Comparative analyses of Medicinal and Aromatic Plants situation in Brazil, Costa Rica and Jamaica

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1._Countries description

1.1._Brazil [6,7,8]

As the eighth largest economy in the world and both a G20 and BRICs member, Brazil plays an important role in the international community. The country's macroeconomic situation is stable, with growing domestic consumption and investment. Nevertheless, issues related to poverty and economic inequalities remain. Also, key trade issues such as its trade diversification strategy and dependence on commodity-based exports remain. The government is trying to maintain a sustainable growth rate and strengthen the country's fiscal policy while also containing the risk of inflation.

On the investment side, Brazil is promoting particularly on investments in transport infrastructure, energy, aeronautics, and other technology-intensive sectors as well as in education and research.

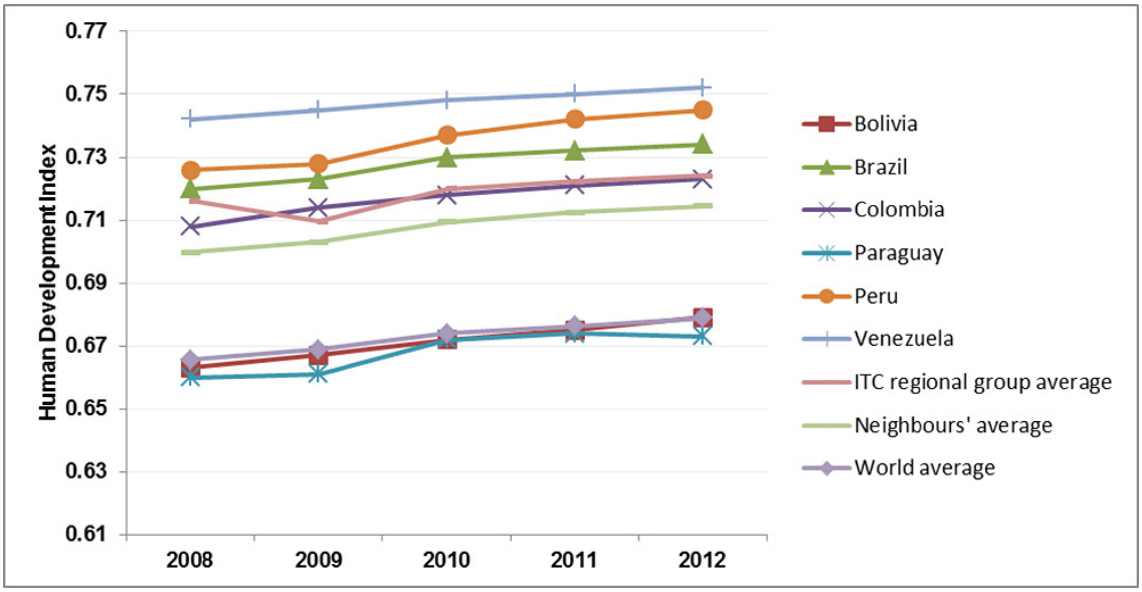
The area of intervention of this analysis is focused in the Alagoas state, in order to adjust to the specifities of a smaller area.

Alagoas is one of the 27 states of Brazil and is situated in the eastern part of the Northeast Region. It borders: Pernambuco (N and NW); Sergipe (S); Bahia (SW); and the Atlantic Ocean (E). It occupies an area of 27,767 km², being slightly larger than Haiti. Its capital is the city of Maceió.

1.1.1. People

Table 1. Brazil demographic features

Total population (growth rates per annum)	191,765,567 in 2012 with growth rates of 0.9% p.a during 2008-2012
Population density (people per sq. km of land area)	23 in 2012
Female population	50.7% in 2012
Population below 15 years of age	24.6% in 2008 ; 26.4% in 2012
Urban population	83.7% in 2012
Population living below $1.25 a day at purchasing power parity (PPP)	6.0% in 2012
Ranking in the Human Development Index (HDI)	85 out of 186 in 2012
Health	Life expectancy at birth (years) (73); Mortality rate, under-5 (per thousand live births) (14.4) in 2012
Education	Education index - expected and mean years of schooling (rank) (112 out of 191) in 2012
Income level	GNI per capita in PPP terms (constant 2005 international $) (10,097) in 2012
Inequality	Inequality-adjusted HDI (rank) (70 out of 191)in 2012
Gender	Gender inequality index (rank) (64 out of 191) in 2012



Source: United Nations Development Programme Human Development Indicators

Note: The Human Development Index measures the overall development of a nation and ranges from 0 (low level of development) to 1 (highest level of development). The United Nations Development Programme (http://hdr.undp.org) provides a detailed explanation. ITC Regional group refers to ITC definition

Figure 1. Human development comparison of Brazil with surrounding countries

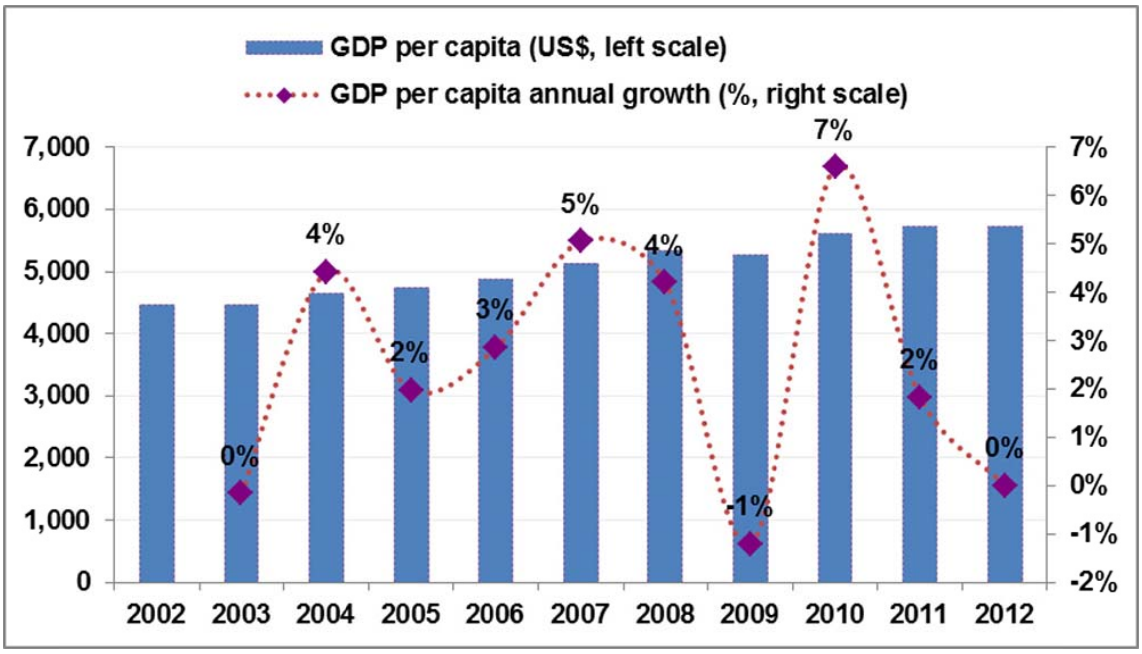
As per the IBGE census of 2007, there were about 3,057,000 people living in the state of Alagoas. More than 65% of the state's population is concentrated in the urban area.[8]

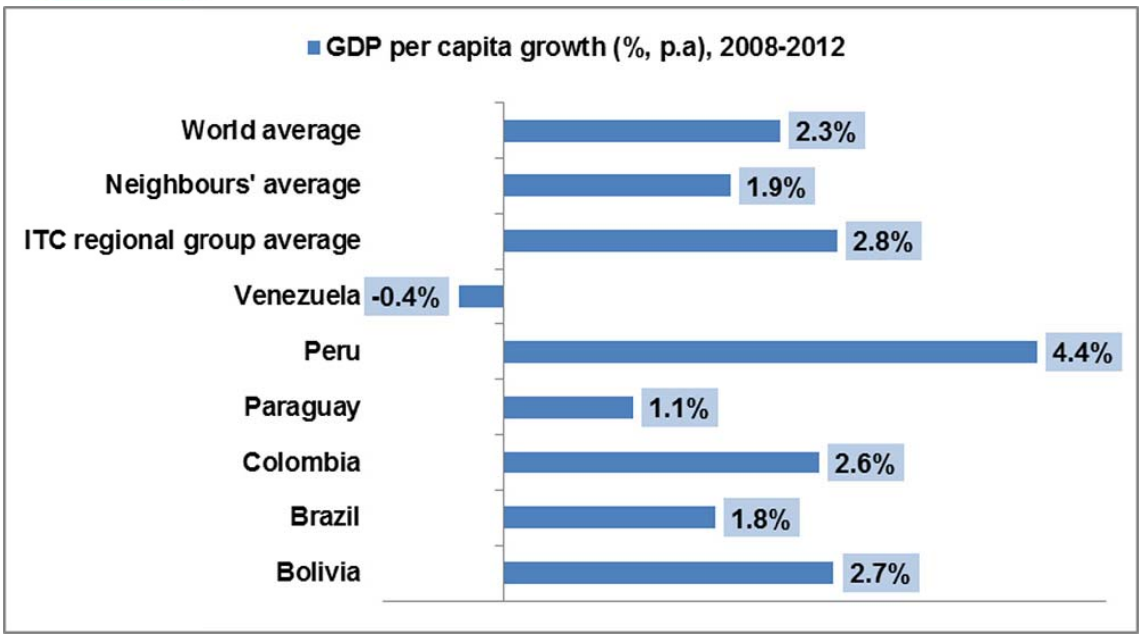
1.1.2. Economy

Table 2. Added value per sector (current US$ and % of GDP) in Brazil

Sector added value	2004		2008	
	US $	%GDP	US $	%GDP
Agriculture	39,383	6.9	83,223	5.9
Industry	171,545	30.1	392,627	27.9
Manufacturing	109,478	19.2	233,979	16.6
Services	358,733	63	931,335	66.2

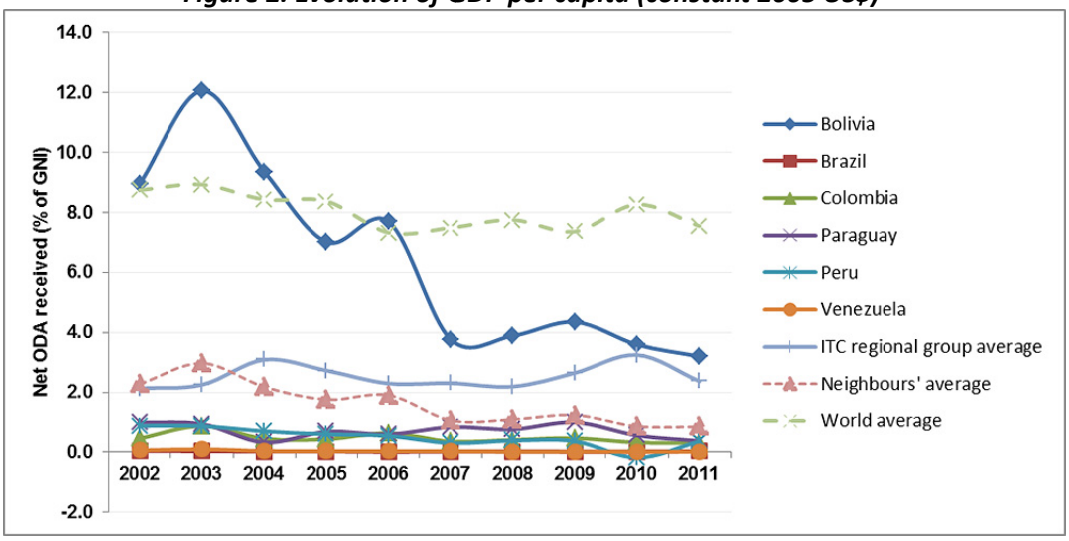
Source: World Bank World Development Indicators (WDI). **Note**: Added value is US$ terms are expressed in million, GDP US$, and "6,976 to be read 6'976"





Source: World Bank World Development Indicators (WDI). Note: ITC calculations based on the World Bank WDI

Figure 2. Evolution of GDP per capita (constant 2005 US$)



Source: World Bank World Development Indicators (WDI). Note: ITC calculations based on the World Bank WDI

Figure 3 . Aid Dependency (Official Development Assistance/Gross National Income) of Brazil

Alagoas is one of the poorest states of Brazil and its HDI is the country's worst. The service sector is the largest component of GDP at 55.8%, followed by the industrial sector at 36.9%. Agriculture represents 7.3%, of GDP (2004). Alagoas exports: sugar 58.8%, alcohol 29.4%, chemicals 9%, tobacco 2.1% (2002) [7,8]. Share of the Brazilian economy: 0.7% (2004). [7]

The economy has been agricultural, dependent largely on large sugarcane plantations with some tobacco farming that is concentrated around the city of Arapiraca. Sugar cane formed the basis for an alcohol industry that is in decline. Small to medium-sized tanker ships took alcohol on board in Maceio's port with considerable frequency during the peak period. Such

loads still take place with less frequency. Another local industry is based on chemical products from brine pumped from deep wells on the outskirts of Maceió. [7]

Over the years, the economy of Alagoas has been largely dependent on the agricultural sector. The state has a large sugarcane plantation and much tobacco farming. Tobacco farming is mainly concentrated in the city of Arapiraca. Sugarcane is grown extensively, mainly for producing sugar and alcohol. Though sugar is produced on a large scale in the state, it still has a plenty of scope for increasing the productivity. [8]

In the last twenty years the tourist industry has found the beaches and Maceió itself has changed from a rather sleepy little port with coconut palm plantations along its beaches to high-rise hotels. The northern coast, particularly around the towns Maragogi and Japaratinga is beginning to see some of this development in the form of resorts attracting people from the south and from Europe. There is considerable European investment (as of 2007) in beach property north of Maceió with walled compounds of beach homes. [7]

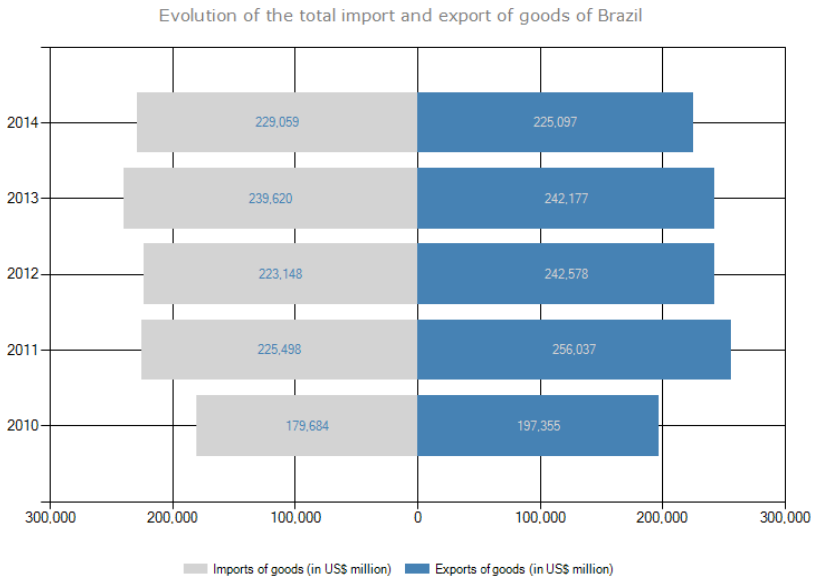
The tourism industry in Alagoas is also on the rise. The beautiful beaches and the coconut palm plantation have been major factors for pulling in large number of tourists in the state. Tourism is particularly prominent in the coastal region of north Alagoas, in towns like Japaratinga and Maragogi. [8]

Imports/Exports:

Brazil has an equaled balance of the international trade (Figure 4).

The most exported products are minerals (mainly iron ores), fresh food (soya beans) and processed food (raw sugar, cane) (Figure 5).

On the other hand, main exported services were other business services, and less: travel and transport (Figure 8).



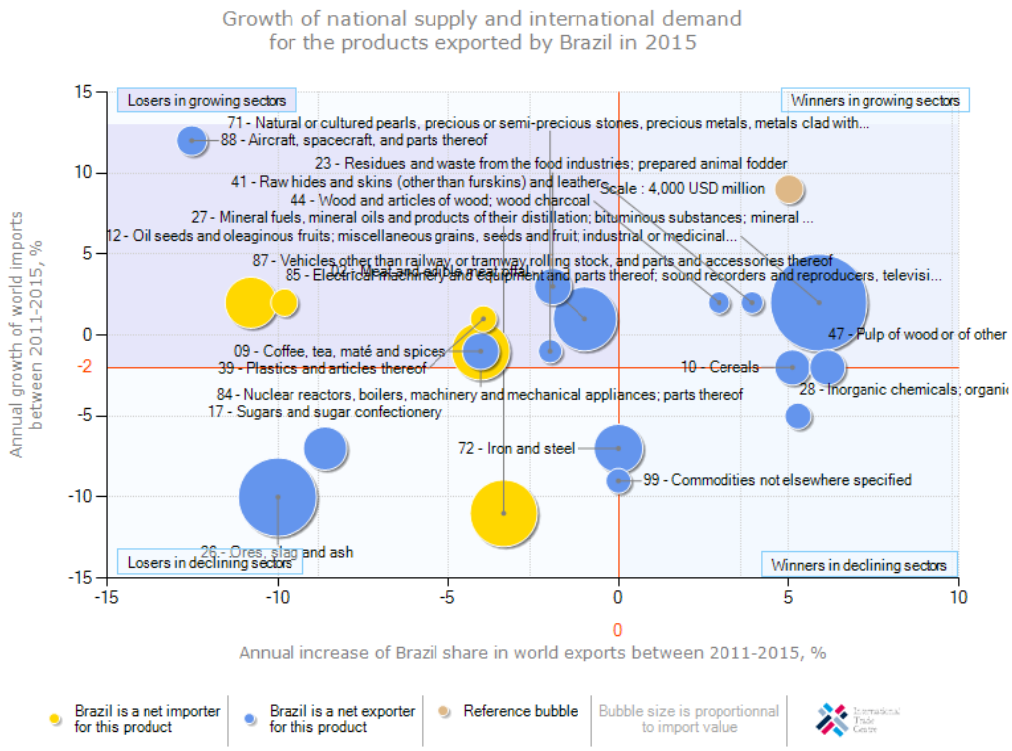
Source: ITC by country Report. Brazil [6]

Figure 4. Evolution of the total import and export of goods of Brazil

Sector	Average share of sector in country's exports 2010-2014	Share of top 3 detailed products (HS6) in sector's exports		Sector's leading exported product HS6
		2010	2014	
Minerals	25.8 %	84.2 %	79.8 %	260111 Iron ores&concentrates,oth than roasted iron pyrites,non-agglomerated
Fresh food	21.7 %	52.9 %	60.5 %	120100 Soya beans
Processed food	11.7 %	69.2 %	65.9 %	170111 Raw sugar, cane
Transport equipment	8.2 %	42.8 %	44.3 %	880240 Aircraft nes of an unladen weight exceeding 15,000 kg
Basic manufactures	7.6 %	29.2 %	27.2 %	720712 Semi-fin prod,iron/n-al steel,rect/sq cross sect,cntg by wgt<.25% carb
Chemicals	6.8 %	15.1 %	14.9 %	220710 Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher
Non-electronic machinery	6.1 %	17.7 %	23.6 %	841191 Parts of turbo-jets or turbo-propellers
Wood products	3.8 %	61.7 %	61.3 %	470329 Chemical wood pulp,soda/sulphate,non-coniferous,semi-bl/bleachd,nes
Unclassified products	2.7 %	99.5 %	99.8 %	999999 Commodities not elsewhere specified
Leather products	1.6 %	47.8 %	55.8 %	410712 Grain splits leather "incl. parchment-dressed leather", of the whole h

Source: ITC by country Report. Brazil [6]

Figure 5. Main exported goods by Brazil



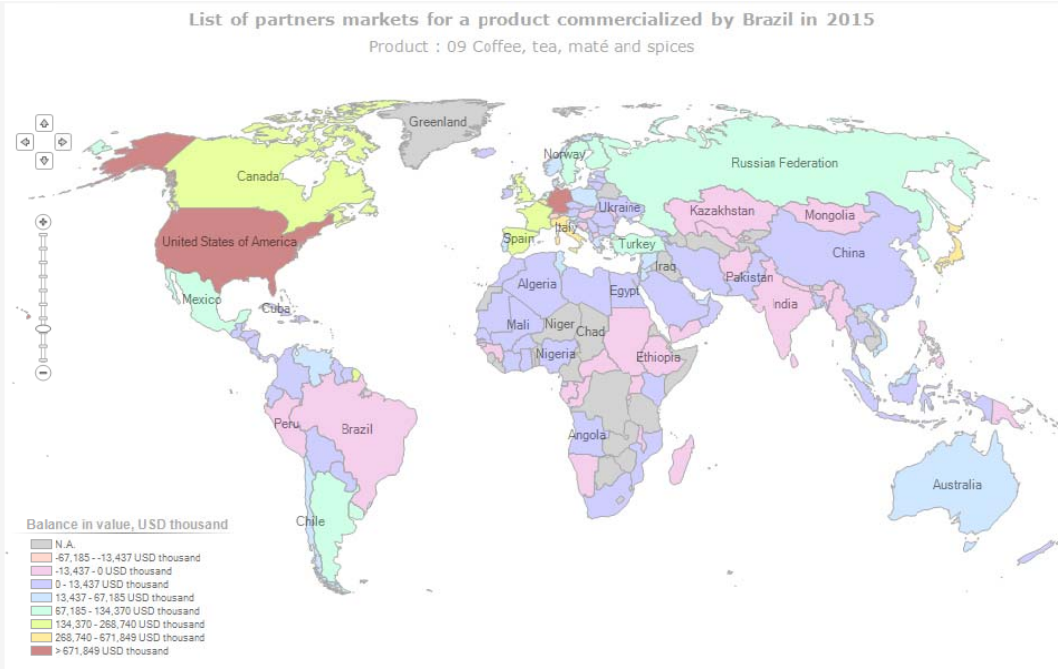
Source: ITC by country Report. Brazil [6]

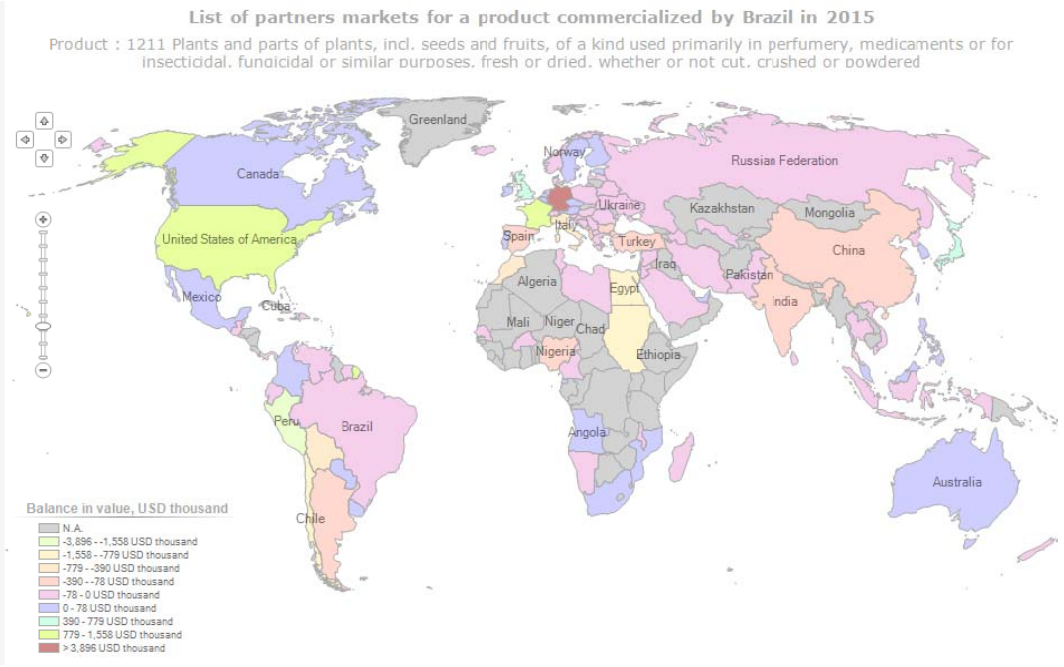
Figure 6. Growth of national supply and international demand for the products exported by Brazil in 2015

In 2015, Brazil exported to the world 6.046.077 US Dollar thousand of the Product: 09 Coffee, tea, mate and spices (92% coffee, while the most commercialized spices were peppers, genera *Piper* and *Capsicum* with 349.875 US Dollar thousand, mainly to USA, Germany, France and Spain, and mate_*Ilex paraguarensis*_ with 101.508 US Dollar thousand, mainly to Uruguay). The imports had a value of 108.624 US Dollar thousand.

This group of products is among the exported ones within the losers in growing sectors (Figure 6).

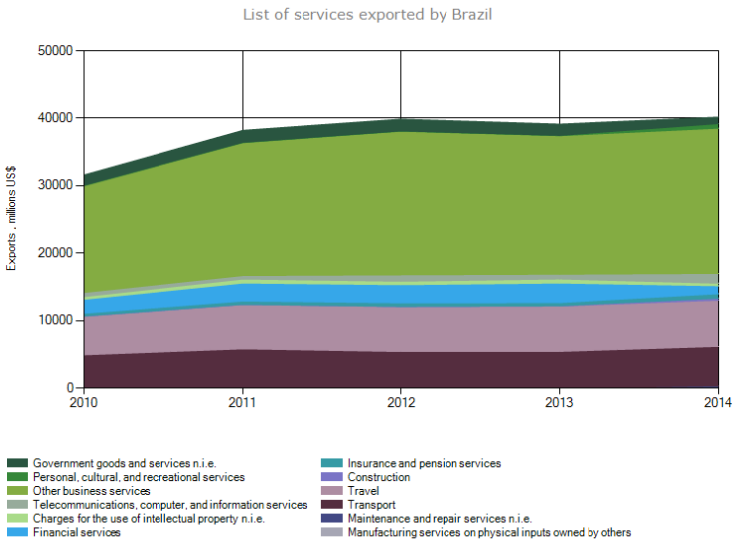
About the Product: 1211 Plants and parts of plants, incl. seeds and fruits, of a kind used primarily in perfumery, medicaments or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered, 11.739 US Dollar thousand were exported from Brazil to the world (mainly to Germany, USA and France). The imports had a value of 14.894 US Dollar thousand.





Sources: ITC calculations based on UN COMTRADE statistics.

