, food regulation, and agricultural policies.

(i) Cultural erosion:
During the last decades food habits have changed significantly in the urban areas. Diversified diets have been replaced by industrial food supported by a very persuasive propaganda strategy. In Brazil, several examples could illustrate this process. However, root & tuber crops are among the most impacted one. According a review carried out by Chu (1991), Brazil uses to have at least 25 edible species of *Dioscorea,* a diverse genus of tuber crops used widely by indigenous people in pre-Columbian time[1]. Until thirty years ago they could be found in Brazilian markets. In 2000, it is quite difficult to get native species of *Dioscorea* in the market. Only species introduced from Africa (yam) during the slavery period are cultivated in some regions of Brazil. The process of genetic erosion affects also indigenous people. In 2002, during a participatory appraisal carried out with indigenous groups in a very remote are of Brazil, young people mentioned that they were losing their food diversity due to replacement of indigenous tuber crops by "white man" food such as pasta (Cordeiro, 2002a). In some cases, governmental bodies introduced this "white food" as part of food aid" programs. Beyond *Dioscorea*, these indigenous groups were also facing problems to keep other tuber crops such as *Xanthosoma* sp. and *Ipomea* sp.

(ii) Market System
Food market in Brazil has been changing also. In the past, local markets were widespread in the country. Even in big cities markets were small and managed by "local neighbors". Globalization lead to internationalization of food chain and big supermarkets put small markets out of the business. In many small cities in Brazil local markets have closed or changed their face selling only industrial products. Consequently, small farmers lost market for local products; agrobiodiversity reduced in the field; and consumers lost food options.

(iii) Food Regulation
Food regulation became a big issue as a collateral effect of increasing monopolies on market and food distribution. Minor crops and products that do not "fit" the regulation could not be commercialized in "formal" markets. Honey produced by Brazilian native bees - or *sting-less* bees - is a good example. Brazil has a great diversity of native bees and stingless bees (**Apidae: Meliponini**) comprise several species from different genus.They are pollinators of many forest species, and some species present restricted distribution to specific environmental conditions (Cortopassi-Laurindo et al, 2004; Zanella et al, 2003). They also produce a very tasteful honey still consumed by indigenous people and traditional communities. In Amazon region, a local farmer keeps 15 species of 6 genus, harvesting honey with different flavors, colors and nutrition quality. However, the food regulation in Brazil only recognizes honey produced by *Apis mellifera*, an exotic specie and main source of commercial honey in this country. Honey produced by native species presents different composition, including higher moisture content (Rodrigues et al, 2001).

Therefore, a small farmer like "Mr. Joaosinho" from the Amazon cannot commercialize honey because his product does not fit food regulation standards. In some cases, honey producers have been asked to buy very expensive equipment for dehumidification, something that small farmers and poor rural communities that still keep these bees cannot afford. Moreover, most of the rural communities that conserve native bees do not have electricity yet. Consequently, because food regulation farmers cannot use biodiversity for increasing family income and Brazilian consumers cannot try other honey flavors.

(iv) Agricultural Policy

Since the seventies, agricultural policies implemented in Brazil has been promoting the expansion of industrial agricultural (Cordeiro, 2002b). During the eighties, plantations and cattle ranches expanded to the Cerrado region (Brazilian Savannah). This approach was pursued through the nineties and in year 2005, soybean plantation reached the Amazon - the last frontier. The orthodox economy policy adopted by the Government in the last three years delegate a special role for industrial agriculture, stimulating international traders to built local structure to support industrial agriculture expansion in such "wild" areas. Cargill itself built a plant at the melting point of Tapajós River and Amazon River to provide export facilities for soybean produced in the Amazon region. As a consequence, Brazil became and important player in the international commodities market, increasing exports and pleasing Government and financial bodies. However, environmental and social indicators did not follow the same direction. From 1995 to 2003, deforestation affected 17,8 million hectares of Amazon forest, an area half size of Germany. After a period of stabilization, deforestation rates in the Amazon started to increase again in year 2002, achieving 2,4 million hectares in year 2003. Despite of some governmental initiatives to combat hunger like Fome Zero Program (Zero Hungry), macro-economic driven forces are the main barriers to reduce poverty in Brazil. Actually, small farming is not considered relevant in economy and the ecosystem approach is not an issue at all in Brazilian policy makers' agenda.