Figure 7. Main Medicinal and Aromatic Plants products market for Brazilian exports in 2015



Source: ITC by country Report. Brazil [6]

Figure 8. Main services exports by Brazil in 2015

Trade and developing strategies:

2011 Plano Agricola e Pecuário 2011-2012

The plan aims to increase agriculture production and encouraging environmentally sustainable practices, expanding the surface of cultivated land and assisting producers in commercializing their products. It outlines strategic actions dealing both with cross-cutting issues (such as access to finance, product marketing, rural risk management, infrastructures) and with sub-sector specific issues. SECTOR: Agro-Energy, Cocoa, Coffee, Forestry, Fruits, Livestock

2010 Brasil Maior

The plan Brasil Maior aims to foster innovation and competitiveness in the Brazilian economy. It focuses on strengthening production processes, developing technological and entrepreneurial skills, improve energy supply, diversify exports and increase internationalization, develop competences for sustainable development. The plan targets specific productive sectors, and it deals with cross-cutting issues such as international trade, investment, innovation, technical and vocational training, sustainable production, small and medium enterprises competitiveness, special initiatives for regional development, customers' well-being, labor conditions and relations.

SECTOR: Aircraft and Spacecraft Industry, Automotive Industry, Bioethanol, Capital Goods, Cereals, Chemicals, Coffee, Construction Materials, Cosmetics, Defense Industry, Fertilizers, Footwear, Fruit Juices, Fruits, Furniture, Garment Industry, Industrial and Business Services, Information Communication Technology, Meat, Medical Equippement, Metallurgy, Oil and Gas Supply, Oil and Gas Supply, Pharmaceuticals, Plastic Industry, Pulp and Paper, Pulses, Textile Industry, Toy Industry, Trade and Logistic Services, Wine.

2008 Estratégia brasileira de exportação

The document provides a diagnostic analysis of the current export performance of Brazilian economy and it outlines a strategy aiming to increase exports and meet the targets contained in the national productive development policy. The strategy envisages five main objectives: 1) increase competitiveness of Brazilian exporters; 2) increase exports added-value; 3) increase the number of exporters; 4) increase access to foreign markets; 5) increase exports of services.

2006 National Tourism Plan

The National Tourism Plan frames the national vision for tourism development, pursuing three main goals: 1) develop high-quality Brazilian tourist products, taking into account regional, cultural and natural diversity; 2) promote tourism along with social inclusion, by generating jobs and income and by making it a consumption item for all Brazilians; 3) foster the competitiveness of Brazilian tourist products on national and international markets, and attract foreign exchange to the country.

2005 UNDAF Brazil 2007-2011

The United Nations Development Assistance Framework (UNDAF) frames the United Nations assistance to Brazil in alignment with the Millennium Development Goals and focusing on reducing inequality. Main objectives are: 1) promoting equal access to public services; 2)

ensuring gender and race equity; 3) reducing vulnerability to violence; 4) promoting transparent policies and human rights; and 5) supporting more sustainable economic development.

1.2._Costa Rica

Costa Rica is one of the most politically stable countries in Latin America. Its economy continues to benefit from economic growth and high commodity prices. While the traditional agricultural exports of bananas, coffee, sugar and beef continue to be an important source of income, Costa Rica's economy has been broadened in recent years through a combination of global high-tech corporations, pharmaceuticals, financial outsourcing, software development and ecotourism. Costa Rica has attracted one of the highest levels of foreign direct investment per capita in Latin America. [1]

Costa Rica has a population of about 4.8 million, a GDP of around US$ 45.10 billion in 2012 and a Gross National Income (GNI) per capita of US$ 13,070 in the same year. During the past three decades and through its participation in GVCs in goods and services, Costa Rica has emerged as one of the more stable and faster growing economies in Latin America. The country's per capita income has grown at an average of 1.2% since 1980, compared to 0.8% for Latin America as a whole and only about 10% of the country's population lives on less than US$ 2 a day, compared to a poverty rate of about 25% across the region. Moreover, its economy is about 20% less volatile than the rest of the region. Costa Rica is considered to be an economic and political leader in Latin America. [2]

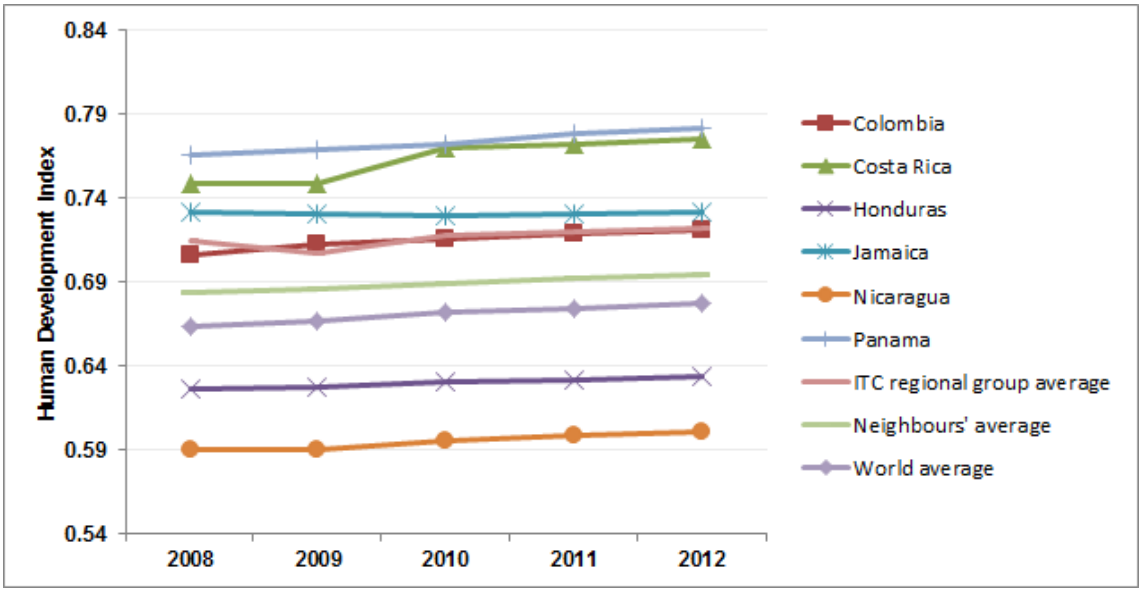
Costa Rica is a tiny Central American country (51 032 km2) that lies about 10º north of the equator. The narrow territory is mountainous, with bare 300 km from coast to coast, the Pacific Ocean shore located to the west and the Caribbean beaches and lowlands spreading east. It is one of the world's most biodiverse locations because of the heavy rainfall that ranges from 1 500 millimetres in north-western areas to 5 000 mm in southern Caribbean lowlands and in the mountains [11].

1.2.1_People

Table 3. Costa Rica demographic features

Total population (growth rates per annum)	4,532,711 in 2012 with growth rates of 1.5% p.a during 2008-2012
Population density (people per sq. km of land area)	89 in 2012
Female population	49.2% in 2012
Population below 15 years of age	23.9% in 2008 ; 26.0% in 2012
Urban population	63.2% in 2012
Population living below $1.25 a day at purchasing power parity (PPP)	2.4% in 2012
Ranking in the Human Development Index (HDI)	62 out of 186 in 2012
Health	Life expectancy at birth (years) (79); Mortality rate, under-5 (per thousand live births) (9.9) in 2012
Education	Education index - expected and mean years of schooling (rank) (88 out of 191) in 2012
Income level	GNI per capita in PPP terms (constant 2005

	international $) (10,842) in 2012
Inequality	Inequality-adjusted HDI (rank) (54 out of 191)in 2012
Gender	Gender inequality index (rank) (87 out of 191) in 2012



Source: United Nations Development Programme Human Development Indicators

Note: The Human Development Index measures the overall development of a nation and ranges from 0 (low level of development) to 1 (highest level of development). The United Nations Development Programme (http://hdr.undp.org) provides a detailed explanation. ITC Regional group refers to ITC definition

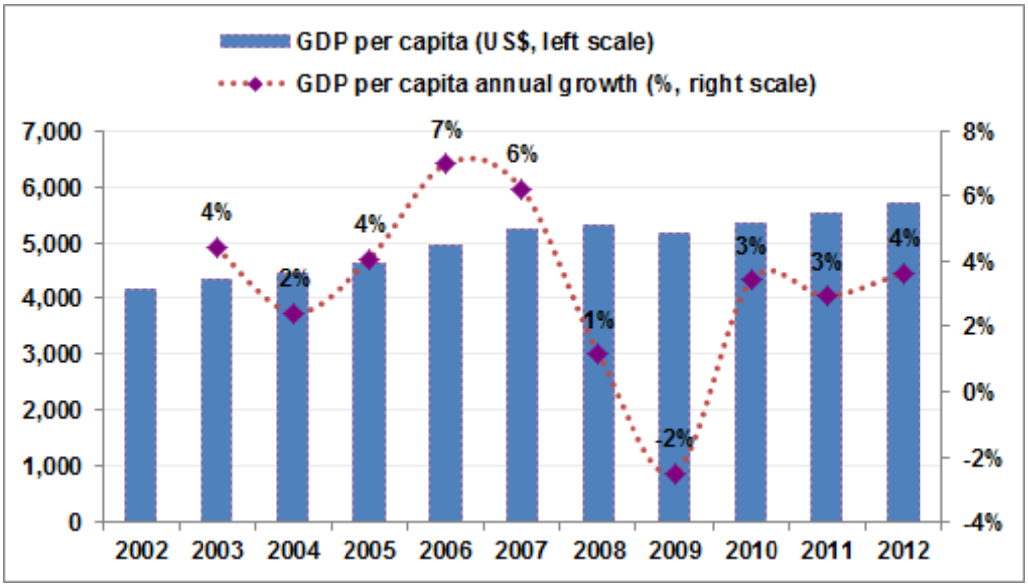
Figure 9. Human development comparison of Brazil with surrounding countries

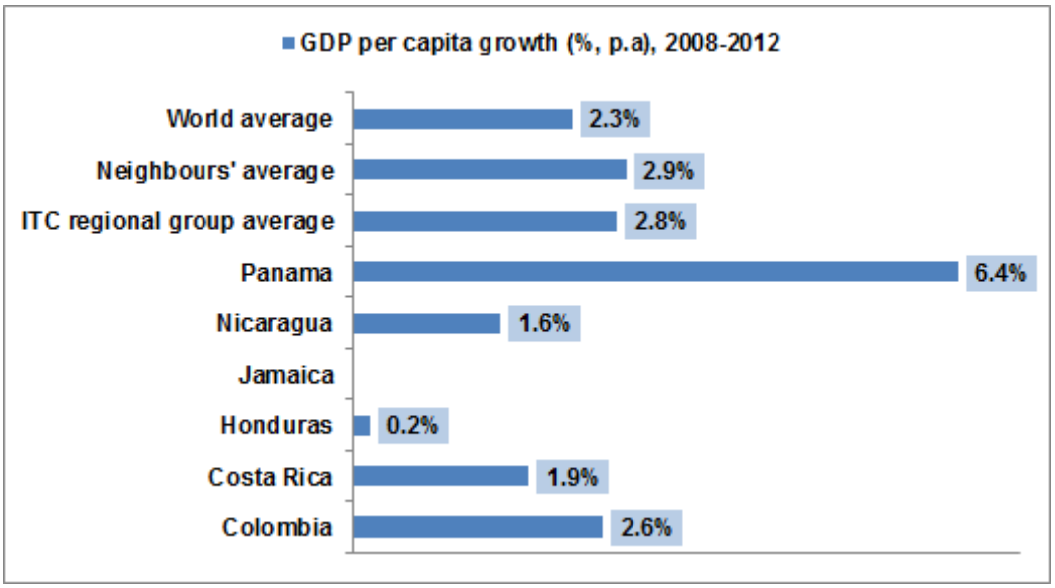
1.2.2. Economy

Table 4. Added value per sector (current US$ and % of GDP) in Costa Rica

Sector added value	2004		2008	
	US $	%GDP	US $	%GDP
Agriculture	1,452	8.6	1,923	7.2
Industry	4,971	29.5	7,654	28.7
Manufacturing	3,661	21.7	5,419	20.3
Services	10,413	61.8	17,108	64.1

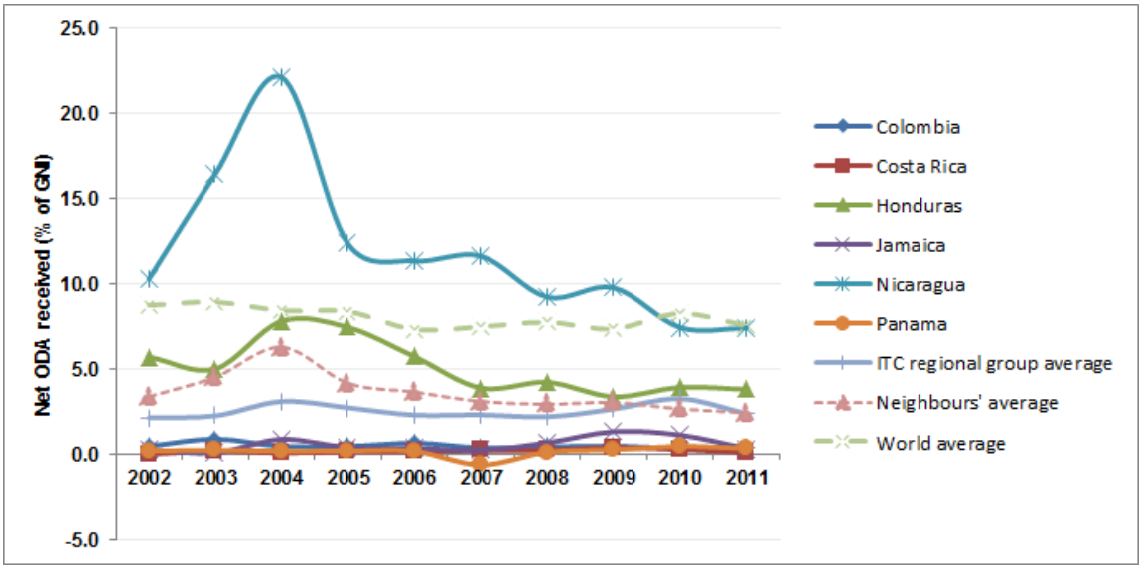
Source: World Bank World Development Indicators (WDI). **Note**: Added value is US$ terms are expressed in million, GDP US$, and "6,976 to be read 6'976"





Source: World Bank World Development Indicators (WDI). Note: ITC calculations based on the World Bank WDI

Figure 10. Evolution of GDP per capita (constant 2005 US$) in Costa Rica

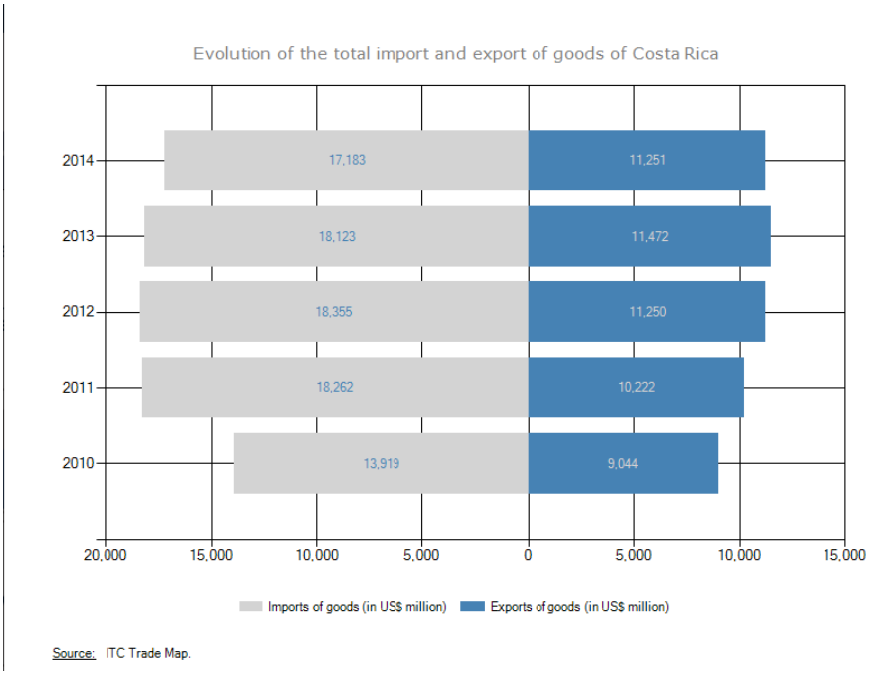


Source: World Bank World Development Indicators (WDI). Note: ITC calculations based on the World Bank WDI

Figure 11. Aid Dependency (Official Development Assistance/Gross National Income) of Costa Rica in relation to surrounding countries

Imports/Exports

Costa Rica has a negative balance of the international trade (Figure 12). The most exported products are fresh food (mainly bananas) and electronic components (Figure 13). The main exported services were travel; telecommunication, computer and information services; and other business services (Figure 16).



Source: ITC by country Report. Costa Rica [1]

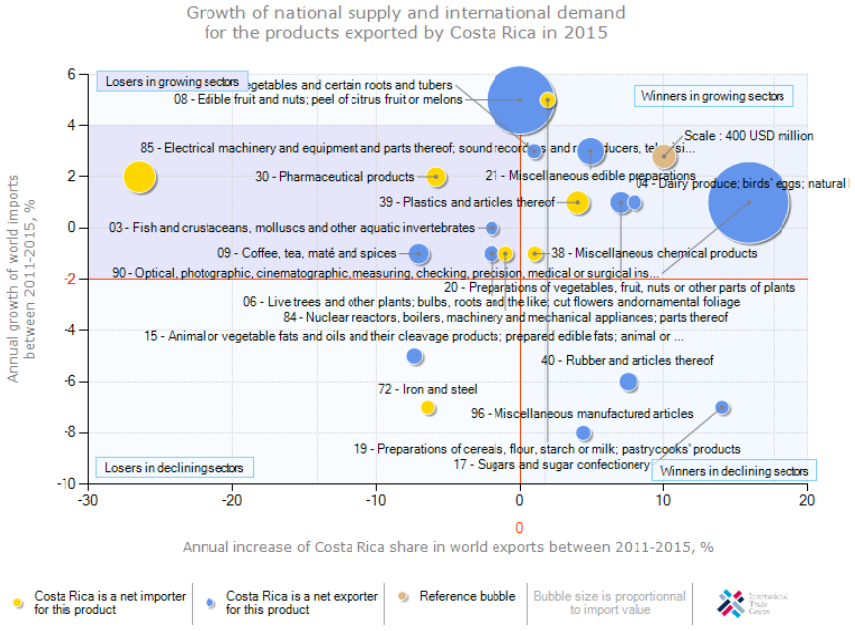
Figure 12. Evolution of the total import and export of goods of Costa Rica

Sectoral diversification in products for Costa Rica's exports

Sector	Average share of sector in country's exports 2010-2014	Share of top 3 detailed products (HS6) in sector's exports		Sector's leading exported product HS6
		2010	2014	
Fresh food	23.5 %	74.4 %	75.6 %	080300 Bananas including plantains, fresh or dried
Electronic components	22.5 %	75.1 %	80.8 %	854231 Electronic integrated circuits as processors and controllers, whether
Miscellaneous manufacturing	16.3 %	66.7 %	73.3 %	901839 Needles, catheters, cannulae and the like, nes
Processed food	13.3 %	38.9 %	33.7 %	210690 Food preparations nes
Chemicals	9.2 %	46.4 %	35.4 %	401110 Pneumatic tire new of rubber f motor car incl station wagons&racg cars
Basic manufactures	4.4 %	32.9 %	28.3 %	701090 Carboys, bottles, flasks, jars, pots, phials and other containers, of
Wood products	2.6 %	58.7 %	55.2 %	481840 Sanitary articles of paper,incl sanit towels&napkin (diapers) f babies
IT & consumable electronics	2.4 %	97.9 %	75.0 %	852990 Parts suitable f use solely/princ w the app of headings 85.25 to 85.28

Source: ITC by country Report. Costa Rica [1]

Figure 13. Main exported goods by Costa Rica



Source: ITC by country Report. Costa Rica [1]

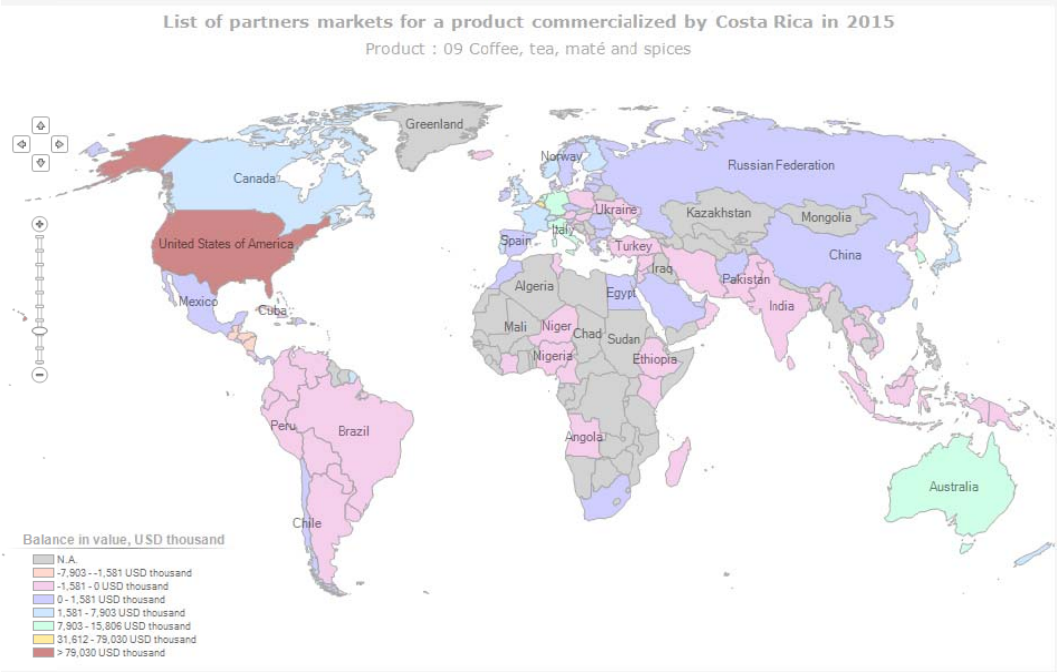
Figure 14. Growth of national supply and international demand for the products exported by Costa Rica in 2015

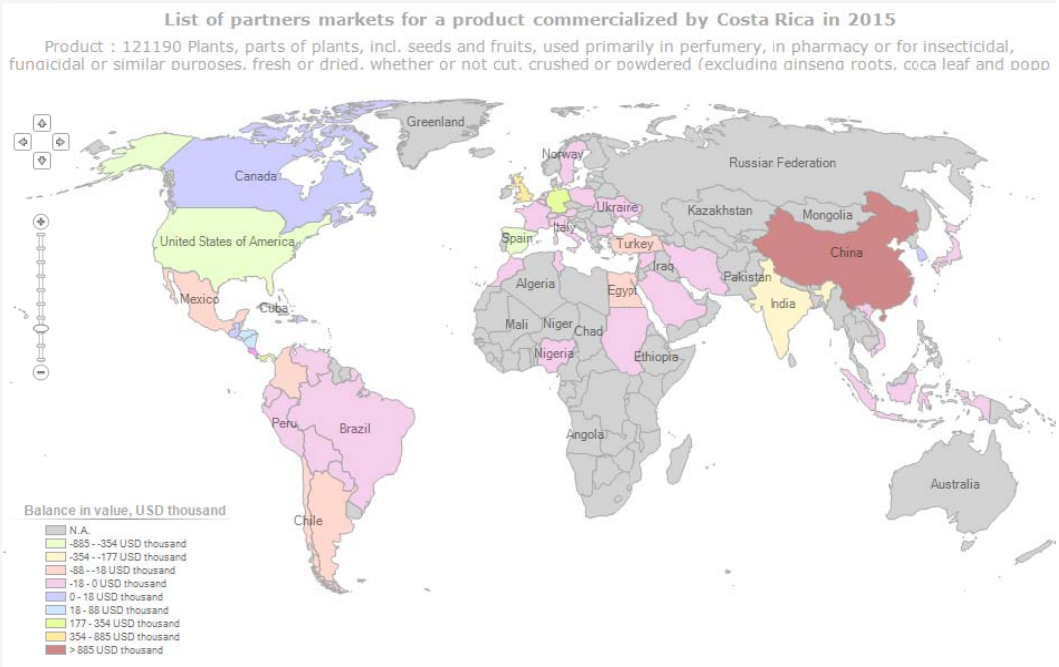
In 2015, Costa Rica exported to the world 313.924 US Dollar thousand of the Product: 09 Coffee, tea, mate and spices (98,6% coffee, while the most commercialized spices were

peppers, genera *Piper* and *Capsicum* with 1.593 US Dollar thousand, mainly to Mexico, USA and Guatemala). The imports had a value of 26.733 US Dollar thousand.

This group of products is among the exported ones within the loosers in growing sectors.

About the Product: 1211 Plants and parts of plants, incl. seeds and fruits, of a kind used primarily in perfumery, medicaments or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered, 2.377 US Dollar thousand were exported from Costa Rica to the world (mainly to China, UK, Germany and Panama). The imports had a value of 2.195 US Dollar thousand.





Sources: ITC calculations based on PROCOMER and Banco Central de Costa Rica statistics since January, 2014. ITC calculations based on UN COMTRADE statistics until January, 2014.

Figure 15. Main MAPs products market for Costa Rican exports in 2015

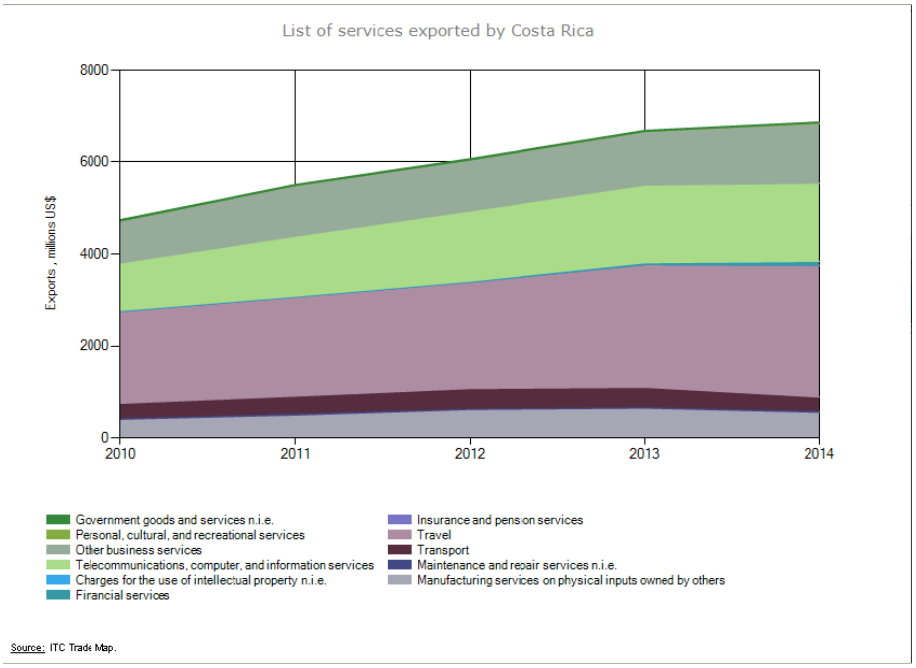


Figure 16. Main services exports by Costa Rica in 2015

Trade and developing strategies:

The growth of global value chains (GVCs) has prompted many emerging economies to abandon old policies of protectionism and a primary focus on agricultural production. Instead, they seek to attract offshore manufacturing jobs and foreign direct investment (FDI) and embraced pro-business and pro-investor policies, liberalizing their economies either unilaterally or through the conclusion of trade agreements, particularly preferential ones and procuring the new skills and education their labour force requires.

Until the early 1960s, Costa Rica's economy was heavily dependent on the agricultural sector (mainly coffee, sugar and bananas), which was crucial in terms of output, employment, exports and fiscal revenues. The concentration on a limited set of primary agricultural commodities made the economy vulnerable to external price and demand shocks and, due to the small size of its territory, imposed a binding constraint on the country's growth prospects. The government therefore started a state-led industrialization programme aimed at reducing its dependence on primary products, which provoked an average growth spurt in GDP of 6% 1960-1980, making the country one of the fastest growing economies [2].

In the late 1980s, Costa Rica launched a trade and investment liberalization process through its accession to the WTO and the ratification of more than ten preferential trade agreements, accounting for over 80% of the country's trade. This process allowed the country to progressively shift its export mix from reliance on primary products towards ever higher shares

of high-tech manufacturing and services, through the establishment of Free Trade Zones (FTZ) and the attraction of significant FDI, notably by Intel, the United States micro-chip manufacturer in the region [2].

Costa Rica's membership in GVCs is anchored in its commitment to foreign trade expansion and FDI attraction. According to the former Foreign Trade Minister of Costa Rica, Anabel González, there were five key determinants to her country's success in GVCs: (i) design of a long-term strategic vision on how to attract FDI; (ii) creation of a sound business environment; (iii) building a strong export platform, including WTO agreements and other bilateral and regional free trade agreements; (iv) producing an educated work force; and (v) focusing on logistical and supply management, including investments in infrastructure [2].

The country has the further advantage of a good geographical location. It has worked hard to enhance other conditions conducive to the development of GVCs irrespective of the specific value segment, such as a stable economic, political and social environment, an FDI-friendly climate and robust commercial law and contract regimes. The government has adopted a progressively more selective approach towards FDI attraction, focusing on companies operating in more knowledge-intensive sectors or innovation-rich activities. These two trends have fostered incipient industrial clusters in offshore business services, medical devices and high tech manufacturing.

Existing strategies [1]:

2011 Plan Nacional de Ciencia, Tecnologia e Innovacion 2011-2014

The plan provides an overview of the current situation of science and technology in Costa Rica and it outlines the reasons for investing in innnovation and human capital development. Hence, it identifies priority areas and it provides for precise strategies, objectives and plans of action.

2011 Programa Nacional de Biocombustibles (Executive Summary)

The program outlines a strategy for the development of biofuels in Costa Rica, in order to face climate change, ensure fuel supply to the country and reactivate local agriculture. Sector: Higuerilla.

2010 Plan Nacional de Desarrollo 2011-2014

The National Development Plan provides an overview of the current economic, social and cultural situation in Costa Rica, and it identifies its vision of Costa Rica in 2014. Hence, it focuses on four main axis, namely: 1) social wellbeing and family; 2) public safety and social peace; 3) environment and local governance; 4) competitiveness and innovation. Moreover, it focuses on the achievement of the MDGs and on public investments.

2010 Programa Nacional de Biocombustibles (Executive Summary)

The program outlines a strategy for the development of biofuels in Costa Rica, in order to face climate change, ensure fuel supply to the country and reactivate local agriculture. Sector: tempate

2009 Programa Nacional de Biocombustibles (Executive Summary)

The program outlines a strategy for the development of biofuels in Costa Rica, in order to face climate change, ensure fuel supply to the country and reactivate local agriculture. Sector: sugar cane.

2008 Plan Nacional de Alimentos

The National Food Plan is inspired to the principles of solidarity and integrality, and it aims achieving three main objectives: 1) ensuring the national supply of basic food products; 2) guarantee access to food for the most vulnerable groups, thus improving their food and nutritional security; 3) avoid rising levels of poverty as a conseguence of increasing levels of basic food prices. Sector: Beans, Rice, White Corn.

2008 Programa Nacional de Biocombustibles (Executive Summary)

The program outlines a strategy for the development of biofuels in Costa Rica, in order to face climate change, ensure fuel supply to the country and reactivate local agriculture. Sector: Palm oil

2007 UNDAF Costa Rica 2008-2012

The UNDAF is alligned with the Millennium Development Goals and the National Development Plan 2006-2010 and it focuses on five main areas of cooperation: 1) Inclusive, sustainable and equitable development; 2) public policy; 3) citizens' participation; 4) environment and sustainability; 5) socio-cultural practices.

Trade contacts

http://www.intracen.org/layouts/CountryTemplate.aspx?pageid=47244645034&id=47244651880

Organisms related to agricultural production:

Cámara Nacional de Productores y Exportadores de Plantas Ornamentales	Apdo. Postal 12078-1000	San José	506 280 59 28	506 224 53 62	cplants@racsa.co.cr	http://www.ornamentalplants.net

Cámara Nacional de Agricultura y Agroindustria de Costa Rica	300 metros Sur y 50 metros Este de	San Jose	+506 2258245	+506 2800969	cnaacr@racsa.co.cr http://www.cnaacr.com/

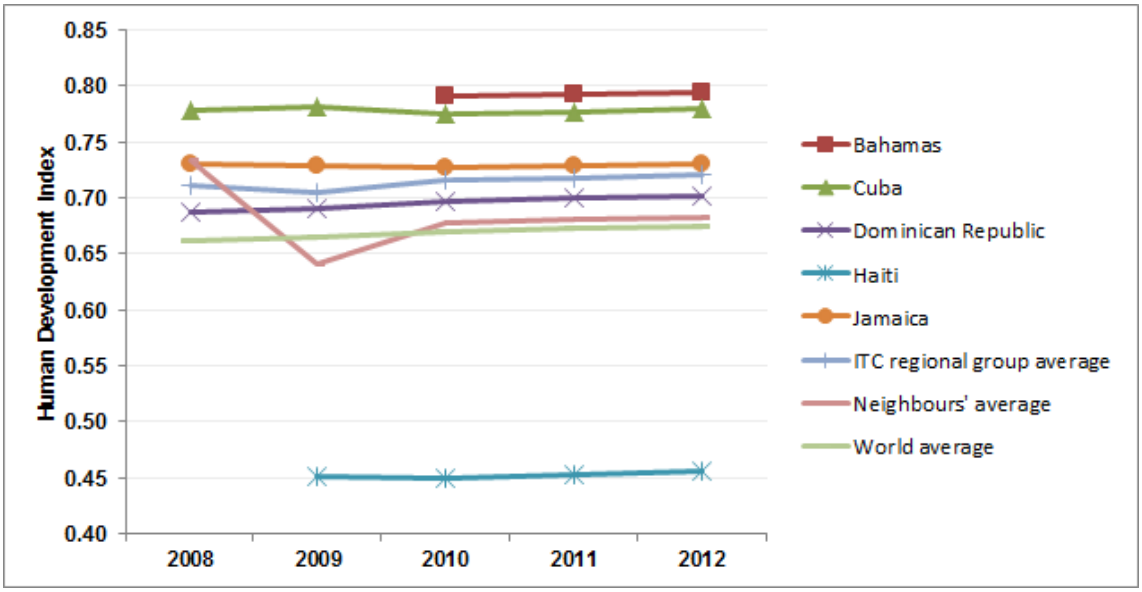
1.3._Jamaica

Jamaica's economy relies on alumina, tourism and remittances. As most countries in the Caribbean region, it was severely affected by the global financial crisis and faces high levels of public debt. The island suffered a recession from 2008 to 2010. The economy is progressively recovering, supported by higher demand of its commodities. The country has a narrow production base and an underdeveloped quality management infrastructure, especially in the agri- processing sector.

1.3.1. People

Table 5. Jamaica demographic features

Total population (growth rates per annum)	2,687,200 in 2012 with growth rates of 0.2% p.a during 2008-2012
Population density (people per sq. km of land area)	248 in 2012
Female population	50.8% in 2012
Population below 15 years of age	27.8% in 2008 ; 30.0% in 2012
Urban population	52.0% in 2012
Population living below $1.25 a day at purchasing power parity (PPP)	NA
Ranking in the Human Development Index (HDI)	85 out of 186 in 2012
Health	Life expectancy at birth (years) (73); Mortality rate, under-5 (per thousand live births) (16.8) in 2012
Education	Education index - expected and mean years of schooling (rank) (61 out of 191) in 2012
Income level	NA
Inequality	Inequality-adjusted HDI (rank) (56 out of 191)in 2012
Gender	Gender inequality index (rank) (62 out of 191) in 2012



Source: ITC by country Report. Jamaica [3]

Figure 17. Human development comparison of Jamaica with surrounding countries

In 2009 Jamaica's unemployment rate was on average approximately 11.4% and 19% of Jamaican people were living below the Jamaica Bureau of Statistics poverty line. There is a direct link between agriculture and the improvement of the economy and the sustainability of rural livelihoods.

Agriculture remains vital with regard to national food and nutritional security and is the foundation of traditional rural life. The last agricultural census showed approximately 200,000 small-scale farmers occupying some 77% of agricultural land holdings.

1.3.2. Economy

Table 6. Added value per sector (current US$ and % of GDP) of Jamaica

Sector added value	2004		2008	
	US $	%GDP	US $	%GDP
Agriculture	507	5.7	671	5.6
Industry	2,263	25.5	2,691	22.6
Manufacturing	835	9.4	1,098	9.2
Services	6,106	68.8	8,525	71.7

Source: World Bank World Development Indicators (WDI). **Note**: Added value is US$ terms are expressed in million, GDP US$, and "6,976 to be read 6'976"

Jamaica's agricultural sector is an important contributor to the national economy and accounted for marginally over 5.4% of GDP contribution in 2009 representing around 28 billion Jamaican dollars. The sector employs approximately 20% of the labour force and is a source of income for a large segment of the population, particularly the rural poor. Jamaica is no exception among the Caribbean countries in relation to the main challenges facing the agricultural sector development.

These challenges include land tenure, irrigation, availability of quality planting material, fragmented production and supply base, Inefficient marketing and market linkages, lack of consistency in production and post harvest handling, insufficient research and development policies and overall lack of competitiveness in the domestic and international markets (often against subsidized products and cheap imports).

In Jamaica, agriculture and agro-processing also represent a major contributor to rural development affecting more than 80% of the population in a direct or indirect manner.

Agriculture in Jamaica can be divided into two principal groups: large-scale farmers producing mainly for (traditional) export and small-scale farmers who supply mostly non-traditional exports and local demand.

The vast majority of Jamaica's farmers exist on relatively small farms in the hilly interior. The 'small farm' sector supports an estimated 150,000 rural families and is the country's largest source of employment. Arable land increased from 1979 to 2004

from 135,000 ha to 174,000 ha. Over the same period, the area irrigated hardly increased (24-25,000 ha).

Small farmers, those with farms of five acres (2.02 ha) and less, constitute some 78 percent of the farming community and produce mainly root crops, pulses and vegetables.

Large-scale farms account for less than one percent of the total number but occupy about 39 percent of farm lands producing mainly sugar, bananas, coffee, **pimento** and, to a lesser extent, citrus and cocoa for the export market.

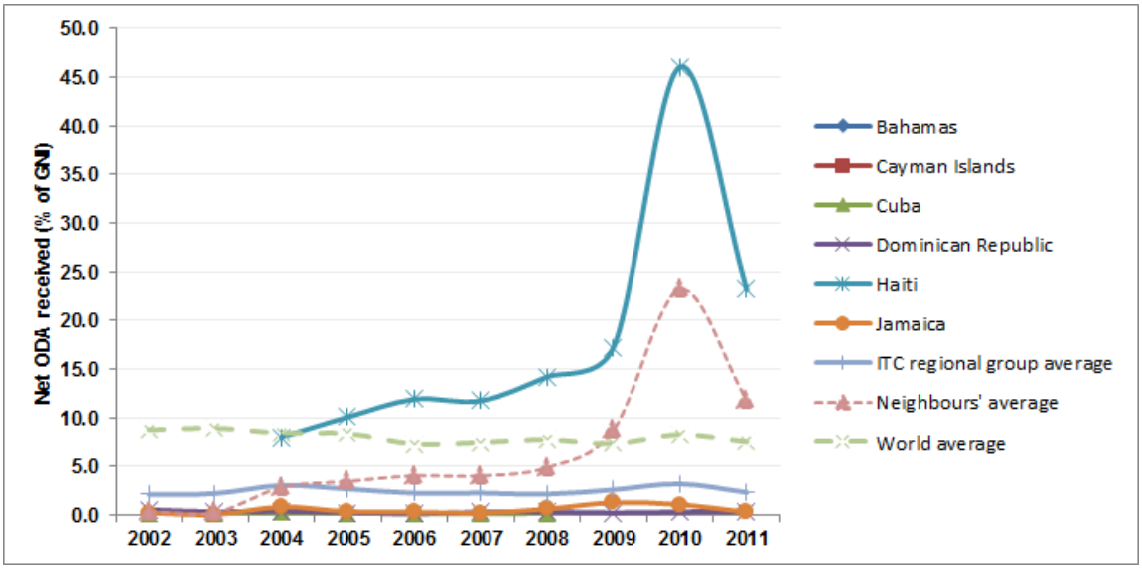


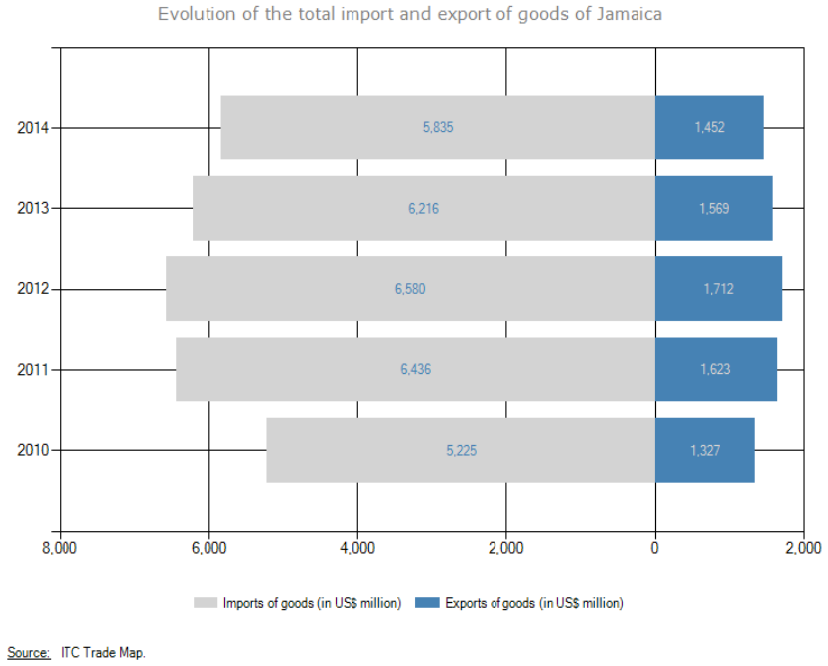
Figure 18. Aid Dependency (Official Development Assistance/Gross National Income) o Jamaica in relation to surrounding countries

International trade

Jamaica has a hard negative balance of the international trade (Figure 19).

The most exported products are minerals (mainly aluminium oxide) and processed foods (mainly rhum and tafia), while the most imported products are minerals (petroleum oils and preparation), chemicals (medicaments) and diverse prepared food (Figure 20).

The main exported services are travel and transport (Figure 24).



Source: ITC by country Report. Jamaica [3]

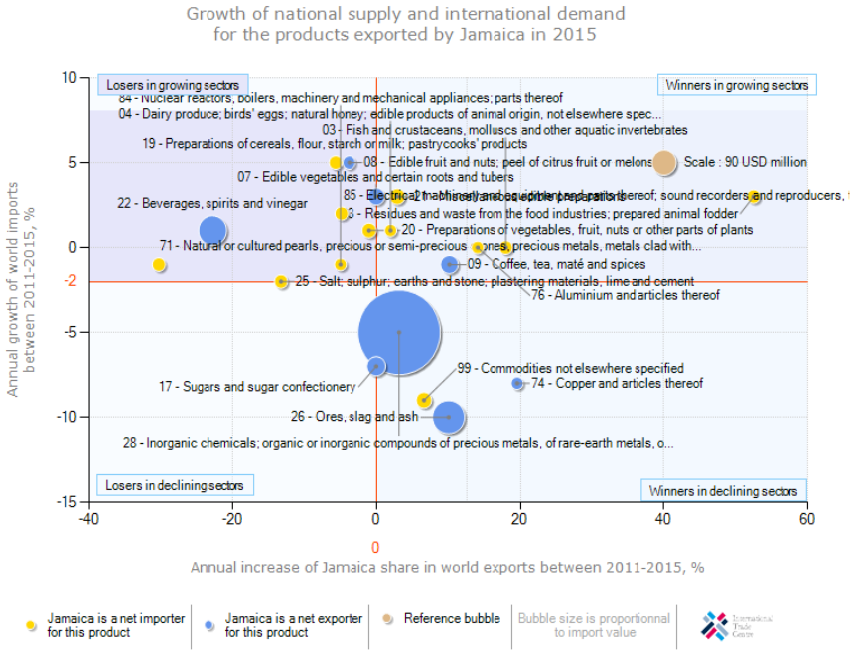
Figure 19. Evolution of the total import and export of goods of Jamaica

Sectoral diversification in products for Jamaica's exports

Sector	Average share of sector in country's exports 2010-2014	Share of top 3 detailed products (HS6) in sector's exports		Sector's leading exported product HS6
		2010	2014	
Minerals	65.3 %	97.4 %	96.2 %	281820 Aluminium oxide nes
Processed food	16.2 %	54.4 %	39.5 %	220840 Rum and tafia
Chemicals	6.4 %	76.8 %	58.6 %	401110 Pneumatic tire new of rubber f motor car incl station wagons&racg cars
Fresh food	5.1 %	54.2 %	54.7 %	071490 Arrowroot,salep etc fr o drid whether o not slicd o pelletd&sago pith
Unclassified products	2.1 %	98.1 %	99.9 %	999999 Commodities not elsewhere specified
Miscellaneous manufacturing	1.1 %	55.0 %	37.9 %	711319 Articles of jewellry&pt therof of/o prec met w/n platd/clad w prec met
Transport equipment	0.9 %	73.4 %	84.4 %	870323 Automobiles w reciprocatg piston engine displacg > 1500 cc to 3000 cc
Basic manufactures	0.8 %	66.3 %	89.0 %	252329 Portland cement nes
Non-electronic machinery	0.6 %	29.5 %	45.9 %	840710 Aircraft engines, spark-ignition reciprocating or rotary type
IT & consumable electronics	0.4 %	61.1 %	55.6 %	851762 Machines for the reception, conversion and transmission or regeneratio
Electronic components	0.2 %	33.8 %	57.6 %	854810 Waste&scrap of prim cell
Wood products	0.2 %	53.9 %	57.3 %	442190 Wood articles nes
Clothing	0.1 %	70.6 %	54.1 %	610910 T-shirts, singlets and other vests, of cotton, knitted
Leather products	0.0 %	68.8 %	44.4 %	640420 Footwear with outer soles of leather and uppers of textile materials

Source: ITC by country Report. Jamaica [3]

Figure 20. Main exported goods by Jamaica



Source: ITC by country Report. Jamaica [3]

Figure 21. Growth of national supply and international demand for the products exported by Jamaica in 2015

The trade products 09-Coffee, tea, mate and spices, are within the winners in growing sectors, while the products 22-Beverages, spirits and vinegars within the losers in growing sectors.

Condiments and seasonings, as well as peppers (genera *Piper* and *Capsicum*) are those spices with export potential in Jamaica.

Other products elaborated from aromatic plants that have also potential are liqueurs and cordials, and vermouth and aromatized wines.

Product group code / description	Exports (US$ thousand)	What is the product's export potential in...?						Technology level	Price stability	Prominence of SMEs	Female labour participation
		Latin America and the Caribbean	Unrealized potential	non-OECD	Unrealized potential	OECD	Unrealized potential				
281820 Aluminium oxide nes	494,392		68%		8%		8%				
220840 Rum and tafia	53,029		90%		89%		53%				
1701XX Raw cane sugar	65,922		100%		87%		31%				
220710 Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	110,475		95%		96%		29%				
220300 Beer made from malt	31,328		78%		83%		59%				
0714XX Arrowroot, salep (yams), etc	22,534		94%		95%		64%				
090111 Coffee, not roasted, not decaffeinated	22,254		100%		94%		81%				
2008XX Cranberries and other fruits, nuts and edible parts of plants, prepared or p	11,378		93%		94%		57%				
210390 Sauces and preparations nes and mixed condiments and mixed seasonin	12,458		90%		92%		26%				
080720 Papaws (papayas), fresh	3,464		100%		100%		79%				
190590 Communion wafers,empty cachets f pharm use&sim prod&bakers' ware	9,058		87%		86%		35%				
071420 Sweet potatoes, fresh or dried, whether or not sliced or pelleted	3,285		81%		82%		73%				
230990 Animal feed preparations nes	7,722		70%		75%		99%				
281830 Aluminium hydroxide	5,558		66%		80%		48%				
220870 Liqueurs and cordials	3,046		28%		45%		82%				
080450 Guavas, mangoes and mangosteens, fresh or dried	1,306		100%		98%		82%				
110100 Wheat or meslin flour	4,381		64%		66%		86%				
220290 Non-alcoholic beverages nes,excludg fruit/veg juices of headg No 20.09	6,822		39%		46%		18%				
0904XX Fruits of the genus Capsicum or of the genus Pimenta	2,747		92%		91%		58%				
220510 Vermouth&oth grape wines flav w plants o arom subst in ctnr <= 2 l	3,549		24%		54%		67%				

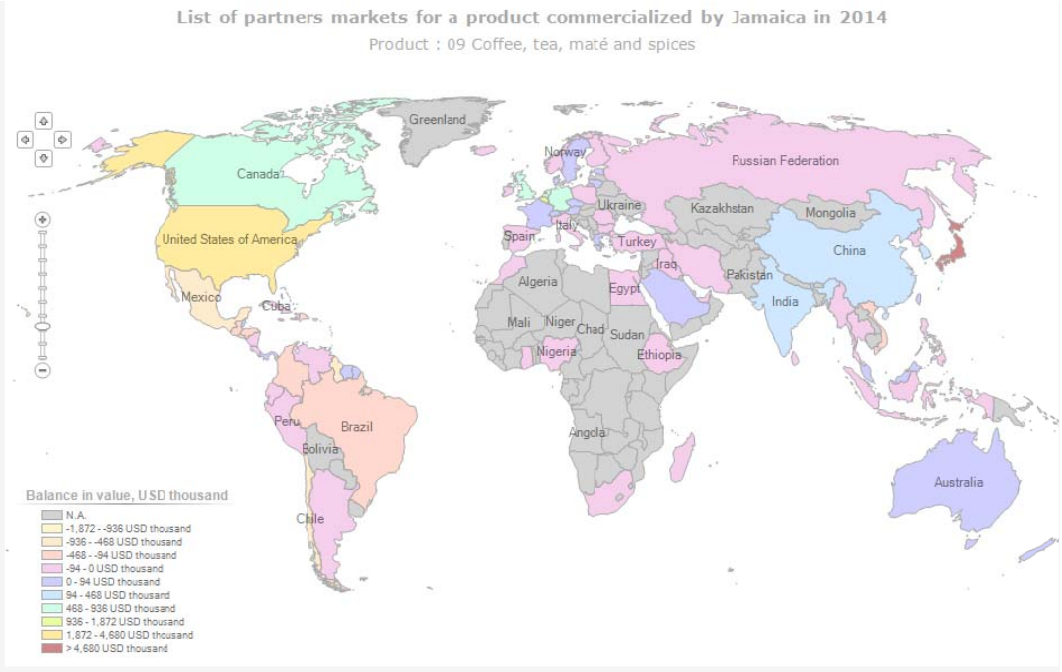
Notes: Top 20 products listed in decreasing order of their export potential to the world. Development indicators are relative to the country's current situation, green indicating performance above its trade-weighted median and red otherwise. A blank cell indicates that data are not available. A blank cell in export potential means that the product was not consistently demanded over five years by any country in the respective region. Exports (US$ thousand) correspond to average exports to the world over the period 2009-2013.

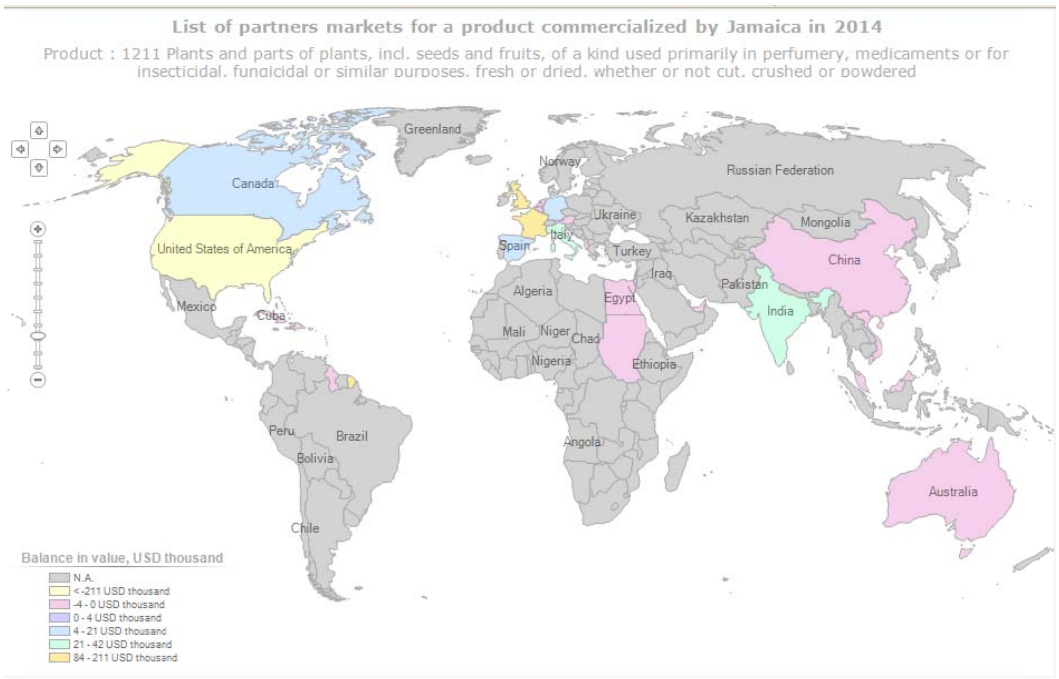
Source: ITC by country Report. Jamaica [3]

Figure 22. Export potential of Jamaica products

In 2015, Jamaica exported to the world 22.977 US Dollar thousand of the Product: 09 Coffee, tea, mate and spices (68.79% coffee, while the most commercialized spices were tea with 2.784 US Dollar thousand and peppers, genera *Piper* and *Capsicum* with 1.593 US Dollar thousand, mainly to USA, Netherlands and India). The imports had a value of 9.631 US Dollar thousand.