HOW TO CHANGE THIS TREND?

The real change requires a new paradigm based on sustainable development policies. Certainly it is a long-term issue that depends on social process that cannot be predicted. However, in the short and medium term much action can be done in order to pave the route for a sustainable future.

(i) Short-Term: Increase awareness

- · Bring food diversity to the schools agenda. Children and youth need to be educated about nutritional, environmental and cultural values linked to food production/consumption, etc.
- · Marketing Campaigns using the mass-media vehicles informing the importance of food diversity. This could be done involving Pop-stars and Sport-stars, such as the campaign carried out by Unicef.
- · Dissemination of information about the nutritional value of food diversity. Especially indigenous people and rural communities need to be aware about the value of their food. They have nothing to be ashamed about.

(ii) Medium-Term: Support Good Practices

- Food Regulation for food diversity. Small farmers and indigenous communities do not have to fit industrial food standards. They need specific regulation for small-scale production and market.
- Protection and promotion of local markets. Government needs to support local markets creating opportunities for farmers selling their products locally.
- Government should provide budget to buy local food for public hospitals, school lunch and other institutions maintained by public funds.

- Research on nutritional value of food diversity. More research is necessary to bring to the public the value of food diversity. Considering that there are thousand of species to be studied, researchers should listen grassroots networks before selecting the priorities.
- Support to small-scale food processing projects. Small farmers and indigenous communities need access to credit to improve local infrastructure and to commercialize their products.

CHANGES ALREADY STARTED

Despite these challenges, small farmers organizations, NGOs, consumer's organizations have been trying to conserve and disseminate food diversity. These grassroots experiences inspired some governmental programs and influence research agenda to some extent. Some examples:

(i) Education:

- In Rio Grande do Sul State, small farmers supported by a local NGO called CAPA, are providing ecological food for several schools (Surita, 2004)[2]. In Santa Catarina State a similar experience has been implemented by AGRECO, a small farmers association of organic farming, with support of University researchers (Schmidt, 2004)[3].
- MST – Brazilian Land-less Movement organized in year 2004 a national writing competition among students of rural settlement areas. The theme was about the importance of agrobiodiversity and hundreds of children participated in this competition. This activity was part of Via Campesina Seeds Campaign.

(ii) Market:

- Ecovida Network[4] joins small farmers, consumers and NGOs working on agroecology basis. They have a network of 100 local markets in the southern Brazil. Linking farmers and consumers has created opportunity to increase diversity in farmers field (Gusson et al, 2003; Meirelles, 2004).
- Cooperativa Grande Sertão is an initiative supported by CAA- Centro de Agricultura do Norte de Minas[5] to process and commercialize native fruits of Cerrado ecosystem (Brazilian savanna). This initiative provided infrastructure for frozen wild fruits and commercialization, generating benefits for hundreds of poor farmers in the region.
- CONAB – Companhia Nacional de Abastecimento[6], a governmental body responsible for regulating food supply implemented specific programs for small farmers, traditional and indigenous communities. These programs created opportunity for farmers selling their products and improve market conditions at local level.

Notes:
1 Local name is "cará"
2 See details of CAPA work on www.capa.org.br
3 See details of Agreco work at www.agreco.com.br
4 See details of Ecovida work at www.ecovida.org.br
5 See details of CAA work at www.caa.org.br
6 See details of CONAB work at www.conab.gov.br/download/instrumentos/agricfamiliar/agricfam.doc

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