About the Product: 1211 Plants and parts of plants, incl. seeds and fruits, of a kind used primarily in perfumery, medicaments or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered, only 663 US Dollar thousand were exported from Costa Rica to the world (mainly to France, USA and UK). The imports had a value of 490 US Dollar thousand.





Sources: ITC calculations based on UN COMTRADE statistics.

Figure 23. Main MAPs products market for Jamaican exports in 2015

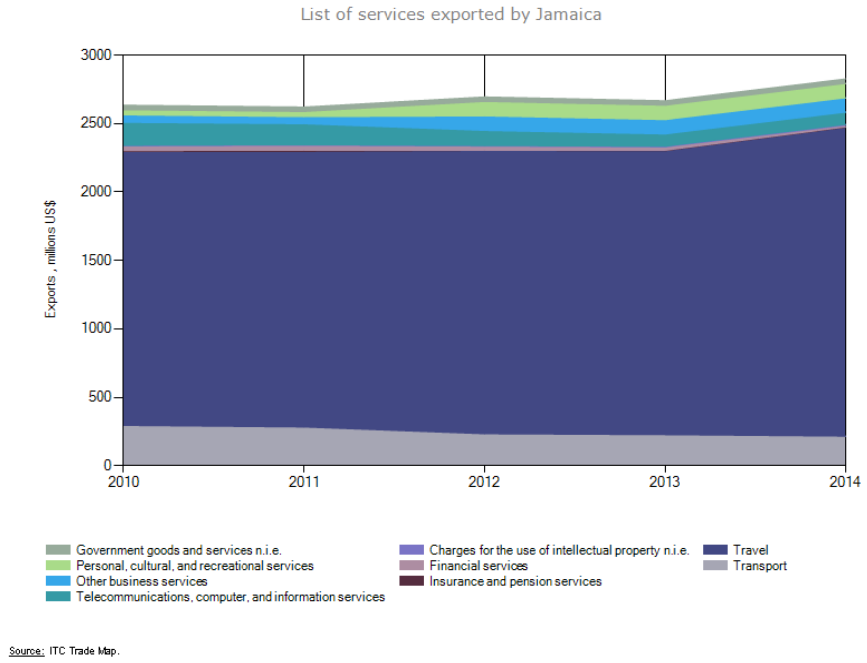


Figure 24. Main services exports by Jamaica in 2015

Trade and developing strategies

2011. Growth Inducement Strategy

The Strategy builds on the Vision 2030 Jamaica - National Development Plan. It analyzes Jamaica's current macroeconomic and microeconomic structure and it outlines ten policies and programmes to be carried out in order to achieve medium term objectives in alignment with the National Development Plan National Outcomes.

2011. UNDAF Jamaica 2012 - 2016

The United Nations Development Assistance Framework (UNDAF) is aligned with the National Development Plan, the Medium Term Socio-Economic Policy Framework and the Millennium Development Goals for Jamaica. It focuses on three main pillars: 1) environment, social empowerment and equity; 2) safety and security; and 3) justice.

2010. Agriculture Export Strategy

The strategy underlines the importance of food processing for Jamaican development and exports performance. It suggests specific markets to target and outlines strategic products to focus on. Finally, it elaborates an action and implementation plan on the basis of six main strategy objectives: 1) establish a private-public coordination mechanism to manage the implementation of the strategy; 2) increase availability of supply and demand related information to allow informed decision making by private sector and policy makers; 3) increase

raw material supply from small-scale farmers by 100% by 2020 by organizing and training farmers through agronomic services; 4) provide access to low-cost funding and risk management mechanisms to 70% of the targeted farming population and processors by 2015; 5) increase the production of processed food products by 150% by 2020 and improve overall value adding operations to improve industry competitive advantage; 6) provide access to low-cost, high-quality planting material (seeds, seedlings) to most farmers by 2015 and enhance agronomic support. SECTOR: Fruits, **Herbs and Spices**, Roots and Tubers, Vegetables.

The mission of the *Jamaican Agriculture Sub-Sector Strategy: Fruits & Vegetables, Herbs & Spices, Roots & Tubers* [5], was to attain sustainable economic growth by becoming a leading producer and agro-processor and by providing services such as:

1. Agricultural and agro-processing competitiveness and farm to market linkages
2. Market driven production, post-harvest practices and value addition
3. Finance and small and medium agri-business promotion,
4. Research and product development
5. Import substitution linkages and export promotion,
6. Food safety and quality programs.

According to that report, Jamaican horticulture and agro-processing suggest immense potential and opportunity waiting to be unlocked. However the biggest hurdle to be overtaken is related to industry mistrust, scepticism and lack of long-term partnership amongst all the value chain players (farmers, marketers, extension services, agro-processors, banks and the ministries).

There is also a strong perception of lack of supply competency and capability from the customer and buyers. The best example of this is the fact that the tourism industry on the island imports 52% of all its fresh produce requirements and sources very little locally or that Agro-processors can hardly get year round supply (in the case of hot-peppers for sauces only 40% of the total needs is produced locally).

On the other hand, farmers perceive there is no transparent market for their produce and their main buyers– an uncoordinated and independent network of thousands of higglers and middle men- do not provide volume, crop type/quality, timing planning or price information.

The Jamaican agriculture related business success stories appear to be either corporate, well established family businesses and/or progressive individuals who have pursued horticultural production, packing, processing and marketing with a commercial bias motivated by profit.

The Strategy identifies two main market priorities:

- Import substitution and development of domestic market for Fresh and processed foods (The Food import bill accounted for approximately 886 USD million dollars during 2008)
- Export development for current and niche products Stakeholders and buyers examined linkages with the tourism and hospitality industry, the opportunity for increasing the

variety and quality of locally processed food products and the competitiveness of current and potential exports.

After prioritising target products and segments according to market demand, supply side capacity and potential for value addition a list of priority products has been defined. In particular stakeholders have agreed to concentrate the strategy efforts towards:

- Fresh fruit and Vegetables for domestic consumption (hotels import 52% of fresh fruits and vegetables needed)
- **Pepper Mash and sauces**
- Concentrates, pastes and Pulps including beverages and industrial ingredients
- Convenience Foods (food preparations, snacks, roots and tubers)
- **Ackee (*Blighia sapida*) based products (food and medicinal)**

The 6 main strategy objectives of the Implementation plan of this strategy are listed below:

1. Establish a private public coordination mechanism for the management of the strategy implementation.
2. Increase availability of supply and demand related information to allow informed decision making by private sector and policy makers
3. Increase raw material supply from small-scale farmers by 400% by 2020 by organising and training farmers through agronomic services
4. Provide access to low-cost funding and risk management mechanisms to 70% of the targeted farming population and processors by 2015
5. Increase the production of processed food products by 150% by 2020 and improve overall value adding operations to achieve industry competitive advantage
6. Provide access to low-cost, high-value planting material (seeds, seedlings) for fruits, vegetables, herbs & spices and roots & tubers to 95% of the 220,000 farmers by 2015 and enhance agronomic support

2009. Medium-Term Socio-Economic Policy Framework

The framework builds on the National Development Plan - Vision 2030 and identifies 11 of the 15 national outcomes therein contained as being the ones achievable in the medium-term (2009-2012). It 6 of them as "Priority National Outcomes" (security and safety; stable macroeconomic framework; strong economic infrastructure; energy security and efficiency; world-class education and training; effective governance) and the remaining 5 as "Supporting National Outcomes" (enabling business environment; international competitive industrial structures; hazard risk reduction and adaptation to climate change; effective social protection; authentic and transformational culture). SECTOR: Banana, Bauxite and Alumina, Cassava, Creative Industries, Dairy Products, Fisheries, Forestry, Fruits, Information Communication Technology, Live Animals, Non-metallic minerals (lime, cement, whiting), Potatoes, Root Crops, Sport Services, Sugar Industry, Tourism, Vegetables.

2009. National Export Strategy of Jamaica

The National Export Strategy (NES) of Jamaica has three main goals: achieving export-led growth, improving exports performance and achieving global export competitiveness. To attain these goals, the strategy focuses on improving exports diversification and increasing the weight of non-traditional sectors, fostering higher value addition in all sectors and a deepening penetration in traditional and emerging markets. The NES depicts the main features of Jamaica's current macroeconomic outlook and outlines the loss in competitiveness and export performance experienced by the country in recent years. Finally, it identifies the main sector priorities and cross-sector issues to be faced. SECTOR: Agro-Processing Industry, Bauxite, Beer, Branded Rhum, Bulk Rhum, Carbonated Beverages, Coffee, Education and Training Services, Entertainment Services, Farm-raised fish, Farm-raised shrimp, Fashion, Jewelry and Accessories, Fashion, Jewelry and Accessories, Fashion, Jewelry and Accessories, Fashion, Jewelry and Accessories, Information Communication Technology, Non-Carbonated Beverages.

2009. Vision 2030 - National Development Plan

The National Development Plan sets 4 main goals for Jamaica to pursue in the next two decades: empowerment of Jamaicans to achieve their fullest potential; a secure, cohesive and just society; a prosperous economy; and a healthy natural environment. Hence, the plan outlines 15 national outcomes to be attained in order to achieve these goals. In particular, national outcomes 7-12 deal with economic prosperity and focus on achieving a more stable macroeconomic framework and an enabling business environment; strong economic infrastructure; efficient and secure energy services; increased technology; and internationally competitive industry structures.

The **Sector Plan for Agriculture** is one of the strategic priority areas of **the Vision 2030 Jamaica - National Development Plan**. It is one of thirty-one sector plans that form the foundation for Vision 2030 Jamaica – a 21-year plan based on a fundamental vision to make 'Jamaica the place of choice to live, work, raise families, and do business,' and on guiding principles which put the Jamaican people at the centre of the nation's transformation.

Under the Agriculture Sector Plan the vision is for the dynamic transformation of the Jamaican agricultural sector through a sustained, research-oriented, technological, market-driven and private sector-led revolution, which revitalizes rural communities, creates strong linkages with other sectors and emphatically repositions the sector in the national economy to focus on production of high-value commodities and contribute to national food security.

According to this plan, the traditional plantation commodities, sugarcane, coffee, cocoa and coconut, as well as cattle (beef and dairy) continue to remain a priority to the Ministry of Agriculture and Fisheries. The non-traditional and emerging export crops – vegetables, root crops and herbs/spices/medicinal plants, and swine production remain on the priority list.

Current R&D efforts are broadly targeted to the areas of:

- Germplasm development/improvement (breeding, plant propagation, varietals selection, biotechnology)

- Agronomy and production systems
- Plant and animal health
- Value added product development

2._Local MAPs species

2.1._Brazil

Brazil has about 44,000 to 50,000 species of vascular plants, representing approximately 18% of the world's plant diversity [26]. The greater number of species, the higher the potential new drugs. Despite over 50 years of research on medicinal plants in the country, the number of species studied is still very low [25].

Brazil is divided into five geographical regions: North, Northeast, Midwest, Southeast and South, which include, in general, more than one biome: Mata Atlântica, Amazon, Pampa, Pantanal, Cerrado, Caatinga [26]. Alagoas State, has two of these biome: Caatinga and Mata Atlântica

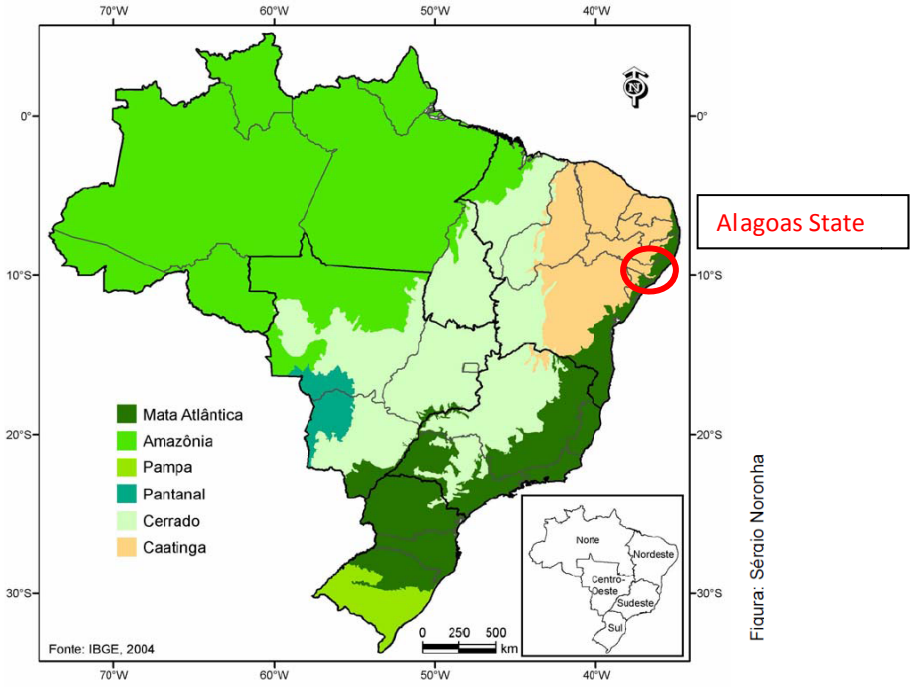


Figura 2: Localização dos biomas brasileiros e regiões

Source: Informe Nacional sobre a situaçao dos recursos fitogenéticos para a alimentaçao e a agricultura do Brasil [26]

Figure 25. Localisation of biomes and regions of Brazil

Caatinga

The annual precipitation rate is highly irregular, and varies between 200 and 800 mm (rarely reaching 1.000 mm), and the rainy season varies between 3 and 5 months and dry season between 7 and 9 months. The temperature is isothermal, with averages between 25 to 29ºC[25].

There are two main types of caatinga: dry Caatinga ("Hinterland") located inside and Caatinga wetter ("Wasteland") towards the coast.
General characteristics of caatinga elements include the total loss of leaves in the dry season, small, firm leaves (xeric), intense branching of trees from the base (which gives them a shrubby appearance) and the presence of cacti and bromeliads species [25].

The vegetation of Caatinga does not form a structural and homogeneous floristic set, but varies depending on factors such as soil, xerotermic index, physiognomy and characteristic genres, namely: *Tabebuia, Aspidosperma, Astronium, Cavanillesia, Schinopsis, Caesalpinia, Mimosa, Syagrus, Spondias , Cereus, Pilosocereus, Jatropha, Piptadenia*, etc. (Sampaio, 1995)[26].

Among the medicinal plants, the most important is the Jaborandi (*Pilocarpus jaborandi*), which together with the *Amburana cearensis* is officially listed as endangered [25].

According to a study of the medicinal plants used in Pernanbuco State, close to Alagoas state, with Caatinga biomas, the main species used from the nature (according to rank priority order) were [26]:

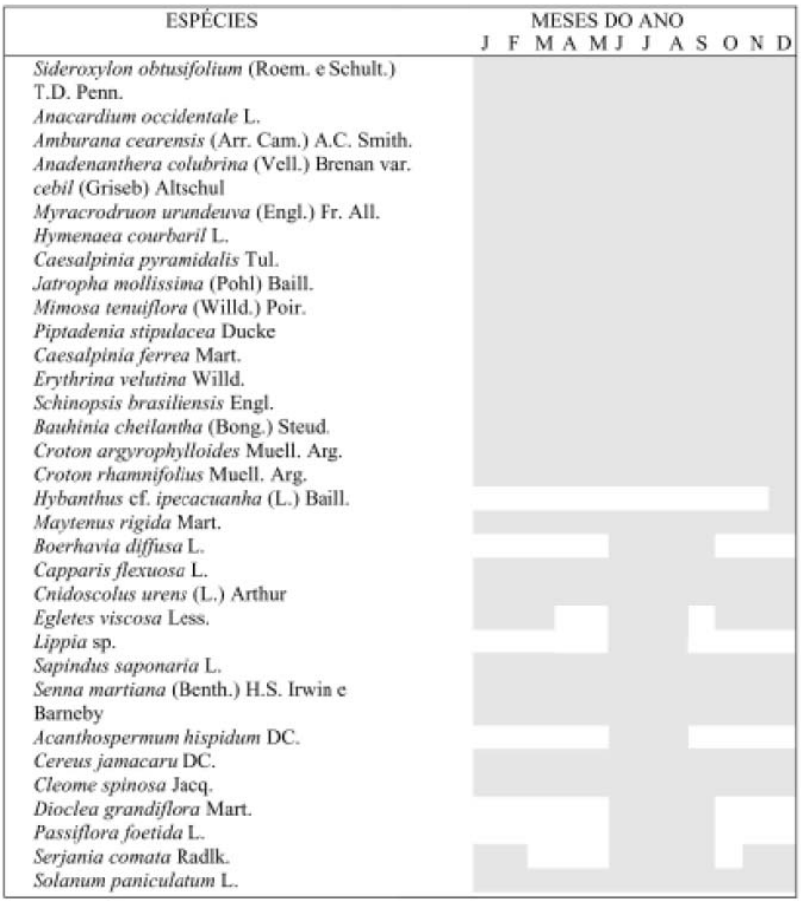


Figura 2. Disponibilidade temporal das plantas medicinais ao longo de um ano para uma comunidade rural no município de Alagoinha, Pernambuco (Nordeste do Brasil). As espécies estão listadas de acordo com a sua importância na comunidade ("rank order priority").

Source: species listed according to the importance to the community (rank order priority)

Figure 26. Seasonal availability of medicinal plants for the rural community of Alagoinha, Pernambuco

Mata Atlântica

Complex mosaic of various types of vegetation, including mangroves, coastal forests of salt marshes, mesophilic forests, forests of low and high mountains, rain forests, rocky fields and high fields.

In this area, traditional medicine uses many plants, including arnica (*Lychnophora ericoides*), chapé (*Hyptis lutescens*), paneira (*Norantea adamantium*), quina-de-vaca(*Remijia ferruginea*), the sambaibinha (*Davilla rugosa*) and catuaba (*Anemopaegma arvense*).

According to the flora database http://floradobrasil.jbrj.gov.br and the Tratados das Plantas Medicinas, in the State of Alagoas the following medicinal plants could be found in the nature (some of the species are not indigenous, but naturalized):

Indigenous:

- *Ageratum conyzoides* L. Mentrasto.
- *Allamanda cathartica* L. Dedal-de-princesa.
- *Alternanthera brasiliana* (L.) Kuntze, *Alternanthera tenella* Colla. Periquita.
- *Anacardium occidentale* L. Caju.
- *Ananas comosus (L.) Merril*. Abacaxi. Endemism.
- *Bixa orellana* L. Urucum.
- *Casearia sylvestris* Sw. Guaçatonga, pau-de-lagarto.
- *Cayaponia tayuya* (Vell.) Cogn. Tajujá. Endemism.
- *Croton campestris* A.St.-Hil. Velame-do-campo.
- *Croton urucurana* Baill. Pau-de-sangue.
- *Cupania oblongifolia* Mart. Camboatá. Endemism.
- *Cuscuta racemosa* Mart. Cipó-chumbo.
- *Cyperus rotundus* L. Tiririca. Endemism.
- *Eclipta prostrata* (L.) L. Erva-botão.
- *Eryngium foetidum* L. Coentro-fedorento, chicória.
- *Hancornia speciosa* Gomes. Mangaba.
- *Heliotropium indicum* L. Crista-do-galo, boragem-brava.
- *Indigofera suffruticosa* Mill. Anileira.
- *Ipomoea batatas* (L.) Lam. Batata-doce.
- *Lippia alba* (Mill.) N.E.Br. ex P. Wilson. Cidrila, cidreira.
- *Manihot esculenta* Crantz. Mandioca.
- *Mikania hirsutissima* DC. Cipó-cabeludo.
- *Operculina macrocarpa (L.) Urb.* Batata-de-purga.
- *Passiflora alata* Curtis. Maracujá. Endemism.
- *Passiflora edulis Sims.* Maracujá-de-suco.
- *Phyllanthus niruri* L. Quebra-pedra.
- *Phyllanthus tenellus* Roxb. Quebra-pedra-falso.
- *Piper aduncum* L. Jaborandi-falso, pimenta longa.
- *Piper regnellii (Miq.)* C.DC. Capeba-do-Brasil.
- *Piper umbellatum* L. Capeba.
- *Pistia stratiotes* L. Erva-de-Santa-Luzia.
- *Polygala paniculata* L. Barba-de-São-Pedro
- *Portulaca oleracea L.* Beldroega.
- *Psidium guineense* Sw. Araçá-da-praia
- *Schinus terebinthifolius* Raddi. . Aroeira.
- *Scoparia dulcis L.* Vassourinha-doce, vassoura de botão.
- *Senna alata* (L.) Roxb. Cássia.
- *Senna occidentalis* (L.) Link. Fedegoso, mangirioba.
- *Smilax syphilitica* Humb. & Bonpl. ex Willd. Salsaparrilha, aputá, cipó japecanga.
- *Solanum americanum* Mill. Erva-moura.
- *Solanum paniculatum* L. Jurubeba.

- *Spigelia anthelmia* L. Erva-lombrigueira.
- *Triumfetta semitriloba* Jacq. Carrapicho-de-calçada
- *Turnera diffusa* Willd. ex Schult. Damiana.
- *Vitex polygama* Cham. Azeitona-do-mato. Endemism.
- *Vanilla planifolia Jacks. ex Andrews*

Naturalized:

- *Arachis hypogaea L.* Amendoim.
- *Artemisia vulgaris* L. Artemísia.
- *Asclepias curassavica* L. Oficial-de-sala.
- *Bidens pilosa* L. Picão.
- *Carica papaya* L. Mamao, papaya.
- *Celosia argentea* L. Crista de galo.
- *Cymbopogon citratus* (DC.) Stapf. Capim-limão.
- *Cyperus esculentus* L. Tiririca.
- *Datura stramonium* L. Estramônio.
- *Desmodium adscendens* (Sw.) DC. Pega-pega.
- *Leonotis nepetifolia* (L.) R.Br. Cordão-da-frade, São Francisco
- *Mentha pulegium* L. Poejo.
- *Mentha spicata* L. Hortelã.
- *Mirabilis jalapa* L. Bonina.
- *Nicandra physalodes* (L.) Gaertn. Balãozhino.
- *Physalis angulata* L. Camapu.
- *Psidium guajava* L. Goiabeira.
- *Tanacetum vulgare* L. Catinga-de-mulata.
- *Urtica dioica* L. Urtiga.
- *Vitex agnus-castus* L. Cordeiro-de-deus.

2.2._Costa Rica

A well-known and often and controversely discussed example for the commercialization of medicinal and aromatic plant material as a financial instrument for nature conservation, are projects of the Instituto Nacional de Biodiversidad (INBio) in Costa Rica. As an important component in its work to promote the sustainable use of Costa Rican biodiversity, INBio co-operates in its programmes on bioprospecting with pharmaceutical companies like Merck (USA), Bristol-Myers Squibb (USA) and Indena (Italy) (Laird, 1993; Sidler, 1994; Laird and ten Kate, 1999; ten Kate 1999) [12].

National Biodiversity Institute of Costa Rica (INBio) is a private non-profit organisation which was established in 1989 with the blessing of the government. Its main objectives are to carry out a species inventory of the country _ which is estimated to have 4% of the world's biological diversity_ and to explore the commercial potential of the country's biological resources.

Costa Rica's 1992 Conservation of Wildlife Law 8 (Laird, 1995; Salazar and Cabrera, 1996) declares national sovereignty over the biological diversity of the country. This is not equivalent to nationalisation of all biogenetic resources in the country. Nevertheless, the State has the exclusive right to grant permits to investigate, collect and exploit the country's biological diversity in the publicly-owned conservation areas, which make up 25% of the whole country. The Ministry of Natural Resources, Energy and Mines (MIRENEM) is authorised to grant bioprospecting permits in these areas, and INBio has such a permit.[9]

According to the Herbario Nacional de Costa Rica [17], the most used medicinal plants that are growing in the wild are:

- *Buddleia americana* L. – Salvia virgen. Shrub that is distributed in Mexico and Central America; in Costa Rica it is found in hot and temperate lands at the Valle Central and the Pacific. It is living from sea level to 1,500 m. Fruits come apperars from January to April. Common in weeds and fences alongside roads.
- *Cecropia obtusifolia* Bertol. – Guarumo. It grows from Mexico to northern South America. From 0 to 1,300 m above sea level. It lives in evergreen forests, when they have been disturbed and open areas.
- *Costus spicatus* (Jacq.) Sw. - Caña agria. It extends from southern Mexico to South America and the West Indies. It lives from sea level to 1,500 m. It blooms from May to July and fruiting from July to September. It grows in rain forests, swampy places, weeds and riverbanks.
- *Cymbopogon citratus* (DC.) Stapf. – Zacate limón. It grows in Central and South America, including the Antilles. It lives from sea level to 1,200 m.
- *Equisetum bogotense* Kunth., *E. giganteum* L. – They live in Central America, South America and the West Indies. They grow in marshy areas, wet meadows and along rivers.
- *Eryngium foetidum* L. – Culantro coyote. It grows in tropical America and the West Indies. From 0 to 1,000 m above sea level. In lowlands, prefer damp places and fertile land. It is cropped as a condiment and medicinal plant.

- *Jathropa gossypiifolia* L. – Frailecillo. It grows in continental tropical America, the Antilles, the Bahamas and old world tropics. From sea level to 500 m. It develops in cultivated and wastelands. Flowers and fruits appear all year.
- *Justicia pectoralis* Jacq. – Tilo. Native to the tropics of America and West Indies. It lives from sea level to 1,500 m. Flowers from January to May, and bears fruit in March. It grows on the forest floor.
- *Lippia alba* (Mill.) N.E. Br. – Juanilama. It extends from the southern United States to northern Argentina and West Indies. It lives from 0 to 1,500 m. It grows in open forests and disturbed areas.
- *Lippia graveolens* Kunth. – Orégano. It extends from the southern United States to southern Central America. From sea level to 1,500 m.
- *Momordica charantia* L. – Sorosí. Native to tropical America and the West Indies. It lives from sea level to 1,000 m. Common in hot and warm earth. It is growing on the shore fences and on other plants adhering to them with their branching tendrils. Fruits throughout the year.
- *Neurolaena lobata* (L.) Cass. – Gavilana. It grows in tropical America and the West Indies at less than 800 m above sea level, in wooded areas, disturbed sites and roadsides.
- *Passiflora quadrangularis* L. – Pasiflora, Granadilla real. Plant native to the West Indies, introduced in the Caribbean, grows in hot areas with fertile soils. From 0 to 500 m. Flowers and fruits all year.
- *Plantago major* L. – Llantén. Native to Europe, naturalized throughout America and West Indies. Inhabits medium lands between 500 to 1,500 m on flat, barren and cultivated lands.
- *Psidium guajava* L. – Guayaba. A native of tropical America. It grows from 0 to 1500 m in pastures and roadsides.
- *Quassia amara* L. – Hombre grande, Palo quinina, Quininagrú. Native from Mexico to northern South America, including the Amazon and the West Indies. It lives from 0-600 m. Wet and dry climates. It blooms from November to June, and bears fruit from February to July.
- *Senna reticulata* Willd., *Senna alata* L. – Saragundí. Nativas desde México hasta Brasil; en Costa Rica se encuentra en zonas bajas y climas de húmedos a muy húmedos. Desde el nivel del mar hasta 600 m. Florece de septiembre a marzo y fructifica de noviembre a marzo.
- *Tradescantia zebrina* Bosse – Cucaracha, Hoja del milagro, Manto del señor. Originally from Mexico to Panama. It grows in moist forests. From 0 to 1,500 m. Naturalized in many tropical countries. It grows on hillsides and riverbanks. Flowers and bears fruits from September to April.
- *Uncaria tomentosa* (Wiil. ex Roem. & Schult.) – DC. It grows in tropical and subtropical areas of America, lives from sea level to 500 m in humid forests and wetlands. Flowers from January to April and bears fruit from March to June.
- *Urera baccifera* (L.) Gaudich. – Ortiga. It grows in Central America, South America and the West Indies. It lives from 0 to 1,400 m. It blooms all year. It is located on land of smaller to medium elevation. He likes rocky regions at the foot of the mountains and river banks.

Native species like zarzaparrilla (*Smilax* sp.) and ipecacuana (*Cephaelis ipecacuanha*), or introduced like quina (*Cinchona* sp.), have had a remarkable economic importance [23].

Among the most commercialized species from the wild are [23], ordered by volume:

- Hojas de sen (*Caesalpinia pulcherrima*).
- Zarzaparrilla, cuculmeca (*Smilax* sp.).
- Ciprés (*Cupressus lusitanica*).
- Cola de caballo (*Equisetum bogotense*).
- Chiquizá (*Leonurus sibiricus*).
- Hombre grande (*Quassia amara*).
- Quina (*Ocotea veraguensis*).
- Saragundí (*Senna reticulata*).
- Roble (*Quercus* sp.)
- Jinocuabe (*Bursera simaruba*)
- Calzonzillo (*Passiflora biflora*).
- Diente de León (*Taraxacum officinale*).

2.3._Jamaica

The most comprehensive work on Jamaica's biodiversity is Adams (1972) which lists 2,888 flowering plant species of which 784 are endemic. There have been some surveys done and books written about the ferns, orchids and medicinal plants of Jamaica.

An estimated 28% of the flowering plants of Jamaica (800 of 3000), 36% of the bromeliads, 12% of the ferns, 50% of the cacti and 70% of the palms are endemic to Jamaica. An estimated 13% of known medicinal plants of Jamaica are also endemic (Mitchell and Ahmad 2006). Endemic plants with potential for food and agriculture include the endemic mountain guava (*Psidium montanum*) and the presently wild-crafted endemic root tonic plant, chainy root (*Smilax balbisiana*) [24].

Wild species of flora make a significant contribution to Jamaica's economy. The wild plants harvested for food production are mostly gathered unsustainably from the forest.

Many medicinal plants are wildcrafted (gathered from the wild) from the forests. Non-destructive harvesting is done for fruit trees such as ackee (*Blighia sapida*), breadfruit, mango, june plum, tamarind, guinep, and for medicinal plants such as pimento (*Pimenta dioica*), nutmeg (*Myristica fragrans*), bizzy (*Cola acuminata*) and noni (*Morinda citrifolia*) [24].

When such plants die, new plants have to arise from their own seeds as no purposeful planting occurs. This neglect may therefore lead to a decrease of such plants. This is especially so for some heavily harvested medicinal plants such as sarsaparilla (*Smilax* sp.) and chainy root (*Smilax balbisiana*). All the near sources are gone, and wild-crafters are heading further into the forest to find harvestable plants. Most of these folks do not know how and therefore do not practice replanting. The recommendation is for replanting protocols be developed for such plants and the Local Forest Management Committees (LFMCs) and Forestry Department (FD) be trained about how to reseed the forest with such species.

Most of the trees mentioned above were once imported, but have become indigenous. There are few examples of endemic plants that have become major food plants. Pimento (*Pimenta dioica*) is an example but this crop has not benefitted from much local research.

Other factors affecting the state of diversity are population pressure especially from urbanization, praedial larceny and the increase in the desire for natural foods, herbs and spices. Economics to a large degree, determines what crops farmers will grow.

3._Cultivated MAPs species

3.1._Brazil

According to Brazilian biomas described in chapter 2.1., Alagoas State have two types: Caatinga and Mata Atlântica.

During the first half of the last century, the expansion of agriculture in the Caatinga was mainly due to cotton. Currently the region is undergoing a major economic expansion due to the implementation of irrigated agriculture. As a result of agriculture, the São Francisco River Valley became a major exporter of fruits, especially grapes, papayas and melons [26].

Agricultural activity in the Mata Atlântica region focuses on a highly mechanized agriculture, with the use of modern inputs, emphasizing the sugarcane plantations and *Eucalyptus* plantations for the pulp and paper industry, which replaced more than 90% of the native vegetation [26].

Agriculture in Brazil is devoted mainly for food purposes. More recently, native medicinal plants have been valued within the agribusiness context [26].

Most cultivated medicinal species are exotic, domesticated in their natural ecosystems and having features of heliophytic plants (pioneers). It may be mentioned in this group: rosemary (*Rosmarinus officinalis*), lemon balm (*Melissa officinalis*) and fennel (*Foeniculum vulgare*), originating in the Mediterranean; rue (*Ruta graveolens*), chamomile (*Matricaria chamomilla*), dandelion (*Taraxacum officinale*), yarrow (*Achillea millefolium*), plantain (*Plantago major*) and thyme (*Thymus vulgaris*), from Europe; Artemisia (*Tanacetum* sp.), originally from Asia; calendula (*Calendula officinalis*), originating in Egypt and lemongrass (*Cymbopogon citratus*), originating in India [25].

In addition to those, according to the flora database http://floradobrasil.jbrj.gov.br and the Tratados das Plantas Medicinas, the following plants with medicinal propierties are cultivated in the State of Alagoas:

- *Cajanus cajan* (L.) Huth. Feijão-andu. Cultivated.
- *Catharanthus roseus* (L.) Don *(= Vinca rosea* L.*).* Boa-noite.
- *Coffea arabica* L. Café.
- *Helianthus annuus* L. Girassol.

- *Mangifera indica* L. Mangueria.
- *Melia azedarach* L. Cinamomo.
- *Musa paradisiaca L.* Bananeira.
- *Oryza sativa* L. Arroz.
- *Ricinus communis* L. Mamona.
- *Saccharum officinarum* L. Cana-de-açúcar
- *Sambucus nigra* L. Sabugueiro.
- *Tamarindus indica* L. Tamarindo.
- *Zea mays L.* Milho.

Biodiversity, particularly higher plants, constitute a major source of raw material for the manufacture of many drugs herbal origin. Form also the basis of home remedies and community (traditional medicine) used in popular and traditional practices. They represent also the raw material for the manufacture and use of herbal medicines, a market that has grown dramatically in recent decades. In addition to this genetic pool, Brazil holds a rich cultural and ethnic diversity. Thus, over hundreds of years the country has accumulated knowledge and traditional technologies, passed from generation to generation, which highlights the rich collection of knowledge about management and use of medicinal plants [26].

Based on this genetic wealth and vast cultural diversity, the country has the opportunity to establish a proper and autonomous development model in health and use of medicinal and herbal plants, which prioritizes sustainable use of biodiversity and genetic resources and respect ethical principles and international commitments, especially in relation to the Convention on Biological Diversity, thereby promoting the generation of wealth with social inclusion. This model uses the premise of respect for the principles of safety and effectiveness in public health, and the reconciliation of socio-economic development and environmental conservation, both locally and nationwide [26].

To promote the management, cultivation, production and marketing of medicinal plants and herbal medicines, as well as involve the various sectors involved in this issue at the state and municipal level, is being developed within each biome, a process of articulation and implementation networks of Medicinal Plants and Herbal medicines. This process is already advanced in the Caatinga biome, where there are already a number of institutional, governmental, and civil society, which should be leveraged and expanded in a joint effort involving the government, civil society, social movements, producers and entrepreneurs [26]

In Alagoas State, there is a Project for enhancing the medicinal plants production (Projeto de Estruturação, Consolidação e Fortalecimento dos Arranjos Produtivos Locais - APL Fitoterápicos). The objective of the project is articulating the production chain so all stakeholders are covered, from the farmer in the nursery until the dispensation of medication by SUS- Sistema Único de Saúde (Unified Health System). APL Fitoterápicos, among strengthening the pharmaceutical care in the SUS, brings to Alagoas to guarantee an

improvement in the living conditions of low-income populations and users of the SUS to be beneficiaries of final products.

The importance of this proposal is the management, optimization of existing resources for pharmaceutical care in SUS, appreciation of the correct use of medicinal plants among the population and effective knowledge for prescription and guidance of these plants, among health professionals linked to primary care network.

Given the current panorama of Alagoas, it shows the possibility of production on a larger scale through APL as an opportunity to generate income for the population Local and therefore economic and social development for the Municipality of Maceio and the State of Alagoas.

Among the specific objectives of this project are:

- Identify and form partnerships with government agencies (state and municipal), educational institutions, government authorities, associations of quality control, development agencies and marketing technological development, geared to activities that account of the needs of consolidating the ALP returned to the National Program of Medicinal Plants and Herbal Medicines.
- Train health professionals on the need to guide the self use of medicinal plants, for a significant portion of population, and sensitizing society to the correct and rational use of medicinal plants and herbal medicines.
- Empower existing members in APL Horticultural Alagoas for organic cultivation of medicinal plants, as well as traditional populations of the State of Alagoas, such as indigenous, with a view to incorporate them in this APL.
- Cheapen the drug costs in primary care in SUS, valuing aspects of popular culture and local biodiversity.
- Create in Alagoas a structure that includes activities ranging from growing to industrialization, in order to assist in the social and economic development for the populations concerned and to the State itself and counties; having SUS as first beneficiary of the supply chain and providing the surplus to the market;
- Create a garden producing seedlings in sufficient quantity to enable the supply of APL de Horticultura for growing medicinal plants, and supply some basic units of the network of health care for Maceio with products originating from the first processing line (Drying and packaging);
- Restructuring the herbal processing laboratory already existing in Maceió;
- Developing, through UFAL (Universidade Federal de Alagoas), quality control protocols cultivation and the different stages of product handling and commit monitoring of the content of active ingredients and pharmacological activity cultivated species.

The production of medicinal plants is an activity with potential to be profitable and sustainable, when using suitable agricultural system, provided that the rules are followed by the National Health Surveillance Agency: Agência Nacional de Vigilância Sanitária (ANVISA). According to the researcher of the Centro Pluridisciplinar de Pesquisas Químicas, Biológicas e

Agrícolas (CPQBA) of the State University of Campinas (Unicamp), Pedro Melillo de Magalhães, the activity is potentially profitable in Brazil due to the favorable climate for several species [23].

Most of the medicinal plants used in herbal industry are still from wild collection, which compromises the quality of the product and can lead some species to extinction. Therefore, this factor is a further incentive for the cultivation of medicinal plants. The trend is the wild collection decrease because of health and environmental legislation. In addition, industries require high quality raw materials and supply regularity. On the contrary, cultivation provides a steady supply of homogeneous raw material, which ensures the longevity of the activity with the same standard of quality, which can not be achieved with material from wild collection [29].

Due to these factors and the increased consumption of herbal medicines, the production of medicinal plants becomes a great business opportunity for small producers, however, still lack technical guidance. In almost all regions of Brazil, missing technical information for producers interested in the cultivation of medicinal plants, requiring the creation of resources to meet this lack, as the training of these professionals [29].

3.2._Costa Rica

Traditional medicinal knowledge in Costa Rica is ethnically rooted Chorotega (north), Cabecar (centre), Huetar (west) and Bribi (south and east) Indians have the most relevant cultural influence, both in the case of cultivated medicinal plant species and in the example of wild specimens traded in the markets. Half the medicinal species grown in front and backyards and purchased in the markets to treat chronic or mild diseases were native from the American continent.

Vegetable production in front and backyards is varied, intercropping or multiple inter-planted species is the norm. Varietal diversity is big, trees intermixing bushes and herbs, which protects the garden or plot against drought, the garden and the house against the wind, and potentiates insect and disease resistance. Organic agriculture is an option in San Jose home gardens and goes together with plant therapy choice over conventional medicine [11].

Among the cultivated medicinal species are [17]:

- *Carica papaya* L. – Papaya. Native to tropical America and the West Indies. It grows from sea level up to 1400 m. It is grown extensively and bears fruit all year.
- *Citrus aurantium* L. – Naranjo agrio. It is grown from sea level to 1500 m.
- *Cupressus lusitanica* Mill. - Ciprés. Native to Central and Southern Mexico, distributed from southern Mexico to Nicaragua. Lives from 900-1400 m. It is grown as an ornamental and wind fences in the prairies.
- *Cymbopogon citratus* (DC.) Stapf. – Zacate limón. It is grown in backyards in rural areas.
- *Eryngium foetidum* L. – Culantro coyote. It is grown as a condiment and medicinal.
- *Lippia graveolens* Kunth. – Orégano. It is grown from sea level to 1500 m.

- *Matricaria chamomilla* L. – Manzanilla. Native to Asia. It is sold in the markets of Central and South America. It is grown in tropical gardens and farms specialized for this crop.
- *Mentha spicata* L. – Hierba buena. Native to Europe. Grows in tropical areas from 50 to 1400 m above sea level. It grows in wet areas. There are other varieties *M. citrata, M. crispa, M.piperita, M.rotundifolia*, etc.
- *Ocimum basilicum* L. - Albahaca. Native to tropical Asia and the Mediterranean. It is grown in countries of tropical America and the West Indies. It grows from 50 to 600 m. It blooms from August to October.
- *Rosmarinus officinalis* L. – Romero. Native to the Southern Europe (Spain and Italy). It grows from sea level to 2000 m. Widely cultivated in backyards and gardens
- *Tradescantia zebrina* Bosse – Cucaracha, Hoja del milagro, Manto del señor. Grown in gardens and pots for its colorful leaves.
- *Zingiber officinale* Roscoe – Jengibre. Native plant of Asia. It is grown in tropical America and the West Indies. From 0 to 1500 m, in areas of farming and agriculture

A FAO survey in 2000 [23], mentions tha exotic crops have been established like sábila (Aloe vera) por the international cosmetics industry. But some native medicinal plants are cultivated too, like juanilama (*Lippia alba*) and saragundí (*Senna reticulate*) [23].

Among the spices, Costa Rica has not a wide variety of native species, but some of them have been cropped, like vanilla in secondary forests. Jamaica (*Pimenta guatemalensis*), unless is present in the forests of Cordillera de Guanacaste, have not been exploited from the wild due to the few natural populations, but have been cultivated. Few quantities of orégano (*Lippia* sp.) are wild collected in the Dry Pacific and is cultivated in other regions in the country. Culantro coyote (*Eryngium foetidum*), initially obtained from the wild, is cultivated now in small areas for the national market, where is competing with culantro (*Coriandrum sativum*) [23].

The cultivation of medicinal plants in Costa Rica is mainly done in household gardens, market gardens (from 0,1 to 1,4 ha) and comercial crops mainly devoted to the traditional cultivation of *Psycotria ipecacuanha*, and nowadays there is a management plan for *Quassia amara*[18].

In Costa Rica and Panama a breeding process has been initiated with *P. ipecacuanha*. There is also a high interest in domesticating Smilax sp., but there not exist a suitable technology to manage this liana plant [17].

Only a few tea companies like Mondaisa, Manza Té and Kábata use locally grown plants like Lemon Grass, Chamomile, Hibiscus and some others for their herbal teas, which you can purchase in almost every supermarket in Costa Rica. Tommy Thomas, a former Peace Corps volunteer and owner of Industrias Los Patitos, a leader in the local spice industry, started The Ark in the 90's in Santa Barbara de Heredia. On this beautiful herb farm, they have over 300 species of medicinal plants from Costa Rica and from all over the world. Sacred Seeds Sanctuary, a sustainable rainforest Eco lodge has a dynamic collection of medicinal plants and houses over 300 tropical medicinal plants [13].

Very few have tried to grow large quantities of medicinal herbs and pioneers like botanist Rafael Ocampo and his wife Flor Maroto have tried hard but a lack of funds and lack of Governmental interest in many projects that were started, put a stop to all industrial growth.

Rafael Ocampo is a scientist and has never sought the commercial side of medicinal herbs and plants. With scientists like Michael Ballick and others, Ocampo has done some incredible investigative work on the development of agroindustrial products like Achiote, Ipecacuana, pepper, flor de Jamaica, curcuma and others [13].

Even though Costa Rica has an incredible potential for growing medicinal herbs for the huge pharmaceutical businesses, it seems nobody has tried to hook into this important industry as far as I know. Rafael Ocampo states in one of his many publications that the country registers the lowest demand of medicinal herbs in Central America, probably due several reasons [13]:

1. Costa Rica has a high level of income per person compared to the rest of Central America.
2. The country spends a lot of the public expenditure on public health.
3. The country has a much higher preventive public health system than other countries.
4. Public health politics have not legislated in favor of alternative production of pharmaceuticals.
5. Agricultural politics have not considered the support of medicinal plants as an alternative of development.

3.3._Jamaica

The Spaniard settlers who followed Columbus arrival in 1494 introduced a variety of crops, establishing plantations, including medicinal plants (eg. *Zingiber officinale*). The British, who arrived in 1655, introduced other spices such as cinnamon (*Cinnamomum zeylanicum*), nutmeg (*Myristica fragrans*) and turmeric (*Curcuma longa*), were introduced in the 18th century. Ackee (*Blighia sapida*) were introduced by Africans and neem (*Azadirachta indica*) was probably introduced by Indians [24].

Some references of cultivated medicinal and aromatic plants [10]:

- ALOE VULGARIS Lam. Aloes; Semper Vivum (Simple or Sinkle Bible). This species yields the Barbados or Curaçao aloes of commerce.
- ARALIA GUILFOYLEI Cogn and March. Aralia. It is common in garden as a hedge plant and is not indigenous.
- ARTEMISIA SP, Garden Bitters. No species of Artemisia is recorded in Jamaica by Fawcett and Rendle so that this, if correctly identified, must be a garden plant. It is possible that garden bitters and abainth (Artemisia absinthium) are identical as Browne says that the latter was introduced into Jamaica and cultivated.
- CASSIA OBOVATA Collad. Jamaica Senna: Port Royal. Dog, Senegal. Tripoli, or Italian Senna: Senegal Cassia. At one time it was cultivated on the Palisadoes with a view to exporting the senna.
- CINNAMOMUM CAMPHORA Nees. Camphor Tree. This tree, a native of Eastern Asia, is found occasionally in Jamaica in cultivation.
- CINNAMOMUM ZEYLANICUM Breyn. Cinnamon. It is thought to have been introduced into Jamaica in 1782.
- COLEUS AROMATICUS Benth. French or Spa..ish Thyme. Country Borage. This species, a native of Java, is cultivated to some extent in the West Indies where it is used for seasoning.
- CYMBOPOGON CITRATUS (DC.) Stapf. Fever Grass; Lemon Grass. This is one of the important oil grasses, producing lemon grass oil which is used medicinally and in perfumery. It was introduced into Jamaica about 1800.
- MENTHA VIRIDIS L. Garden Mint: Black or Sweet mint. The plant, introduced into the gardens of Jamaica, is much used as a medicinal herb.
- OCIMUM BASILICUM L. Barsley. This plant is grown in gardens and, in addition to its use in cooking, it is employed in a similar manner to the wild species.
- PIMENTA DIOICA L. (Merr.). Pimento: Allspice. This species produces the well-known spice.

Traditional export crops, which dominate the export market, include coffee, **pimento**, citrus (oranges, ortaniques, grapefruit) and cocoa with sugar and copra (coconut) as commodities.

Pimento (*Pimenta dioica*): The MOA through its export division maintains a nursery for pimento seedlings. There is a genebank of pimento at the Orange River Research Station. Improved selection techniques for pimento include approach grafting and this has resulted in the selection of high yielding cultivars. The acreage in pimento has increased due to governmental support and distribution of seedlings. Pimento seed production fell (but pimento oil production increased) since 1996 and the response was the Pimento Resuscitation and Replanting Program which commenced in 2003. This crop is important for domestic consumption and as an important foreign exchange earner.

Domestic crop production has decreased over the last ten years. Input (eg fertilizer, fuel) prices have increased while farmgate prices have struggled to keep up with inflation. Affordability rather than availability is the major factor, except after a hurricane. This sector includes a range of crops such as legumes, vegetables, herbs and spices, fruits, cereals (corn), plantain, yams, cassava, coco, dasheen, sorrel and potatoes (irish and sweet).

There are several encouraging trends in plant production over the last ten years[24]:

- Trend towards targeted R&D activities to specific plant groupings – eg MOA Fruit Tree Crop Project, several Medicinal Plant (Biotechnology Centre) and nutraceutical (SRC) projects.
- Trend towards initiation and revitalization of *ex situ* gene banks by the MOA (many), NCU (breadfruit), CASE (a few) and UWI/BTC (medicinal plants).
- Trend towards *in vitro* gene banks - SRC (banana, plantain, spices, food crops, fruit trees and ornamentals), UWI/BTC (spices, medicinal plants, agricultural crops).

The Biotechnology Centre was opened in 1989 and the Molecular Biology Building of UWI in 1998.The Medicinal Plant Research Group and the Natural Products Institute, both at UWI were initiated in 1999. A major nutraceutical project involving UWI, SRC and MOA between 2001 and 2007 not only encouraged R&D but also brought the entities mentioned closer together. The herbal sector was consolidated in 2002 and this has widened the number of plants being considered as viable crops [24].

Underutilized species such as breadfruit, breadnut, pineapple, culinary herbs and spices, fibre, medicinal and aromatic plants could be expanded along with the local staples mentioned above to enhance food security and increase exports [24].

Biodiversity inventories: Spices and medicinal plants are considered priorities for future inventories and surveys of plant genetic resources, crop-associated biodiversity and wild plants for food production.

Medicinal plant collections: A medicinal plant garden ex situ gene bank is being maintained by the Biotechnology Centre at UWI with between 50-100 plant species being represented by at least one plant. The medicinal trees are being planted at Hope Botanical Gardens in a medicinal tree grove.

In vitro collections: The Biotechnology Centre has an active tissue culture collection of mainly medicinal plants. Plant species presently in vitro include: aloe (*Aloe vera*), ackee, arrowroot

(*Maranta arundinacea*), bottle brush (*Callistemon viminalis*), cerassee (*Momordica charantia*), chainy root (*Smilax balbisiana*), ginger (*Zingiber officinale*), fever grass (*Cymbopogon citratus*), medina (*Alysicarpus vaginalis*), neem (*Azadirachta indica*), pepper elder (*Piper amalgo*), pineapple (2), sarsaparilla (*Smilax regelii*),scotch bonnet pepper, spirit weed (*Eryngium foetidum*), strong back (3), tuna (*Opuntia cochenillifera*), turmeric (*Curcuma longa*), wicker (*Philodendron* sp.) and yam.

4._Marketed MAPs species

4.1._Brazil

4.1.1._Used plants

Brazil has a very diverse "popular pharmacopoeia", based on medicinal plants, resulting in a cultural miscegenation involving African, European and indigenous, and introduction of exotic species, by settlers, immigrants and slaves [25].

Brandao et al. (2006; 2008) reviewed the four editions of the Brazilian Pharmacopoeia (Pharmacopoeia of the United States of Brazil, in 1926, Brazilian Pharmacopeia, 1959, the Brazilian Pharmacopeia, 1977, Brazilian Pharmacopoeia, 1988-1996), seeking data on medicinal plants and other plant products described therein. The results showed as biodiversity, native plants and derived products have been progressively excluded from official Brazilian medicine over the years. In addition, the results showed that from the second half of the last century there was intense replacement of native plants in Brazil by industrialized medicine and other imported plant products, thus confirming the need for investment in research validation of local medicinal plants [25].

Many native species have been widely used by people in therapy. Some species have chemical or pharmacological studies supporting their use, others are used from the empirical or traditional knowledge of the population (REIS; MARIOT, 1999) [25].

In 2006, the Pharmaceutical Association of Alagoas (Associação Farmacêutica de Alagoas - AFAL), by through the Project Program for the SUS (PPSUS-AL), held through home visits and filling in specific forms, identification of medicinal plants grown in the home environment and their uses by Alagoas population. This study included 37% of municipalities in Alagoas. Identifying 100% of respondents make use of medicinal plants, grown on the residence or acquired through neighbors; only 8% reported the use of medicinal plants through medical indication or knowledge acquired bibliographic sources and 92% found the statement with relatives and neighbors they were already using [14].

Table 7. Used plants for the Alagoan population [14]

Plant*	Local name	Used part	Medicinal use
Melissa officinalis L.	Cidreira	Leaf	Calming, colic
Cymbopogon citratus (DC) Stapf.	Capim santo	Leaf	Calming, pressure, colic
Peumus boldus Molina	Boldo	Bark	Liver, kidneys, gases
Mentha sp.	Hortelã	Leaf	Flu, worms
Schinus terebinthifolius Raddi	Aroeira	Bark	Inflammation, healing
Stryphnodendron barbatiman	Babatimão	Bark	Inflammation, healing
Hyptis pectinata	Sambacaitá	Bark	Inflammation, healing
Pimpinella anisum L. *Foeniculum vulgare* Mill.	Erva doce	Leaf	Calming, colic, intestine
Lepidium sp.	Mastruz	Leaf	Flu, cough, gastritis, worm
Matricaria chamomilla L.	Camomila	Leaf	Calming, pressure
Eucalyptus globulus L.	Eucalipto	Leaf	Fever, pressure
Phyllanthus nururi L.	Quebra pedra	Leaf	Kidney stone
Sambucus australis Cham. & Schldtl.	Sabugueiro	Leaf, flower	Fever, cough, flu, inflammation
Alpinia speciosa	Colônia	Leaf	Heart
Cinnamomum zeylanicum J.Presl	Canela	Bark	Vomiting, expectorant
Eugenia uniflora L.	Pitanga	Leaf	Dysentery
Nasturtium officinale	Agrião	Leaf	Cough
Psidium guajava L.	Goiabeira	Leaf	Dysentery
Citrus x limon *Allium sativum*	Limão com alho	Fruit	Flu, cough
Justicia pectoralis Jacq.	Anador	Leaf	Ache
Citrus sinensis	Laranja	Leaf	Calming, Vitamin C
Ocimum gratissimum L.	Alfavaca	Root	Cough, flu, colic, inflammation
Lippia sidoides Cham.	Alecrim pimenta	Leaf	Antifungal
Beta sp.	Beterraba	Root	Anemia
Solanum paniculatum L.	Jurubeba	Fruit, leaf	Flu
Aloe vera L.	Babosa	leaf	Inflammation, laxative, emollient
Zingiber officinale Rosc.	Gengibre	Root	Cough

Source: AFAL, 2008

*The scientific name was not indicated in the document. This is the one believed to be used in this area (NT).

According to a study of the medicinal plants used in Pernanbuco State, close to Alagoas state the main medicinal species used for the local population were [26]:

TABELA IV

PLANTAS USADAS PARA FINS MEDICINAIS EM UMA COMUNIDADE RURAL DO MUNICÍPIO DE ALAGOINHA, ESTADO DE PERNAMBUCO (BRASIL)*

Espécies	Parte usada	Formas de uso e indicações terapêuticas
Acanthospermum hispidum DC.	Raiz	Com um infuso prepara-se um xarope para combater a tosse e a asma.
Amburana cearensis (Arr. Cam.) A.C. Smith.	Casca do caule	Com um infuso prepara-se um xarope para tosse. Para a gripe na forma de chá.
Anacardium occidentale L.	Casca do caule	A tintura ou o decocto são usados externamente contra inflamações e pancadas.
Anadenanthera colubrina (Vell.) Brenan var. *cebil* (Griseb) Altschul	Casca do caule	Com um infuso prepara-se um xarope para a tosse.
Bauhinia cheilantha (Bong.) Steud.	Sementes, folhas e cascas do caule	Torra-se e pulveriza-se as sementes preparando uma bebida ingerida para a dor de cabeça. Com um infuso das folhas ou cascas do caule prepara-se um xarope para a tosse e expectorante. O chá das folhas também é usado para diabetes.
Boerhavia diffusa L.	Raiz	Com um infuso prepara-se um xarope para a tosse. O chá é usado para combater inflamações.
Caesalpinia ferrea Mart.	Cascas do caule	Prepara-se um decocto que é usado na forma de chá para labirintite. Também empregado nos problemas renais.
Caesalpinia pyramidalis Tul.	Casca do caule	Com um infuso prepara-se um xarope para combater a tosse.
Capparis flexuosa L.	Cascas do caule	As cascas são raspadas e deixadas em água. Bebe-se o líquido resultante contra picada de cobras.
Cereus jamacaru DC.	Caule	As cascas são raspadas e deixadas em água. Bebe-se o líquido resultante contra problemas renais.
Chenopodium ambrosioides L.	Folhas	Com um infuso prepara-se um xarope para combater a tosse.
Citrus aurantium L.	Folhas	Com o infuso prepara-se um chá para combater a febre.
Cleome spinosa Jacq.	Flor e folhas	A flor em tintura para uso externo em inflamações. As folhas como lambedor para combater a tosse.
Cnidoscolus urens (L.) Arthur	Raiz	Com o decocto prepare-se um chá para combater inflamações.
Croton argyrophylloides Muell. Arg.	Casca do caule	Coloca-se de molho em água esfregando-se vigorosamente. Bebe-se para aliviar a dor de barriga.
Croton rhamnifolius Muell. Arg.	Folha	O chá das folhas é considerado depurativo.
Cymbopogon citratus (DC) Stapf.	Folhas	Com o infuso prepara-se um chá usado para problemas digestivos (dor de barriga, má digestão), dores de cabeça e febre.
Dioclea grandiflora Mart.	?	?
Egletes viscosa Less.	Folhas	Com o infuso prepara-se um chá que é usado para problemas digestivos (dor de barriga, má digestão).
Erythrina velutina Willd.	Casca do caule	Com o infuso prepara-se um chá para combater inflamações (internamente ou externamente) e como tranqüilizante.
Eucalyptus sp.	Folha	Com o infuso prepara-se um chá para debelar a febre.
Gossypium herbaceum L.	Folha	Prepara-se um emplasto e aplica-se diretamente em queimaduras.
Hybanthus cf. ipecacuanha (L.) Baill.	Raiz	Com o infuso prepara-se um xarope para combater a tosse.
Hymenaea courbaril L.	Casca do caule	Com o infuso prepara-se um xarope para combater a tosse, a bronquite, fraqueza e debilidade.
Jatropha curcas L.	Látex	Usado contra picadas de cobras.
Jatropha mollissima (Pohl) Baill.	Látex	Usado contra picadas de cobras.
Kalanchoe brasiliensis Cam.	Folha	A folha é aquecida e colocada sobre locais doloridos.
Lippia sp.	Folhas	Com o infuso prepara-se um chá que é usado para problemas digestivos (dor de barriga, má digestão).
Lippia alba (Mill.) Brow.	Folhas	Com o infuso prepara-se um chá que é usado para problemas digestivos (dor de barriga, má digestão), dores de cabeça, febre e pressão alta.
Maytenus rigida Mart.	Casca do caule	Com o infuso prepara-se um xarope para combater a tosse. Para o reumatismo, as cascas são deixadas em repouso em uma garrafa com água por três dias.
Mimosa tenuiflora (Willd.) Poir.	Folhas e casca do caule	Folhas usadas topicamente para aliviar a dor de dente. Com as cascas do caule prepara-se uma infusão aplicada externamente para inflamações.
Momordica charantia L.	Toda a planta	Prepara-se um infuso que é utilizado banhando-se o corpo para aliviar alergias ou erupções cutâneas de outras origens.
Myracrodruon urundeuva (Engl.) Fr. All.	Casca do caule	A tintura ou decocto é usado externamente contra inflamações e pancadas. Para aliviar a gastrite bebe-se um preparado feito com as cascas deixadas de repouso em água.
Ocimum campechianum Mill.	Folhas	Com o infuso prepara-se um chá que é usado para problemas digestivos (dor de barriga, má digestão).
Passiflora foetida L.	A planta toda	Com um decocto, acrescido de sal, prepara-se um xarope para combater a tosse.
Phyllanthus niruri L.	Raiz	Com o infuso prepara-se um chá para problemas renais (inflamações e pedras nos rins).
Piptadenia stipulacea Ducke	Casca do caule	A tintura ou decocto é usado externamente contra inflamações.
Plectranthus sp.	Folhas	Com o infuso prepara-se um xarope para combater a tosse.
Psidium guajava L.	Folhas	Com o infuso prepara-se um chá para combater disenteria.
Rosmarinus officinalis L.	Folhas	Com o infuso prepara-se um chá para combater a febre.
Ruta graveolens L.	Folhas	Prepara-se uma tintura em álcool para dor de cabeça.
Sapindus saponaria L.	Casca do caule	Prepara-se um decocto com o qual lava-se o cabelo para combater micoses.
Schinopsis brasiliensis Engl.	Casca do caule	Com o infuso prepara-se um xarope para combater a tosse. Para a gripe é usado na forma de chá.
Senna martiana (Benth.) H.S. Irwin e Barneby	Casca do caule	Com o infuso prepara-se um xarope para combater a tosse.
Serjania comata Radlk.	Raiz	O infuso é usado na forma de chá para combater o reumatismo.
Sideroxylon obtusifolium (Roem. e Schult.) T.D. Penn.	Casca do caule	A tintura ou decocto é usado externamente contra inflamações e pancadas, e como cicatrizante.
Solanum paniculatum L.	Raiz/frutos	O infuso é usado na forma de chá para combater inflamações gerais e afecções do fígado.
Ziziphus joazeiro Mart.	Casca do caule	As cascas são raspadas e deixadas em água. Bebe-se o líquido como cicatrizante. Para combater a tosse usa-se na forma de xarope.

*As espécies estão listadas por ordem alfabética. Informações adicionais encontram-se na Tabela I.

4.1.2._Plants sold in the market

VALUE CHAIN

The herbal distribution channel in Brasil presents different arrangements. The commercialization of this raw material can be widespread through four main distribution channel arrangements (A, B, C and D), involving producers or extractors, brokers, wholesalers, retailers, and the herbal medicines industry. The trade of medicinal plants can occur in both the fresh market and the dehydrated plant market [28]:

Channel A: Producer/Collector – Intermediary - Wholesaler

The vast majority of medicinal plants sold in Brazil come from wild collection. Collectors are usually family farmers who live nearby regions to collection areas. It is common the existence of informal intermediaries in collection regions. These companies or individuals are responsible for aggregating the amounts collected in larger batches and sell them mainly to wholesalers.

In Brazil, wholesalers operate on two distinct levels. There are those who only carry the load deployment process by providing mainly for compounding pharmacies. There are still those who perform processes of adding value through the processing plant, providing raw material for both industry and pharmacies for handling. These can still perform export and import of plants

In this channel, dehydrated medicinal plants are marketed. The drying process also in rural property enables them to have a shelf life greater than the fresh plants. The drying and storage conditions under which the medicinal plants are subjected substantially affect the quality of the product to be marketed.

Serious problems related to the quality of the raw material are found in that channel. Alteration products, such as mixtures of different species, the presence of foreign objects and fungal contamination are recurring problems. These are due mainly to the lack of management of collection and disabled drying processing and storage.

Also free market trading mechanisms are identified (spot) and informal contracts. However, due to the presence of intermediates in this process and the low quality of the raw material prices paid to collectors are usually very low. As cooperative actions are not observed between the collectors, these have low bargaining power, which makes the price takers.

Thus, low managerial capacity, low technological level and the difficulty of access to information for collectors make the role of essential intermediary for the marketing of medicinal plants.

Channel 2: Producer / Collector – Wholesaler

The producers / collectors involved in that channel, are characterized by a higher level of organization than those of the channel A. This makes them able to provide the wholesaler without the use of intermediates. These producers are generally of greater size, growing a few species and in larger quantities (specialization of production). In the case of collectors, it is common that commercialisation is done through associations, which allows the service of production scale requirements.

The commercialisation mechanisms found in this channel are similar to those of channel A. In addition, the bargaining power between wholesalers and their suppliers leads to adversarial behavior and opportunistic actions. It is emphasized that these mechanisms, both the supply (producers) and purchase (wholesalers) are not guaranteed. Thus, it appears that the continuity of transactions (frequency) depends mainly on product quality and reputation of the agents involved.

Channel 3: Producer / Collector - Industry

The herbal medicines industry demand raw materials in quantity, regularity and quality. However, these companies have faced difficulties in the supply of these products. Given the specificity of the assets, the industry has developed other marketing mechanisms such as formal contracts and vertical integration.

Although emerging, some initiatives have been observed. In this situation, companies have greater control over the management of production (quantity and variety) and, consequently, the quality of the raw material. In addition there are no intermediaries, allowing greater gains for the producer, these mechanisms strengthen long-term relationships. This "guarantee" creates incentives for producers to invest in improvements in their business.

Channel 4: Producer/Collector – Retailer

This channel illustrates the commercialisation of medicinal plants between producers and retailers, in this case free trade and / or supermarkets. This is the fresh market of medicinal plants. Thus, they sold in jars or in packets. Due to the perishable nature, these products require special care in their marketing.

In this market, the commercialization between producers and market traders is through *spot* type transactions. The price is negotiated at the time of sale, according to the supply and demand for the product. It is noteworthy that the different species of medicinal plants have seasonality of production and consumption (season of the year and fad), influencing the bargaining power of the parties involved. Because it is a short channel, marketing margins are not shared with other agents representing a possibility of higher margins for producers.

In the case of trade between producers and supermarkets, also can occur “hybrid” transactions, such as informal or formal contracts.

EXPORTS
Brasil is exporting 10 tons of pilocarpine salts obtained from *Pilocarpus* sp. and 35 tons of rutine from *Ruta graveolens* [17].

ALICE-Web Internet search system is free and developed by the Foreign Trade Secretariat (SECEX) of the Ministry of Development, Industry and Foreign Trade (MDIC). Provides information updated monthly on the statistics of Brazilian exports and imports in support of the Integrated Foreign Trade System (SISCOMEX), which manages the Brazilian foreign trade

In relation to essencial oils, the ALICE-Web system, from January 2005 to October 2008, shows 27 products including 7 essential oils of citrus (orange, bergamot, petit orange grain, lemon, lime, other lime and other citrus fruits), 4 oils of mints (peppermint - *Mentha piperita*, Japanese mint - *M. arvensis*, spearmint - *M. spicata* and oils of other mints), 4 flower oils (geranium, jasmine, lavender or lavender and other lavender oil), 4 wood oils (pau-rosa, pau-santo, *Bulnesia sarmientol*, cabreúva and cedar) and leaves remaining, as citronella, lemongrass (campim-limão), palmarosa and eucalyptus oil in addition to the vetiver and "other oils vetiver" and oil of coriander seeds (coriander), totaling 26 items. The 27th item includes other essential oils, without detailed description of the products [30].

DEMAND

About the most demanded species, that could be interesting for MAPs producers (according to UNIARARAS and UNICAMP researchers) are [29]:

- *Matricaria chamomilla.*
- *Mentha sp.*
- *Cymbopogon citratus.*
- *Calendula officinalis.*
- *Equisetum hyemale.*
- *Pimpinella anisum.*
- *Stevia rebaudiana.*
- *Cordia verbenacea*
- *Bauhinia fortificata*

4.2._Costa Rica

4.2.1._Used plants

Costa Rica used to have a strong culture for the use of medicinal herbs but over the last 20 years most of it disappeared. Hierba Buena, cuculmeca, zacate limon, cola de caballo, diente de leon, hombre grande and pichichio are some of those local medicinal herbs, you just need to know where to buy them and what they are used for. You will find three kinds of herbs in Costa Rica: Indigenous, Afro-Costarican and Caucasian, but the indigenous influence of the use of these medicinal herbs has always been the strongest. You will find that, throughout Costa Rica, over 300-500 different medicinal plants are used by the local population [13, 23].

The Museo Nacional de Costa Rica jointly with INBIO elaborated the Herbario Nacional de Costa Rica, where 28 medicinal especies of well established use in Costa Rica are described [17]:

- *Buddleia americana* L. – Salvia virgen.
- *Carica papaya* L. – Papaya.
- *Cecropia obtusifolia* Bertol. – Guarumo.
- *Citrus aurantium* L. – Naranjo agrio.
- *Costus spicatus* (Jacq.) Sw. - Caña agria.
- *Cupressus lusitanica* Mill. - Ciprés.
- *Cymbopogon citratus* (DC.) Stapf. – Zacate limón.
- *Equisetum bogotense* Kunth., *E. giganteum* L. – Cola de caballo.
- *Eryngium foetidum* L. – Culantro coyote.
- *Jathropa gossypiifolia* L. – Frailecillo.
- *Justicia pectoralis* Jacq. – Tilo.
- *Lippia alba* (Mill.) N.E. Br. – Juanilama.
- *Lippia graveolens* Kunth. – Orégano.
- *Matricaria chamomilla* L. – Manzanilla.
- *Mentha spicata* L. – Hierba buena.
- *Momordica charantia* L. – Sorosí.
- *Neurolaena lobata* (L.) Cass. – Gavilana.
- *Ocimum basilicum* L. - Albahaca.

- *Passiflora quadrangularis* L. – Pasiflora, Granadilla real.
- *Plantago major* L. – Llantén.
- *Psidium guajava* L. – Guayaba.
- *Quassia amara* L. – Hombre grande, Palo quinina, Quininagrú.
- *Rosmarinus officinalis* L. – Romero.
- *Senna reticulata* Willd., *Senna alata* L. – Saragundí.
- *Tradescantia zebrina* Bosse – Cucaracha, Hoja del milagro, Manto del señor.
- *Uncaria tomentosa* (Wiil. ex Roem. & Schult.) – DC.
- *Urera baccifera* (L.) Gaudich. – Ortiga.
- *Zingiber officinale* Roscoe – Jengibre.

On the other hand, according to Traditional Medicinal Knowledge in Costa Rica [11], by Madaleno, Isabel Maria of the Portuguese Tropical Research Institute, the most used medicinal plants in Costa Rica are the following:

- *Matricaria chamomilla* L. Camomile. Herb. Sedative, analgesic, anti-flu, collyrium, ear infections. European
- *Mentha piperita* L. var. *citrata* (Ehrh.) Briq., *M. spicata* L. Mint. Herb. Sedative, digestive, carminative. European
- *Rosmarinus officinalis* L. Rosemary. Bush. Rheumatic pains, hair washing. European.
- Aloe vera (L.) Burm.f. Aloe. Bush. Stomach ulcers, cancer, tumours, prostate diseases, skin problems. African.
- *Jatropha gossypiifolia* L. Frailecillo. Bush. Stomach aches, diuretic, hemostatic, depurative, prostate problems. Tropical American.
- *Ruta graveolens* L. Rue. Herb. Ear infections, sour throat, arthritis. European.
- *Cymbopogon citratus* (DC.) Stapf. Lemongrass. Herb. Stomach aches, analgesic, cough, sedative, anti-flu. Tropical Regions.
- *Quassia amara* L. Bitter wood. Tree. Diabetes, hepatic, febrifuge, antidiarrhoea, depurative. Tropical American.
- *Triumfetta semitriloba* Jacq. Mozote. Herb. Stomach aches, diarrhoea, uric acid control, anti-flu, antirheumatic. Tropical American.
- *Taraxacum officinale* F.W. Wigg. Dandelion. Herb. Prostate problems, digestive, hepatic, anti-rheumatic. European.

In spite of general native species dominance, this list shows that the three top ranking plants used in infusions, concoctions, macerations and external applications are European.

On fourth of the plants used in traditional healing practises and domestic remedies had been introduced by European colonisers. Explanation is several world-known herbs are accepted by the conventional medicine and most of them are sold in small pockets in the pharmacy.

- ✓ In fact, the preferred medicine is Camomile (*Matricaria chamomilla* L.), taken orally in digestive infusions, also recommended against menstrual pains, used as a mild sedative and anti-influenza tea. Costa Ricans sometimes use solely the leaf and the flowers, particularly as pain killers and as collyrium, a popular external convenience for the herb, others the whole plant, together with the root. In this instance they tend to buy the specimen from local traders. External usage of the whole plant infusion in ear drops is considered the best recommendation against ear infections.

- ✓ Mint (*Mentha* sp.) refreshments are advised against stomach aches because of the carminative virtues the herb possesses, but in San Jose the mint leaf is eaten in salads for the recognised digestive properties.

- ✓ Rosemary (*Rosmarinus officinalis* L.) decoctions are used against cough, and externally in remedies to ease rheumatic pains, such as in topical frictions and cataplasms. Women wash their hair with the infusion of this European species in order to protect the scalp and make the hair stronger.

- ✓ In case of hair treatments Rosemary has a good and appreciated native alternative, an Acanthaceae, *Justicia tinctoria*, locally know by the Spanish designation of Azul de Mata. It has been used from ancient times by the Huetar Indian communities against allergies and to eliminate dandruff. The species has been chemically tested and has proven effects against *Candida albicans*,*Escherichia coli* and *Staphylococcus aureus*.

- ✓ Bitter wood (*Quassia amara* L.) is another native species, a tropical forest tree, also active against *Candida albicans* and *Staphylococcus* spp. The concoction of the bark is considered a good antidiabetic, suggested to be taken orally after meals. Before the main meals the popular recommendation is the maceration, used as stimulant, febrifuge and depurative.

- ✓ The bark of another tropical forest species, Mozote (*Triumfetta semitriloba* Jacq.), is used macerated in water in ancient Bribi Indian prescriptions to facilitate child delivery. The concoctions of the stem are diuretic, anti-diarrhoeal and used to control acid uric. The native Tiliaceae is applied externally against rheumatic pains.

- ✓ As anti-dysenteric the Cabecar Indians prefer the usage of native Gavilana (*Neurolaena lobata* (L.) Cass.) that has proven effects against *Escherichia coli* and *Staphylococcus aureus*, pyogenes and tiphi (Navas, 2007, Fernandez, 2007). The fresh cuttings are steeped in a boiling litre of water and taken orally in case of gastritis and colitis. The hepatic virtues favour the usage of the infusion as digestive. It is antidiabetic too. External applications in baths are common in Costa Rica for its antifungal and antibacterial activities that confirm traditional medicinal recommendations.

- ✓ The European Dandelion (*Taraxacum officinale* F.W. Wigg.) grows everywhere, even along the roads, fed on the heavy rains. Introduced in the early days of colonisation, Costa Ricans eat the herb in salads and drink the infusion cold, as refreshment, for the digestive and hepatic actions.

- ✓ As diuretic, however, a well-known native is traditionally prescribed by Chorotega Indian healers – corn (*Zea mays* L.) a prescription common to the Aztecs.

- ✓ In addition to Bitter wood and Gavilana, already mentioned, residents use Sorosi (*Momordica charantia* L.), an African native vine, recommended in infusions of the leaf and flower.

- ✓ Another example is a tree, Guapinol (*Hymenaea courbaril* L.) about 40 metres tall, consumed in infusions of the leaf and bark.

- ✓ It is also the advice given in the use of Guarumo (*Cecropia obtusifolia* Bertol.), taken orally in concoctions of the leaf.

- ✓ The tropical forest tree is about 20 metres tall. Escalera de Mono (*Bauhinia manca* Standl.) is a liana that grows from Central America to the Amazon rainforest. In Brazil the locals use the native species (Bauhinia guianensis Aubl.) instead.

- ✓ The Calaguala (*Polypodium aureum* L.) roots are used both as antidiabetic and as anti-cancer. Calaguala is a tropical American fern.

- ✓ Back to the home gardens, Frailecillo (*Jatropha gossypiifolia* L.) is another domestic recommendation; in fact it is the fifth most consumed species in San José. It's also the case with Aloe (*Aloe vera* (L.) Burm.f.), an African importation that occupies the fourth place in the ranking of preferences. The stem juice mixed with honey and whiskey is prescribed against prostate problems, including cancer, a central market recommendation that an over seventy years old informant declared to use regularly with success.

- ✓ Coffee beans and leaf (*Coffea arabica* L.) taken orally in concoctions are again recommended to decrease glucose tolerance.

The National Museum has a pretty nice herb selection with great explanations on most of them in "El Herbario Nacional" located in San Jose on Calle 17, between Central and Second Avenue, right behind the Plaza de la Democracia [13].

4.2.2._ Plants sold in the market

You won't find any medicinal plants and herbs in shopping malls. Macrobiotica or health food stores might carry some extracts, but you won't find any fresh medicinal herbs in those stores either. For the real thing, you will either have to shop at the farmer's markets or the central markets that most town and cities in Costa Rica have. You will find most of them around the fresh vegetable stands [13].

Traditionally, medicinal plants are sold in local markets. In farmers fairs it is possible to find alive plants and fresh vegetal material. The population of lower income is buying medicinal plants in street vending. But there also exist botanical shops or "biohealth", where are offered both raw material and manufactured products [23].

The herbal teas industry is the one using the higher volumes of raw material, coming from wild collection or cultivation. This industry is producing both for local consumption and for export [23].

In a study of the potential market of 8 medicinal plants done in México, Colombia, Guatemala Costa Rica, Nicaragua and Honduras, the following had a higher demand [19]:

- calahuala (Phlebodium aureum), with 26 tons of rhizomes and leaves from cultivation;

- Mexican oregano (Lippia graveolens), with 300 tons of dry leaves obtained from cultivation and wild collection.
- Zarzaparrilla (Smilax dominguensis), with 100 tons of leaves and dry plant.
- Maracuyá (Passiflora edulis), with 100 tons mainly of dry fruits from cultivation.
- Cuasia (Quassia amara), with 1 ton of bark obtained mainly from wild collection.

This study revealed that in the last years, countries like Japan, France, Italy and Australia have shown interest in buying these species, but they prefer those coming from cultivation.

The Non Wood Forest Products (NWFP) have had a significative participation in the national economy of Costa Rica and play an important role for the rural population. During the Colony, some NWFP were commercially exploited: zarzaparrilla (*Smilax* spp.), vanilla (*Vanilla* sp.), el hule (*Castilla elastica*), chidra ó semko (*Carludovica palmata*), añil (*Indigofera* sp.), and balsams and resins. During XXth Century the NWFP exploitation continued, driving to an overexploitation. Sol, ipecacuana (*Cephaelis ipecacuanha*) was firstly obtaind from wild collection, but was then domesticated afterwads. Nowadays, this species is the most important NWFP in the country [23].

In Costa Rica, 133 medicinal plants are traded, 82% of those locally produced (from wild collection or cultivation), with a production of 170 t of raw material. The 53% of the traded plants are native ones [23]. The only information on medicinal herb export is that Costa Rica exported 18,2 metric tons of medicinal herbs in 1992 [11].

According to a study pretending to characterize the value chain of medicinal plants in Costa Rica (Ammour et al, 1994), there were traded 167.371 kg of medicinal plants. 35% of this quantity (57.907 kg) came from wild colletion. These plants were commercialized as fresh raw material, dried raw material (whole or grinded) and, at lower scale, as manufactured products like as ointments, hidroalcoholic extracts, capsules and others [23].

Costa Rica is exporting ipecacuana (*Cephaelis ipecacuanha*), quina (*Ocotea veraguensis*), zarzaparrilla (*Smilax* sp.) and sábila (*Aloe vera*), the three first as raw material and the last one as extract. In 1992, the international market of ipecacuana was not overcoming 100 t of dry root, Costa Rica covering the 40% of them [23].

Costa Rica is trading *Cinchona* sp. and producing *Aloe* gel to the international market. In Costa Rica and Panama a breeding process has been initiated with *P. ipecacuanha*. This is the main product of wild origin obtained for export to United States of America, Germany, France, United Kingdom, Malaisia and Thailand [17].

Smilax sp. has a wide use in the indigenous populations as a blood depurative. Costa Rica is exporting roots of this plant to Spain, further used for pharmaceutical industries. Nevetheless, the main producer of these dry roots is Mexico, following Honduras and Costa Rica. United States imports around 72 tons per year from Mexico and 3 tons of Honduras and Jamaica [20, 21].

Costa Rica started the cultivation of *Zingiber officinale* in the decade of 70, but nowadays is Guatemala who is selling the rhizomes to Europe [17].

4.3._Jamaica

4.3.1._Used plants

Accoding to the report MEDICINAL PLANTS OF JAMAICA. PARTS 1 & 11, by G. F. Asprey, M.Sc., Ph.D. (B'ham.), Professor of Botany, U.C.W.I. and Phyllis Thornton, B.Sc. (Liverpool), BotanistVomiting Sickness Survey. Attached to Botany Department, U.C.W.I., the use of local plants for medicinal remedies is a very prevalent practice in Jamaica. Among the poorer families, the morning meal frequently consists of nothing more than a cup of bush-tea prepared by steeping the leaves in hot water, with perhaps a small piece of bread or a little corn meal porridge. It is perhaps significant that the term breakfast is not used but 'taking' or 'drinking' tea is substituted. Many of the plants used for treatment of colds and indigestion also provide the normal morning drinks.

The plants used as home remedies are frequently known only by their common names which may vary from district to district.

Some attempt has been made to record usages in other areas of the Caribbean and in Africa as perhaps showing relationship with Jamaican practices. Upwards of one hundred and sixty species of plants distributed through sixty-two plant families will be dealt with in detail. The families (Acanthaceae to Zygophyllaceae) with the Latin names of the relevant species are arranged alphabetically.

Table 8. Reference list of medicinal plants in Jamaica arraned in alphabetical order of families

ACANTHACEAE
ANDROGRAPHIS PANICULATA Nees. Rice Bitters; Wild Rice. Used in Jamaica to prepare a general beverage and in treatment of fever and colds.
BLECHUM BROWNEI Juss. Wild Hops; John Bush. Use of this species in baths and for sore feet.
DIANTHERA PECTORALIS Murr. Fresh Cut; Garden Balsam. Probably acquired its common name from the use made of it in the treatment of cuts. The leaves are bruised, alone or with rum, and applied as a plaster. Tea made with the leaves is taken for colds.
AMARANTACEAE
ACHYRANTHES INDICA Mill. Devil's Horsewhip; Ridingwhip or Backbone; Colic Weed; Hug-me-close. A common Jamaican weed used to make tea for colic and colds. For the latter purpose it may be mixed with Mimosa pudica.
AMARANTUS SPINOSUS L. Prickly Calalu; Spinach. A. TRISTIS L. Spanish Calalu. A. VIRIDIS L. Green or Garden Calalu; Spinach; Caruru. A. viridis and A. spinosus and perhaps the third species are among the most common green vegetables in Jamaica. Calalu is said to be 'good for the bowels'. A. viridis contains vitamin C, tannin, resin and reducing sugars.
IRESINE PANICULATA Kuntze. Juba's Bush. Said, by Beckwith, to be used for colds, pain in the bowels and colic and as a drink for a woman in childbirth. For the latter purpose it is made into tea with Piper nigrinodum, salt, and a few drops of whisky. In other cases either a tea or the juice is used.
AMARYLLIDACEAE
HIPPEASTRUM PUNICEUM (Lam.) Urban. Red Lily; Maroon Lily. The bulb of this species is used to make a plaster with bread or, with Eryngium foetidum, for use on swellings and sores.

ANACARDIUM OCCIDENTALE L. Cashew. Beckwith reports the use of cashew leaves in combination with Dryopteris sp.. rat ears (Peperomia pellucida, Kth.) and maidenhair fern in the treatment of colds and 'any sickness at all'. Cashew leaves are sometimes used in bush baths for fever.

MANGIFERA INDICA L. Mango. It seems doubtful if this species is much used medicinally in Jamaica but the fruit contains vitamins A. Band C and traces of D. Black mangoes particularly are said to be laxative. Leaves are used in baths.

SPONDIAS MONBIN L. Hoq Plum. The buds are chewed and the juice swallowed or they are boiled for tea in the treatment of colds. An infusion of bark and leaves for oedema.

ANNONACEAE

ANNONA MURICATA L. Soursop. The fruit pulp. which is used in the preparation of drinks and ice-cream. contains vitamin C. It has been used as a febrifuge and the dried unripe fruit in the form of a powder was at one time used for dysentery. The plant (probably a tea made from the leaves) is said to induce perspiration and to be used for colds and 'nerves'.

ANNONA RETICULATA L. Custard Apple. In Jamaica the leaves are occasionally used beaten up and applied to sprains.

ANNONA SQUAMOSA L. Sweetsop. For coughs sweetsop is said to be used with calabash to make a syrup.

APOCYNACEAE

ECHITES UMBELLATA Jacq. Maroon Weed: Savannah Flower. It is used as a poultice for a sore leg and that it will 'cause vomiting if the leg is poisoned'.

VINCA ROSEA L. Periwinkle: Ram Goat Rose: Brown Man's Fancy; Old Maid. This plant enjoys a widespread reputation in the treatment of diabetes. It is so used in Jamaica. The plant is said to contain an alkaloid vincarosin which is a cardiac poison. In Jamaica it is also used as tea for colds. The white variety is used for high blood pressure.

ARALIACEAE

ARALIA GUILFOYLEI Cogn and March. Aralia. The leaves are used in Jamaica to prepare tea for colds.

ASCLEPIADACEAE

FUNASTRUM CLAUSUM (Jacq.) Schleder. Milk Wys (Withe). Used in decoction as a general beverage for adults and children, and as a cold remedy.

BIGNONIACEAE

CRESCENTIA CUJETE L. Calabash. For coughs, colds and 'to clean out the womb' young fruits are roasted, the juice squeezed out and taken with castor oil.

BORAGINACEAE

CORDIA GLOBOSA H.B.K. Black Sage; John Charles; Gout Tea. This species is used in Jamaica to prepare a tea as a general beverage and for colds and tightness in the chest'.

HELIOTROPIUM PARVIFLORUM L. Wild Clary; Dog's Tail: Sage. Used to make tea for colds, 'for the belly', and as a wash for sore eyes. It may also be used as a general beverage.

TOURNEFORTIA HIRSUTISSIMA L. Chiqqer Nut; Crocus Bush: ?Hog Hook. Used both internally and externally in the treatment of colds, coughs and fever. Both leaves and stems are used to make the decoction.

CACTACEAE

OPUNTIA TUNA Mill. Tuna: Indian Fig; Prickly Pear. The 'leaves' (stems) of tuna are used to make a decoction used 'to keep away inflammation inside'.

CAESALPINIOIDEAE

CAESALPINIA BONDUC Roxb. Yellow Nicker: Nicker; Bonduc. C. BONDUCELLA Flem. Grey Nicker: Nicker; Bonduc. Although grey nicker is considered superior, the seeds of both species are dried and ground and used like coffee to prepare a drink which is thought useful for kidney trouble, diabetes and high blood pressure.

C. CORIARIA Willd. Divi-divi: Libi-dibi. The fruits contain 30 to 50 per cent tannin and tannic acids. They are astringent and are used to make a gargle for sore throat. A decoction of the leaves and stems is similarly used and also for stomach-ache. The pod, powdered, is also said to be tonic and antiperiodic.

CASSIA OBOVATA Collad. Jamaica Senna: Port Royal. Dog, Senegal. Tripoli, or Italian Senna: Senegal Cassia. Stated to have been introduced into Jamaica in the seventeenth century by a slave, this senna is still said to be used here as a substitute for the official sennas.

C. OCCIDENTALIS L. Wild Senna: Dandelion; Stinking Weed or Wood; John Crow Pea: Wild Coffee. The seeds of this species are dried, beaten up, and used as a coffee substitute. The drink prepared from them has a reputation for usefulness in kidney and bladder troubles and malaria. it is also said to be useful for palpitations and high blood pressure. The leaves are probably used for constipation, pain, fever and colds.

HAEMATOXYLUM CAMPECHIANUM L. (Campeachy) Logwood. The chipped bark is used with sugar to make a drink. The wood and bark were formerly used by Jamaican medical men as an astringent for diarrhoea and dysentery.

TAMARINDUS INDICA L. Tamarind. The pulp of the tamarind fruit is used in Jamaica in the making of sweetmeats, in chutneys and to prepare a cooling drink. It is known and used as a laxative and to prepare a gargle for sore throat.

CAPRIFOLIACEAE

SAMBUCUS SIMPSONII Rehder. Elder. Naturalized in Jamaica in the cooler parts, this plant is said to be used for coughs, colds, fevers and constipation.

CARICACEAE

CARICA PAPAYA L. Papaw. The juice is said to be used for boils and was also used for ringworm, warts. worms, and in the treatment of enlarged liver and spleen.

CHENOPODIACEAE

CHENOPODIUM AMBROSIOIDES L. Semicontra (Semen Contra); Worm Weed; Worm Seed; Mexican Tea; Bitter Weed; Hedge Mustard. This species is the source of oil of chenopodium, the well-known anthelmintic. It is fairly commonly employed in Jamaica as a vermifuge.

COMMELINACEAE

COMMELINA ELEGANS H.B.K. Water Grass. C. LONGICAULIS Jacq. Water Grass. These species are mucilaginous and are used to boil tea for colds and malaria, and as a drink for babies.

ZEBRINA PENDULA SChnitzl. Red Water Gmss; Wandering Jew; Creeping Jennie; Rolling Calf Bed. Another mucilaginous species with considerable reputation as a cold cure.

COMPOSITAE

ARTEMISIA SP, Garden Bitters. Under Remedy for stomach-ache and, with chicken weed (*Salvia serotina* L.) and salt, for constipation. worm weed (*Artemisia absinthium* L.) is mixed with pimento and starch for worms and diarrhoea.

BIDENS PILOSA L. Spanish Needle; Spanish Nettle. Sometimes used in Jamaica, when young, as a green vegetable or potherb. It is boiled like calalu, occasionally with lard, and is said to be good for the bowels. Tea is prepared from it and used in the treatment of worms and as a general beverage.

BIDENS REPTANS (L.) G. Don. Marigold; Golden Rod; Honeysuckle; McKitty or McCathy Weed. The shoots are used in decoction as a cold remedy and also used in cases of menstrual troubles.

CALEA JAMAICENSIS L. Bee-Bee. Cold remedy.

CHAPTALIA NUTANS (L.) Polak. Kema Weed; Dandelion; White Back; Heal-I-and-Draw; Lion's Tail. Reckoned an excellent diuretic and is used as such by many people. Decoction for colic and wind, colds, convulsions; as a drink for women at childbirth and to provoke the menses.

CHRYSANTHELLUM AMERICANUM (L.) Vatke. Strong Back. Used to prepare tea with Desmodium sp. and Mimosa pudica to induce sleep in case of pain.

CLIBADIUM SURINAMENSE L. Jackass Breadnut. Said to be used as a cold remedy.

EMILIA SAGITTATA (Vahl) DC. Consumption Weed; Grease Bush. Much used in the country parts as a general beverage and for coughs and colds.

ERIGERON BONARIENSIS L. Asthma Weed. Said to be used with *Cuscuta* sp. to make tea for asthma.

ERIGERON CANADENSIS L. Canada Fleabane; Dead Weed. Said to be used as tea for babies.

EUPATORIUM ODORATUM L. Jack-in-the-Bush; Bitter Bush; Archangel; Christmas Rose; Hemp Agrimony. This is a popular plant for the preparation of a tea used as a general beverage and

in the treatment of colds. The shoots are boiled to make the tea.

EUPATORIUM TRISTE DC. Bitter Bush; Old Woman Bitter Bush; Hemp Agrimony. E. VILLOSUM Sw. Bitter Bush; Old Woman Bitter Bush; Hemp Agrimony. Reported the use of these species to make tea for constipation and fever and, boiled with *Vernonia arborescens* (L.) Sw., to bathe a woman after childbirth.

MIKANIA SPP. Guaco or Gwaco Bush. Guaco bush is used as a cold remedy and a decoction of the leaves is also used to bathe the skin for itch or the fresh leaves are merely rubbed on.

PARTHENIUM HYSTEROPHORUS L. Wild Wormwood: Dog-flea Weed; Whitehead; Mugwort; Bastard Feverfew. Country people use it to prepare a decoction for colds and to make a bath for fleas on dogs.

PECTIS SP. Stink Weed. It is used as a tea for fever.

PLUCHEA ODORATA (L.) Cass Riverside Tobacco: Wild Tobacco; Sweet-scented Fleabane. To be applied to sores and used for women in labour.

VERNONIA DIVARICATA Sw. (Old) Man Bitter Bush; Fleabane. It is used as a tea for colic.

WEDELIA TRILOBATA (L.) Hitchc. Wild or Running Marigold; Gold Cup; Creeping Ox-eye; Water Weed. Used to make tea for fever and colds.

CONVOLVULACEAE

CUSCUTA SPP. Love Weed or Bush: Dodder; Hell Weed; Devil's Guts. Tea used as a general beverage and for colic in children. It enjoyed a reputation as a diuretic and laxative and had been used in 'some of the compositions of the shops'.

IPOMOEA DISSECTA (Jacq.) Pursh. Know You. Said to be used as a cathartic. An undetermined species of Ipomoea, called hog meat, is said to be used as a poultice.

CRASSULACEAE

BRYOPHYLLUM PINNATUM Kurz. Leaf of Life. The leaves of this succulent are much used for colds.

CUCURBITACEAE

CUCURBITA PEPO L. Pumpkin. The reputation of pumpkin seeds as a vermifuge is known in Jamaica but there is little evidence of their use.

FEVILLEA CORDIFOLIA L. Antidote Cocoon; Segra Seed; Nhandiroba. The seeds are purgative. From the early days it has had the reputation in Jamaica as an antidote for poison (probably due to its emetic and purgative properties), a wound dressing and a useful bitter.

MOMORDICA CHARANTIA L. Cerasee. One of the most widely used medicinal herbs of Jamaica, the fruits of a large variety also being used especially by the Chinese in cooking. The aerial parts of the plant, either dry or fresh and free of large fruits are used to make a decoction which is very bitter, or in some cases to make an infusion. The tea is used for colds and fever (including malaria), for stomach-ache, constipation in children, and as a general tonic beverage. An infusion of cerasee alone or with *Bidens reptans* is used for menstrual troubles.

EUPHORBIACEAE

CROTON WILSONII Gr. Pepper Rod; Doctor John; ?John Charles. Beckwith states that this plant is taken as tea for colds.

EUPHORBIA HIRTA L. E. HYPERICIFOLIA L. E. HYSSOPIFOLIA L.. Spurge; Milk Weed or Tea; Mapempe; Pempe. E. LASIOCARPA Klotzsh. E. PROSTRATA A.H.K. It is possible that all these herbaceous Euphorbia species are used in a similar manner to make tea for colds and indigestion. The latex is made into a dressing for cuts.

JATROPHA CURCAS L. Physic Nut. It is used in Jamaica as a purgative.

PHYLLANTHUS NIRURI L. Carry-me-seed; Quinine Weed. This plant is commonly used throughout the West Indies and in India as a remedy for fevers. It is also sometimes used for genito-urinary infections and, in Jamaica. in combination with milk weed, it is said to be good for gonorrhoea.

RICINUS COMMUNIS L. Castor Oil Plant. Castor oil is used in the usual manner, in Jamaica. as a purge. It is also used with *Capsicum* leaves as a dressing for boils. and the leaves of the plant are tied on as a cool dressing for a headache.

FILICINEAE

DRYOPTERIS SP. White Stick. Said to be used for colds and as a general panacea.

POLYPODIUM EXIGUUM Hew. Hug-me-tight. Used in a bath for 'female weakness'.

GESNERIACEAE

GESNERIA SP. Rock Bush. Being in use to induce perspiration in fever.

RYTIDOPHYLLUM TOMENTOSUM Mart. Search-my-heart. Used as a general drink and for colds.

GRAMINEAE

CENCHRUS SPP. Burr Grass. This species appears to be used to some extent to make tea for fever, colds and vomiting.

CYMBOPOGON CITRATUS (DC.) Stapf. Fever Grass; Lemon Grass. A decoction of the leaves and roots is still a favourite treatment for colds and fevers.

CYNODON DACTYLON Pers. Bahama or Bermuda Grass; Dog's Tooth Grass. In some parts of the Island, at least, a tea made by boiling the roots is thought to be good for the kidneys. It is used in the Transvaal by Europeans for indigestion and wounds.

LABIATAE

HYPTIS PECTINATA (L.) Poit, Piaba. Used to prepare tea for stomach-ache, sometimes with H. suaveolens. The juice of the plant is used for sores and cuts. The tea is also said to be good for colds and headaches, as a drink for a woman in labour, and as an appetizer.

HYPTIS SUAVEOLENS (L.) Poit. Spikenard: Pig Nut. Being of use in nervous and visceral disorders and it seems likely that it is still in use for stomach-ache (see *H. pectinata*) and indigestion (alone or with *Cissus sicyoides*) and for 'a fluttering heart'.

MENTHA VIRIDIS L. Garden Mint: Black or Sweet mint. Tea is prepared by infusion or decoction and is used as a general beverage and for stomach trouble. It is sometimes used with gin or rum for stomach-ache and vomiting.

MICROMERIA BROWNEI (Sw.) Benth. Pennyroyal (Pennyrial).The leaves are used to make tea for stomach pains.

MICROMERIA VIMINEA (L.) Urb. Peppermint. Beckwith, identifying this species as peppermint, says that it is used with ginger to make tea for colic.

OCIMUM MICRANTHUM Willd. Wild Barsley: Mosquito Bush, Wild Basil. Used as a general beverage. For fever and pain the decoction is taken as a drink and also as a bath.

OCIMUM BASILICUM L. Barsley. This plant in addition to its use in cooking, it is employed in a similar manner to the wild species.

SALVIA SEROTINA L. Chicken Weed or Bitters: Wild Sage. Used to make tea as a general beverage for colic, biliousness. constipation, fever and for the blood'. It is also used, 'rubbed up', as an application to scratches, especially for a baby. It may also be used for skin complaints such as eczema.

LAURACEAE

CINNAMOMUM ZEYLANICUM Breyn. Cinnamon. Boiling water poured on to them makes a drink which may also be taken on corn meal porridge. It is said to be good for the stomach.

PERSEA AMERICANA Mill. Avocado or Alligator Pear. The leaves are boiled to make tea which is thought to be 'good for the blood'. This may perhaps be interpreted to mean for anaemia or of low blood pressure. The tea is also used as a drink for colds and as a lotion for pains.

LILIACEAE

ALLIUM SATIVUM L. Garlic. Garlic trash is sometimes used to make a drink which is given to both adults and children. The plant has been used medicinally from early times.

ALOE VULGARIS Lam. Aloes; Semper Vivum (Simple or Sinkle Bible). Despite, or perhaps on account of. Its unpleasant smell and bitter taste the plant is much esteemed in Jamaican peasant medicine. A small piece of the leaf is boiled to make tea for biliousness and colds.

SMILAX BALBISIANA Kth. China Root. S. ORNATA Hook. Jamaican Sarsaparilla. The roots are the parts of the plants which are used. Sarsaparilla is official and occurs in the pharmacopoeias of Britain and India. It was formerly imported from Central America via Jamaica.

LOGANIACEAE

SPIGELIA ANTHELMIA L. Pink Root; Worm Grass; Indian Pink; Pink Weed. This is used for worms, especially in small children.

LORANTHACEAE

ORYCTANTHUS OCCIDENTALIS Eichl. God Bush: Scorn-the-Earth; Mistletoe.

PHTHIRUSA PAUCIFLORA Eichl. Mistletoe; Scorn-the-Earth. From the leaves of a number of mistletoes a drink is prepared which is said to be of use for fever and pains, and for high blood pressure.

LYTHRACEAE

CUPHEA PARSONIA R. BI. Milk Weed: Strong Back. Said to be mixed with *Euphorbia* sp. to make tea and to be used with marigold for menstrual pain.

MALVACEAE

GOSSYPIUM SPP. Cotton; White Cotton Bush. A number of Gossypsium species occur in Jamaica and it is probable that all are similarly employed. The leaves are used to make a decoction for colds.

HIBISCUS SABDARIFFA L. (Red, French or Indian) Sorrel: African Mallow. Sorrel is used in Jamaica to make a drink which is reputed to be cooling and diuretic. It is a sweetened decoction of the fleshy calyces and the ovary without the seeds and may be flavoured with ginger and wine or rum added.

MALVASTRUM COROMANDELIANUM Garcke. Mallow: ?Broomweed. Reported its use for pains in the stomach.

MELASTOMACEAE

CLIDEMIA HIRTA D. Don. Indian Currant Bush: Soap Bush. Said to be used to make tea.

MICONIA LAEVIGATA DC. Chicken Net: Indian Currant Bush; Johnny Berry. Use of this for sores and itch and in bush baths.

MELIACEAE

SWIETENIA MAHOGONI Jacq. Mahogany. The bark is said to be astringent and has been used in decoctions for diarrhoea. as a bitter and febrifuge. For colds and fevers, a leaf decoction was used as tea and as a bath.

MENISPERMACEAE

CISSAMPELOS PAREIRA L. Velvet Leaf or Bush; False Pareira-brava. The shoots are used in Jamaica principally to make tea for colds.

MIMOSOIDEAE

MIMOSA PUDICA L. Shame Weed; Shut Weed; Shama; Shama Lady (many variations); Dead and Awake; Sensitive Plant. The root. particularly in combination with plants such as *Desmodium* sp. and *Achyranthes indica* is used to make tea for colds.

MORACEAE

ARTOCARPUS INCISA L. Breadfruit. The belief in the efficacy of a tea made from breadfruit leaves in cases of high blood pressure is widespread in Jamaica.

CECROPIA PELTATA L. Trumpet Tree: Snake Wood. A decoction of the leaves is used for colds and is said to be a sovereign remedy for a sore throat and hoarseness.

MYRISTICACEAE

MYRISTICA FRAGRANS Houtt. Nutmeg. It is official in the pharmacopoeias. Powdered nutmeg is given to women in labour.

MYRTACEAE

PIMENTA DIOICA L. (MERR.). Pimento, Allspice. This species produces the well-known spice, which is used in Jamaica in the preparation of the liqueur pimento dram. This has some reputation for the relief of stomach-ache and painful menstruation.

OCHNACEAE

SAUVAGESIA BROWNEI Planch. Strong Back: Iron Shrub. This species, which is mucilaginous, was at one time used in the West Indies in cases of irritation of the bladder. In Jamaica, it is used for a weak back, a little tea being taken daily.

PALMAE

COCOS NUCIFERA L. Coconut. Coconut water, a favourite drink of Jamaicans, is said to be good for tbe bladder.

PAPAVERACEAE

ARGEMONE MEXICANA L. Mexican Poppy or Thistle: Prickly Poppy; Gamboge or Yellow Thistle. This plant is used for colds, especially in children. The seeds, in a dose of one to five, were used

by the country people for diarrhoea and dysentery. It is reputed that in the island of Nevis 'the oil obtained from the seeds is used as a substitute for castor oil'.

PAPILIONATEAE

ABRUS PRECATORIUS L. Red Bead Vine: John Crow Beads; Crab's Eyes; Wild Liquorice; iquorice Vine; Lick Weed. The root has long been used in India, Africa and the West Indies as a substitute for true liquorice. In Jamaica the plant is said to be used for constipation.

CAJANUS CAJAN Millsp. Gungo (Congo) Pea: Pigeon or No-eye Pea. The seeds are a favourite food in Jamaica while the leaves are sometimes used to make tea for colds.

STYLOSANTHES HAMATA Taub. Donkey Weed: Pencil Flower: Lady's Fingers; Cheesy Toes. S. VISCOSA Sw. Poor Man's Friend. It is possible that these species are not distinguished by those using them medicinally. It is used In Jamaica for kidney trouble.

PASSIFLORACEAE

PASSIFLORA FOETIDA L. Love-in-a-Mist: Granadilla. The dry plant is used in some parts to make tea which is said to be 'good for the kidneys'

PASSIFLORA SEXFLORA Juss. Duppy Pumpkin: Bat Wing; Goat or Duck Foot; Passion Flower. This plant is used for colds, either alone or with *Cissampelos pareiras* and as a plaster for sores, a lame foot or a stiff neck.

PHYTOLACCACEAE

PETIVERIA ALLICAEA L. Guinea Hen Weed: Strong Man's Weed. This plant has a strong smell of garlic and the meat and milk of cattle feeding on it acquire a very disagreeable smell and taste. The plant contains mustard oil. The leaves are rubbed up and sniffed or tied on the head for headaches.

PIPERACEAE

PEPEROMIA PELLUCIDA Kunth. Pepper Elder (Pepper Helda); Rat Ears; Ratta Temper; Silver Bush; Shinv Bush. This plant is used as a tea for a loose cough.

PIPER AMALGO L. Joint Wood: Pepper Elder. The young stem and leaves of this species provide a decoction for flatulence and serve as a tonic for the blood. The root is sudorific, diaphoretic and good for dropsy, and that the leaves and shoots were used in baths and fomentations. The fruits provide an alternative to commercial pepper.

PIPER NIGRINODUM C.DC. Jointer Bush: Black Joint (Giant); Black Jointer. For fever and colds the twigs are boiled, the resulting decoction being used as a tea and for a bath. The bath is also taken for pains and the tea, with ginger added, is used for stomach-ache and as a general beverage.

PIPER UMBELLATUM L. Cow or Colt's Foot. For colds this plant is made into a tea, either alone or with other cold bushes.

PLANTAGINACEAE

PLANTAGO MAJOR L. English Plantain. The juice of the baked leaf or a decoction is used as an eye lotion.

RHAMNACEAE

GOUANIA LUPULOIDES Urb. Chew or Chaw Stick. Chew Stick is still in use as a toothbrush and as flavouring for ginger beer.

RUBIACEAE

BORRERIA LAEVIS (Lam.) Griseb. Button Weed or Bush. B. VERTICILLATA (1.) Meyer. Button Weed or Bush. Said to be used to make tea for constipation.

MORINDA ROYOC L. Red Gal: Yaw Weed; Duppy Poison; Yellow Ginger; Strong Back. In some districts the root is used with sarsaparilla and china root to make a tonic which is supposed to be good for the blood.

RUTACEAE

CITRUS AURANTIFOLIA Swingle. Lime. Considerable use is made of the lime in Jamaican household medicine. As a beverage, and for colds, tea is made by boiling a few lime leaves in a little water.

CITRUS AURANTIUM L. Sweet Orange. C. VULGARIS Risso. Seville, Biller, Sour or Biqarade Orange. A decoction of orange leaves or peel is used for stomach-ache and as a bitter tonic. The juice of sour oranges is used for colds and sore throat.

SAPINDACEAE

BLIGHIA SAPIDA Koenig. Akee. In some parts of Jamaica akee leaves are boiled to make a 'rub' for pains. It is also said that in Jamaica tea made with the leaves is used for colds.

SIMARUBACEAE

PICRAENA EXCELSA Lindl. Jamaica Quassia: Bitter Wood; Bitter Ash. The wood provides the Jamaican Quassia of commerce.

PICRAMNIA ANTIDESMA Sw. Maioe Bitters: Macary or Old Woman's Bitter; Tom Bontrin's Bush; Bitter Wood; Honduras Bark; Cascara Amarga. This plant is still in use in Jamaica for the preparation of home remedies. It is said to make a good tea for a teething baby.

SOLANACEAE

CAPSICUM SPP. including C. FRUTESCENS L. Bird Pepper. Capsicum fruits are much used as condiments in the tropics. In Jamaica the leaves are commonly used with vaseline or castor oil as a dressing for boils while one leaf boiled in a little water is thought to increase urine in babies.

DATURA STRAMONIUM L. Thorn Apple; Trimona; Jimson or Jamestown Weed; Devils' Trumpets. This well-known drug plant is used to some extent in Jamaica for asthma and sinus infections.

SOLANUM ACULEATISSIMUM Jacq. Cockroach Poison. In some parts of Jamaica the plant is pounded with lime juice and used for ringworm, the treatment appearing to be successful.

SOLANUM MAMMOSUM L. Sou8umba; Mackaw Bush; Turkey Berry. S. TORVUM Sw. Sousumba; Turkey Berry. Under the name of sousumba tr.e berries of both species provide a vegetable eaten with salt fish. It seems probable that the leaves of both are collected indiscriminately and made into a tea which is used chiefly as a cold remedy.

SOLANUM NIGRUM L. Branched Calalu; Guma; Black Nightshade.This plant has long been in use in Jamaica as a green vegetable and potherb. It is said to be good for the blood and as an aperient. In Africa and Jamaica the leaves have, or have had, a reputation as a local anodyne for inflammation. The plant is also employed for treatment of fevers of various kinds.

STERCULIACEAE

COLA ACUMINATA Schott and Endl. Cola (Kola); Bissy (Bichy, Busy) Nut. Cola nuts are used in Jamaica for stomach pains and as a purge when poison is suspected. The nuts are grated and boiled like coffee or taken with strong rum. A little cola is sometimes added to country chocolate and it is considered to allay hunger.

HELICTERES JAMAICENSIS Jacq. Corkscrew; Screw Tree. With the wood and leaves, which are bitter, a tea is made for biliousness.

MELOCHIA TOMENTOSA L. Tea Bush; Raichie. Used to make tea for colds.

WALTHERIA AMERICANA L. Raichie. This plant provides a tea for colds.

TILIACEAE

CORCHORUS SILIQUOSUS L. Broom Weed: Slippery Bur. For colds and asthma a tea made by boiling with *Piper umbellatum* is sweetened with sugar.

TRIUMFETTA SPP. Bur Weed or Bush. Use of the fresh scraped root with or without camphor to check bleeding and to heal cuts.

TURNERACEAE

TURNERA ULMIFOLIA L. Ram-goat Dash Along, Ram-goat National, Ram-goat Rational, National Ram-goat; Holly or Sage Rose. The leaves of this species, boiled to make tea, are a favourite beverage and cold remedy in all parts of Jamaica where the plant can be found.

UMBELLIFERAE

ERYNGIUM FOETIDUM L. Fit Weed or Bush; Spirit Weed. A decoction of the plant is used for colds and fits in children. The plant is also rubbed on the body for fainting fits and convulsions.

URTICACEAE

PILEA MICROPHYLLA Liebm. Wild Thyme (Tim); Baby Puzzle; Lace Plant; Artillery Plant. In Jamaica this plant is said to provide relief in cases of asthma.

VERBENACEAE

LANTANA CAMARA L. Wild Sage: White Sage. L. CROCEA Jacq. Wild Sage: Black Sage. L. INVOLUCRATA L. Wild Sage; Wild Mint. L. TRIFOLIA L. Wild Sage: Goat Weed. It is highly

probable that leaves of the above species of Lantana, together with others, are used indiscriminately to make a tea as a cold and fever remedy.

LIPPIA ALBA (Mill.) N.E.Br. ex Britton & P.Wilson (sin. LIPPIA GEMINATA Kth. Colic Mint: Guinea Mint; ?Cat Mint; Cullen Mint.). The leaves are used either dry or fresh. They are commonly made into a tea to provide a drink which is also considered valuable for indigestion and flatulence.

PRIVA LAPPULACEA L. Clammy Bur; Rattle Weed; Styptic Bur; Velvet Bur. Said, by Beckwith, to be used alone or with liquorice to make tea for colds.

STACHYTARPHETA JAMAICENSIS Vahl. Vervain (Vervine, Verryvine). A morning drink either alone or with castor oil provides a remedy for colds, 'cleaning the system', and for dysmenorrhoea.

VITACEAE

CISSUS SICYOIDES L. Pudding Wys (Withe); Snake Withe (Wys) or Bush; Wild Yarn; Mary Bush; Yaws Bush; Bastard Bryony; Scratch Wys. The leaves, chopped and mixed with fat or 'quailed' and rubbed with castor oil, provide a plaster for boils and bruises. For colds a decoction is taken and the leaves may be used as snuff to relieve a headache. As a tonic the stern is boiled with sarsaparilla, *Morinda royoc*, china root and *Desmodium supinum*.

ZINGIBERACEAE

ZINGIBER OFFICINALE Rosc. Ginger. The rhizome ('root') of this species is the ginger of commerce now used mainly as a spice but formerly much used in medicine. Ginger is used in Jamaica, alone or with *Momordica charantia*, as a carminative and digestive stimulant.

ZYGOPHYLLACEAE

GUAIACUM OFFICINALE L. Lignum Vitae: Pockwood Tree. The wood and resin (gum guaiacum) were at one time officially included in the pharmacopoeias. Gum guaiacum is a hard resin which, in Jamaica, is soaked in rum and used as a gargle for sore throat, as a drink for 'bellyache' and as an application to cuts and bruises.

TRIBULUS CISTOIDES L. Jamaica or Kingston Buttercup; Police Macca; Turkey Blossom; Kill Buckra. In Jamaica this plant is used for colds and malaria, and also apparently for kidney and bladder infections.

Source: Medicinal plants of Jamaica [10]. Underlined: plant with important use.

4.3.2._Plants sold in the market

The most sold medicinal plants in local markets are:

- DIANTHERA PECTORALIS Murr. Fresh Cut; Garden Balsam. In Trinidad this plant is called garden balsam and is sold in the markets as a cold remedy.
- CINNAMOMUM ZEYLANICUM Breyn. Cinnamon. Cinnamon twigs and leaves are sold in Jamaican markets.
- CANELLA WINTERANA Gaertin. (= G. alba Sw.) Wild Cinnamon: White Cinnamon; Whitewood Bark; Canella; False Winter's Bark. The bark of *Canella winterana* is commonly sold in the markets of Jamaica and, soaked in rum.
- MYRISTICA FRAGRANS Houtt. Nutmeg. This plant produces the nutmeg and mace of commerce.
- PIMENTA DIOICA L. (MERR.). Pimento: Allspice. This species produces the well-known spice
- PICRAENA EXCELSA Lindl. Jamaica Quassia: Bitter Wood; Bitter Ash. The wood provides the Jamaican Quassia of commerce.

For the international market, Jamaica is exporting *Smilax* sp. to United States of America, and has been the first producer and exporter of *Zingiber officinale* for long time, growing as an understory plant in the forest [17].

According to a FAO report on plant genetic resources for agriculture [24], the major Plant Genetic Resources for Food and Agriculture (PGRFA), being also the major export crops, include sugar, banana, coffee, cocoa, citrus, coconut and **pimento** (*Pimenta dioica*).

Pimento (*Pimenta dioica*): This crop is important for domestic consumption and as an important foreign exchange earner. Several value-added products are also sold internationally. Total exports for whole pimento, pimento leaf and berry oils, liquors, jerk seasoning etc earned US $ 5 million in 2006. According to Jamaica Export Association, in 2006, Jamaica exported 264.560 kg of Pimento (allspice), dried, crushed or ground, with FOB Value of 1.410.484 US $.

Minor PGRFA include native plants used mainly to supply the domestic market, among these some aromatic and medicinal plants could be highlighted: hot pepper (*Capsicum* sp.), hemp, pimento. And also some fruits and vegetables having medicinal uses: guava (*Psidium guajava*), custard apple (*Annona reticulata*), sweetsop (*Annona squamosa*), coconut (*Cocos nucifera*).

Non-food biodiversity includes many medicinal plants such as ramoon (*Trophis racemosa*), sarsaparilla (*Smilax* sp.) and chainy (chaney, china) root (*Smilax balbisiana*).

Imported PGRFA also make up part of the domestic market: ginger (*Zingiber officinale*), ackee (*Bligbia sapida*), breadfruit (*Artocarpus incisa*), cinnamon (*Cinnamomum zeylanicum*), nutmeg (*Myristica fragrans*), turmeric (*Curcuma longa*), etc.

Non-traditional exports include herbs, spices (including ginger and turmeric), fruits, vegetables and horticultural crops.

Both native and imported minor PGRFA make up the non-traditional export market (eg. ackee, hot pepper, ginger, turmeric, pimento). These are exported as fresh produce and value-added products.

There is an increasing awareness of the importance of PGRFA in the country over the last ten years. Many value-added food, nutraceutical and medicinal products and an increasing number of agro-processors have developed in this period using local PGRFA and this needs to be supported and encouraged.

5._Existing organisations

4.1._Brazil

APL - Arranjos Produtivos Locais. APL Horticultural Alagoas. APL Fitoterápicos.

UFAL - Universidade Federal de Alagoas.

ANVISA - Agência Nacional de Vigilância Sanitária

Centro Pluridisciplinar de Pesquisas Químicas, Biológicas e Agrícolas (CPQBA) - UNICAMP

UNICAMP - University of Campinas.

UNIARARAS - Instituição atuante na produção, preservação e transmissão de conhecimentos

3.2._Costa Rica

INBio – Instituto Nacional de Biodiversidad.

MIRENEM - Ministry of Natural Resources, Energy and Mines. Authorisation of bioprospection permits.

5.3._Jamaica

BTC - The Biotechnology Centre, UWI. Medicinal Plant Research Group - This research group manages a medicinal plant gene bank at the Centre and a medicinal tree grove at the Hope Botanical Gardens (over 100 species). The MPRG also manages an active in vitro medicinal plant collection and is involved with DNA fingerprinting and natural product development. Production and dissemination of Jamaican medicinal plant monographs.

CASE- College of Agriculture and Science Education

FD - Forestry Department (statutory body)

LFMC - Local Forest Management Committee (affiliated with the FD)

MOA- Ministry of Agriculture.

NCU- Northern Caribbean University

SRC- Scientific Research Institute

UWI- University of the West Indies

Apart from these institutions, some areas that need increased institutional capacity are the [24]:

- Masters programs and certified courses developed around a theme such as food and agriculture genetic resources, medicinal plants, ethnobotany, tourism, water, waste, biodiversity management, policy and planning on a needs basis.
- There is a need to encourage the production of biodiversity-related and food-crop educational training material especially for the primary schools such as Readers on different topics such as Food Crops of Jamaica, Uses made on Jamaican biodiversity, Jamaican wildlife, Medicinal Plants of Jamaica, etc. with lots of pictures and simple words.

6._SWOT analyses

Comparative between countries

Table 9. Demographic features of each country in 2012

Country	Area	Population	Population density (people/m^2)	Population below 15 years of age	Rural population	HDI
Brazil	8.516.000 km^2	191.765.567	23	26,4%	16,3%	85
Alagoas	*27.765 km^2*	*3.057.000 (2007)*			*35 % (2007)*	*Worst in the country*
Costa Rica	51.032 km^2	4.800.000	89	26,0%	36,8%	62
Jamaica	10.991 km^2	2.687.200	248	30,0%	48%	85

HDI: Human development index (ranking out of 186)

Table 10. Share of Gross domestic product (GDP) of each country in 2008

Country	Agriculture	Industry	Manufacturing	Services	Total US$
Brazil	5,9%	27,9%	16,6%	66,2%	1.641.164
Alagoas	*7,3%*	*36,9%*		*55,8% (Beach tourism)*	*0,7% of Brazil economy*
Costa Rica	7,2%	28,7%	20,3%	64,1%	32.104
Jamaica	5,6%	22,6%	9,2%	71,7%	12.985

Table 11. Main agricultural products

	Main crops	Exported products
Brazil	Soya, Sugar cane	Soya beans, raw sugar, cane
Alagoas	*Sugar cane, Tobacco, Cotton, Eucalyptus*	*Sugar, alcohol, tobacco*
Costa Rica	Banana, Coffee, Sugar cane	Bananas, coffee, sugar, beef
Jamaica	Sugar cane, bananas, Coffee, Pimento* Citrus, Cocoa	Sugar, rhum, bananas, coffee, pimento* citrus, cocoa

*Allspice (*Pimenta officinalis*)

Table 12. Exports of medicinal and aromatic products

	09 Coffee, tea, mate and spices	1211 Plants and parts of plants, incl. seeds and fruits, of a kind used primarily in perfumery, medicaments or for insecticidal, fungicidal or similar purposes
Brazil	6.046.077 US$ Net exporter Loser in growing sector	11.739 US$ Net importer
Piper and Capsicum	349.875 US$	
Ilex paraguarensis	101.580 US$	
Costa Rica	313.924 US$ Net exporter Loser in growing sector	2.377 US$ Net exporter
Piper and Capsicum	1.593 US$	
Jamaica	22.977 US$ Net exporter Winner in growing sector	663 US$ Net exporter
Piper and Capsicum	2.784 US$	

Table 13. Most important medicinal and aromatic species in each country

Country	Present in the wild	Wild collected	Cultivated	Used	Marketed
Brazil			*Achillea millefolium* *Cymbopogon citratus* *Foeniculum vulgare* *Matricaria chamomilla* *Melissa officinalis* *Plantago major* *Rosmarinus officinalis* *Ruta graveolens* *Taraxacum officinale* *Thymus vulgaris*		***Aniba roseadora*** *Bauhinia fortificata* *Calendula officinalis* ***Citrus sp.*** *Cordia verbenacea* ***Coriandrum sativum*** ***Cymbopogon citratus*** *Equisetum hyemale* ***Eucalyptus globulus*** *Geranium sp.* *Jasminum sp.* *Lavandula sp.* *Matricaria chamomilla* ***Mentha spicata*** ***Mentha x piperita*** ***Pilocarpus sp.*** *Pimpinella anisum* ***Ruta graveolens*** *Stevia rebaudiana* *Vetiveria zizanioides*
Alagoas	*Artemisia vulgaris* *Bidens pillosa* *Bixa orellana* *Cymbopogon citratus* *Datura stramonium* *Desmodium ascendens* *Eryngium foetidum* *Lippia alba* *Mentha pulegium* *Mentha spicata* *Passiflora alata* *Psidium guajava* *Schinus terebinthifolius* *Senna alata* *Smilax syphilitica* *Tanacetum vulgare* *Turnera diffusa* *Urtica dioica* *Vanilla planifolia* *Vitex agnus-castus*	*Abmurana cearensis* *Anacardium occidentale* *Anemopaegma arvense* *Davilla rugosa* *Hyptis lutescens* *Lychnophora ericoides* *Norantea adamantium* *Pilocarpus jaborandi* *Remijia ferruginea* *Sideroxylon obtusifolium*	*Catharantus roseus* *Melia azedarach* *Ricinus communis* *Sambucus nigra*	*Allium sativum* *Aloe vera* *Alpinia speciosa* *Beta sp.* *Cinnamomum zeylanicum* *Citrus limon* *Citrus sinensis* *Cymbopogon citratus* *Eucalyptus globulus* *Eugenia uniflora* *Foeniculum vulgare* *Hyptis pectinata* *Justicia pectoralis* *Lepidium sp.* *Lippia sidoides* *Matricaria chamomilla* *Melissa officinalis* *Mentha sp.* *Narturtium officinale* *Ocimum gratissimum* *Peumus boldus* *Phyllanthus nururi* *Pimpinella anisum* *Psidium guajava* *Sambucus australis* *Schinus terebinthifolius* *Solanum paniculatum* *Stryphnodendron barbatiman* *Zingiber officinale*	

Country	Present in the wild	Wild collected	Cultivated	Used	Marketed
Costa Rica		*Buddleia americana* *Cecropia obtusifolia* *Cephaelis ipecacuanha* *Costus spicatus* *Cymbopogon citratus* *Equisetum bogotense* *Eryngium foetidum* *Jathropa gossypiifolia* *Justicia pectoralis* *Lippia alba* *Lippia graveolens* *Momordica charantia* *Neurolaena lobata* *Passiflora quadrangularis* *Plantago major* *Psidium guajava* *Quassia amara* *Senna reticulata* *Smilax sp.* *Tradescantia zebrina* *Uncaria tomentosa* *Urera baccifera*	*Aloe vera* *Carica papaya* *Citrus aurantium* *Coriandrum sativum* *Cupressus lusitanicus* *Cymbopogon citratus* *Eryngium foetidum* *Hibiscus sabdariffa* *Lippia alba* *Lippia graveolens* *Matricaria chamomilla* *Mentha spicata* *Ocimum basilicum* *Pimenta guatemalensis* *Psycotria ipecacuanha* *Quassia amara* *Rosmarinus officinalis* *Senna reticulata* *Tradescantia zebrina* *Zingiber officinale*	*Aloe vera* *Bauhinia guianensis* *Buddleia americana* *Carica papaya* *Cecropia obtusifolia* *Citrus aurantium* *Costus spicatus* *Cupressus lusitanica* *Cymbopogon citratus* *Equisetum bogotense* *Eryngium foetidum* *Hymenaea courbaril* *Jathropa gossypiifolia* *Justicia pectoralis* *Lippia alba* *Lippia graveolens* *Matricaria chamomilla* *Mentha spicata* *Mentha x piperita* *Momordica charantia* *Neurolaena lobata* *Ocimum basilicum* *Passiflora quadrangularis* *Plantago major* *Polypodium aureum* *Psidium guajava* *Quassia amara* *Rosmarinus officinalis* *Ruta graveolens* *Senna reticulata* *Taraxacum officinale* *Tradescantia zebrina* *Triumfetta semitriloba* *Uncaria tomentosa* *Urera baccifera* *Zea mays* *Zingiber officinale*	***Aloe vera*** *Bursera simaruba* *Caesalpinia pulcherrima* ***Cephaelis ipecacuanha*** ***Cinchona sp.*** *Cupressus lusitanica* *Equisetum bogotense* *Leonurus sibiricus* ***Lippia graveolens*** ***Ocotea veraguensis*** *Passiflora biflora* ***Passiflora edulis*** ***Phlebodium aureum*** ***Quassia amara*** *Quercus sp.* *Senna reticulata* ***Smilax dominguensis*** ***Smilax sp.*** *Taraxacum officinale*

Country	Present in the wild	Wild collected	Cultivated	Used	Marketed
Jamaica		*Smilax sp.* *Smilax balbisiana* *Blighia sapida* *Pimento dioica* *Myristica fragrans* *Cola acuminata* *Morinda citrifolia*	*Aloe vulgaris* *Aralia guilfoylei* *Artemisia sp.* *Azadirachta indica* *Blighia sapida* *Cassia obovata* *Cinnamomum obovata* *Cinnamomum zeylanicum* *Coleus aromaticus* *Curcurma longa* *Cymbopogon citratus* *Mentha spicata* *Myristica fragrans* *Ocimum basilicum* *Pimenta dioica* *Zingiber officinale*	*Allium sativum* *Anacardium occidentale* *Annona muricata, A. reticulata, A. squamosa* *Artocarpus incisa* *Cajanus cajan* *Capsicum sp.* *Cassia obovata* *Cenchrus sp.* *Chenopodium ambrosioides* *Cinnamomum zeylanicum* *Cocos nucifera* *Cola acuminata* *Cymbopogon citratus* *Datura stramonium* *Emilia sagittata* *Eryngium foetidum* *Eupatorium odoratum* *Guaiacum officianale* *Hibiscus sabdariffa* *Justicia pectoralis* *Lippia alba* *Mangifera indica* *Mentha viridis* *Myristica fragrans* *Ocimum basilicum* *Ocimum micranthum* *Persea americana* *Petiveria allicaea* *Picraena excelsa* *Piper amalgo* *Plantago major* *Solanum nigrum* *Tamarindus indica* *Triumfetta sp.* *Turnera ulmifolia* *Vinca rosea* *Zingiber officinale*	*Aloe vulgaris* *Annona reticulata* *Annona squamosa* ***Blighia sapida*** *Canella winteriana* *Cannabis sativa* *Capsicum sp.* *Cinnamomum zeylanicum* *Curcuma longa* *Cymbopogon citratus* *Justicia pectoralis* *Myristica fragrans* ***Pimenta dioica*** *Pricraena excelsa* *Psidium guajava* ***Smilax balbisiana*** ***Smilax sp.*** ***Zingiber officinale***

6.1._SWOT analysis Brazil

BRAZIL	Strengths	Weaknesses	Opportunities	Threats
Economy	Important Beach tourism in Alagoas The Plano Agricola e Pecuário have encouraged the environmentally sustainable practices Large economy Few aids dependency	Poverty and economic inequalities Poor people have low chance of investments	National Tourism Plan aims at developing high-quality tourist products taking into account natural diversity. Estratégia brasileira de exportaçao envisaged the increase of exports.	Lack of economy diversification and dependence on commodity-based exports Risk of inflation
Wild collection of MAPs	18% of the world's plant biodiversity Natural resources availability*	**Industries demand high quality and supply regularity:** Lack of organisation of the collection activity*: low bargaining power Inadequate collection management* Difficult access to information* Low quality of collected plants Lack of management of drying and storage: low technological level	Increasing demand* Certification* Greater number of species, higher potencial of new drugs	Species sustainability threat* Environmental legislation versus survival need* Decrease of the activity due to health and environmental legistlation Presence of intermediation network*
Cultivation of MAPs	Potential activity for family farms* Rich knowledge about management of medicinal plants **Industries demand high quality and supply regularity:** Cultivation provides a steady supply of homogeneous raw material (same standard of quality) **Project APL-Fitoterápicos in**	Inadequate cultivation techniques* Investment needs* Lack of technical information* Lack of technical guidance for producers	Increasing consumption of herbal medicines: Increasing demand of medicinal plants* Business opportunity for small producers ANVISA requirements (origin warranty)* Organic cultivation* **National Program of Medicinal plants and Herbal Medicines:** Promotion of the management, cultivation,	Lack of scientific studies on species domestication* Presence of intermediation network*

BRAZIL	Strengths	Weaknesses	Opportunities	Threats
	Alagoas state: Empower existing member in APL Horticultural Alagoas for organic production of medicinal plants Structure to organize the activity Garden producing seedlings Development of quality control protocols for monitoring cultivated plants		production and marketing of medicinal plants	
Traditional uses of MAPs	Rich knowledge on uses of medicinal plants: mix of African, European and Indigenous cultures		Need for investment in reseach validation of local medicinal plants	Native plants and derived products have been progressively excluded from official medicine Replacement of native plants by industrialized medicinal and other imported plants
Trade of MAPs	Net exporter of spices	Net importer of medicinal plants The vast majority of sold medicinal plants comes from wild collection Quality problems found in raw material in bulk selling High presence of intermediaries Low prices paid to collectors	The industry has developed marketing mechanisms to guarantee quantity, regularity and quality: formal contracts and vertical integration This guarantee crates incentives for producers to invest in their businesses Direct selling to retailers represent higher margins to producers	

*Features indicated in the SWOT analysis for Familiar farms producing medicinal plants [28]

6.2._SWOT analysis of Costa Rica

COSTA RICA	Strengths	Weaknesses	Opportunities	Threats
Economy	Most politically stable country in Latin Ameria Economic growth and high commodity prices Importance of pharmaceuticals and ecotourism services Educated workforce Few aids dependency	Negative balance of international trade	Enhancement of high-tech manufacturing and services	Abandon of primary focus on agricultural production Agricultural strategies more focused to biofuels
Wild collection of MAPs	4% of the world's plant biodiversity Existing programms on bioprospection		Exploration of commecial potential of biological resources	The State has the exclusive right to grant permits for collection in 25% of territory (protected)
Cultivation of MAPs	Great knowledge of traditional medicinal plants cultivation in the gardens Existence of small producers producing herbal teas Breeding process of *Psycotria ipecacuanha* Management plan for *Quassia amara* Some investigation on the development of different medicinal plants	Very few farms have tried to grow large quantities of medicinal plants Lack of funds and lack of Government interest for industrial medicinal plants cultivation	Potential for growing medicinal plants for the pharmaceutical business Interest in domestication *Smilax* sp.	Public health politics have not legislated in favor of alternative production of pharmaceuticals Agricultural politics have not considered the support of medicinal plants as an alternative of development
Traditional uses of MAPs	Strong culture for the use of medicinal plants: Indigenous, African, Causasian Stronger influence of Indigenous use Over 300-500 different medicinal plants used by local population Existence of the			Over the last 20 years most of traditional use have disappeared Despite the general native speices dominance, the 3 top ranking plants used in herbal products are European (camomile, mint, rosemary)

COSTA RICA	Strengths	Weaknesses	Opportunities	Threats
	Herbario Nacional de Costa Rica			
Trade of MAPs	Net exporter of spices and medicinal plants The industry is producing both for local consumption anf for export	Medicinal plants are sold in local markets, not in shops 82% of medicinal plants are locally produced (wild and cultivation)	Herbal teas industry is using high volumes of raw material International trade prefer plants coming from cultivation	53% of traded plants are native ones (35% of volume came from the wild)

6.3._SWOT analysis of Jamaica

JAMAICA	Strengths	Weaknesses	Opportunities	Threats
Economy	High importance of agriculture Few aids dependency	Recession Agri-processing sector: narrow production base and underdeveloped quality management Agriculture mainly devoted for food subsistence Small-scale farmers (78% of farming community) Fragmented production and supply base Lack of long-term partnership amongst all the agricultural value chain players No transparent market Inefficient marketing	Recovering the demand of its commodities **Agricultural export strategy:** Increase raw material supply from small-scale farmers Provide access to low-cost funding Improve agro-processing competitiveness Enhancement of agronomic support to farmers Market driven production Research and product development Import substitution and development of domestic market	High levels of public debts Lack of competitiviness in the domestic and international market Hard negative balance of international trade
Wild collection of MAPs	Wild species of flora make a significant contribution to Jamaica's economy			Overexploitation of several endemic plants (eg. *Smilax balbisiana*) People do not know how to do non-destructive collection and therefore do not practice replanting

JAMAICA	Strengths	Weaknesses	Opportunities	Threats
				Threat of natural habitats urbanization
Cultivation of MAPs	The herbal sector was consolidated in 2002, widening the viable crops Spices and medicinal plants are considered priorities for future inventories Active tissue culture collection of medicinal plants (Biotechnology Centre) National genebank and nursery for Pimento: selection of high yielding cultivars Increase of Pimento surface due to Government support	Domestic crop production has decreased	Trend towards R&D activities for medicinal plants, revitalisation of *ex situ* and *in vitro* gene banks **Sector plan for agriculture:** Germplasm development and improvement Agronomy and production systems Plant and animal health Value added product development	Increase of farming inputs and decrease of outputs prices
Traditional uses of MAPs	The use of local plants for medicinal remedies is a very prevalent practice in Jamaica (poor people)			
Trade of MAPs	Net importer of spices and medicinal plants Agricultural export strategy for herbs and spices: Peper mash and souces, Ackeee (*Blighia sapida*) based products Sector plan for Agriculture: herbs, spices and medicinal plants More value-added food, nutraceutical and medicinal products Increasing number of		Export potential for condiments and seasonings (peppers) Non-traditional exports include herbs and spices Increasing awareness of the importance of plant genetic resources for agriculture	

JAMAICA	Strengths	Weaknesses	Opportunities	Threats
	agro-processors using local genetic resources			

7. CONCLUSIONS

The 3 countries share common feature:

- ✓ They have common species (eg. *Cymbopogon citratus, Eryngium foetidum, Smilax sp., Mentha sp. , Justicia pectoralis, Lippia alba, Zingiber officinale*, etc.).
- ✓ Most of the species still come from the wild.
- ✓ The most demanded species are being studies for initiating programmes of domestication.
- ✓ The quality of the raw material is still very low, due to lack of training of producers and lack of marketing structures among producers.
- ✓ The majority of the producers are small farmers.

And different ones:

- ✓ Jamaica has an agricultural plan for enhancing exports of herbs and spices.
- ✓ Brasil has an agricultural plan for promoting local medicinal plants: local cultivation for improve health of local populations.
- ✓ Costa Rica is addressing to the valorization of local flora for pharmaceuticals and also to enhance ecotourism. Producers are focusing to elaborated products.

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