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GREEN GROWTH AND SOCIAL INCLUSION: POSSIBILITIES AND CHALLENGES FOR THE BRAZILIAN ECONOMY

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Green growth and social inclusion: possibilities and challenges for the brazilian economy[1]

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Abstract

The objective of this study is to analyze the main arguments in favor of a transition towards a green economy in Brazil, emphasizing the potential benefits at the three required levels: economic, social and environmental. The main point is to present the green economy as a possible path for economic development where social inclusion and environmental conservation act as engines (rather than obstacles) for higher levels of activity and welfare. This paper is divided in five sections. The first section introduces main aspects of the study. Second, we carry out the review of the literature and indicators on the Brazilian experience are selected. Third section is dedicated to the elaboration of an input-output model estimating the employment and wages effects of the expansion of selected sectors. Fourth section analyses selected sections in terms of green growth while the fifth last section poses some final remarks.

[1] A brief version of this paper was published in the book "Los desafios del crecimiento sustentable com inclusión em América Latina", Ed. Teseo,Argentina

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Introduction

The objective of this study is to analyze the main arguments in favor of a transition towards a green economy in Brazil, emphasizing the potential benefits at the three required levels: economic, social and environmental. The main point is to present the green economy as a possible path for economic development where social inclusion and environmental conservation act as engines (rather than obstacles) for higher levels of activity and welfare. However, this green economy path is a possibility that has to be induced by specific public and private policies, rather than a "natural" or "spontaneous" trend that would emerge from development process, as argued by those who present the concept of an "Environmental Kuznets" Curve.[3]

Three main ideas appear as the basis for the proposition of a transition towards a green economy model:

- The proper consideration of the environmental aspects in the decision making ("internalization of externalities") contributes positively to the level of economic activity, since many sectors are directly or indirectly benefitted by this;
- Social inclusion is also improved in a Green economy model because the poor (and other socially fragile groups) tend to be more affected by changes in the provision of ecosystem services; and
- The economic costs of the transition increases over time, since the accumulation of negative externalities brings problems that become more and more expensive to be dealt in the future. Therefore, the sooner the better in terms of the economic costs for the transition from the "Business as Usual" scenario towards a sustainable development.

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[3] The Environmental Kuznets Curve is a proposition that there is an inverted U-shape relation between environmental degradation and income per capita, so that, eventually, growth reduces the environmental impact of economic activity (Stern 2004). Since there would be a hypothetical point where environmental quality increases with economic development, there is an implicit idea that, in the limit, improvement of environmental conditions would become a "natural" consequence of modern economic growth. Moreover, it implies that some environmental degradation are a "necessary cost" to pay for future development. Nevertheless, there is a fierce debate about the empirical and theoretical foundations of the EKC hypothesis, since there are no unequivocal evidence about its existence: many authors strongly oppose the EKC hypothesis because of the weakness of the arguments used for those who favor it (for example, see Atkinson et al. 1997, Munasinghe et al. 2006)

Three different methodological approaches were adopted to present this position. First of all, a survey of previous studies on this issue was carried out, complemented by the presentation of selected indicators for the Brazilian experience.

A second approach was the elaboration of an input-output model estimating the employment and wages effects of the expansion of selected sectors. The results show that activities that are more identified with green economy principles present better impacts in terms of jobs and wage creation than the activities that are linked to the exploitation of natural resources without value adding transformation (agriculture and mineral extraction). The same is valid when industrial activities are compared: the better results are obtained in the sectors that present smaller potential pollution impacts. In contrast, the most pollution-intensive sectors tend to be more capital intensive, and because of that have smaller employment and wage effects. Therefore, a reversal of the existing trend is necessary for a long term transition towards a greener economy, encouraging activities that are characterized by higher innovation and less pollution effects, instead of the current trend of specialization on primary goods and "dirty" industrial commodities.

The third approach is a detailed analysis of three selected sectors that present important role in a transition towards a green economy: biofuels, wind power and protected areas. Specific aspects of each sector are discussed, including potentialities and challenges.

Literature review and selected indicators on the Brazilian experience

The concept of green economy has many alternative definitions, but one of the most widespread has been presented by the United Nations Environmental Program (UNEP): a green economy results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP 2010). This requires the economy to be low-carbon, resource efficient, and socially inclusive, in a way that public and private investments generate growth in income and employment through action aiming at the reduction of carbon emissions and pollution, more energy and resource efficiency, and the conservation of biodiversity and ecosystem services. The concept of a green economy does not replace sustainable development; but there is a growing recognition that achieving sustainability rests almost entirely on getting the economy right. Decades of creating new wealth through a "brown economy" model

based on fossil fuels have not substantially addressed social marginalisation, environmental degradation and resource depletion, and existing policies and market incentives have contributed to this problem of capital misallocation because they allow businesses to run up significant, largely unaccounted for, and unchecked social and environmental externalities (UNEP 2010).

Hence, the challenge posed by the green economy principle is to avoid the conventional perception of a trade-off between environmental sustainability and economic progress: the greening of economies neither inhibits wealth creation nor employment opportunities but, instead, open new opportunities for investment, growth and jobs. Also, it emphasizes that a health environment is a necessary condition for social inclusion, rather than a luxury only wealthy countries can afford, since poor people have their livelihoods and security strongly dependent on nature and ecosystem services. Because of that, developing countries must invest in the conservation or rebuilding of natural capital, perceived as a critical economic asset and source of public benefits.

Even though the short run results from the UN Conference on Sustainable Development (Rio +20, held in June 2012) were very limited, there was strong defense that green economy policies present potential solutions towards sustainability, with more weight for institutions that "act locally", including governments, companies and civil society organizations. The main principle is that environmental policies should not be seen as costly restrictions imposed by the state bureaucracy or pressure from radical environmentalists, but as opportunities for innovation to reduce production costs in the medium and long term (eg, avoiding waste and inefficiencies in the consumption of energy and raw materials) or ways to conquer new markets by improving the image of the company and its products to consumers. That is, costs can be reversed on benefits: what would be a problem (to meet environmental standards) becomes an advantage, because of the potential gains in efficiency and competitiveness, simultaneously improving the quality of life of the population. Reversing the myth, it can be said that economic growth and environmental quality are complementary in a virtuous cycle of sustainable development.

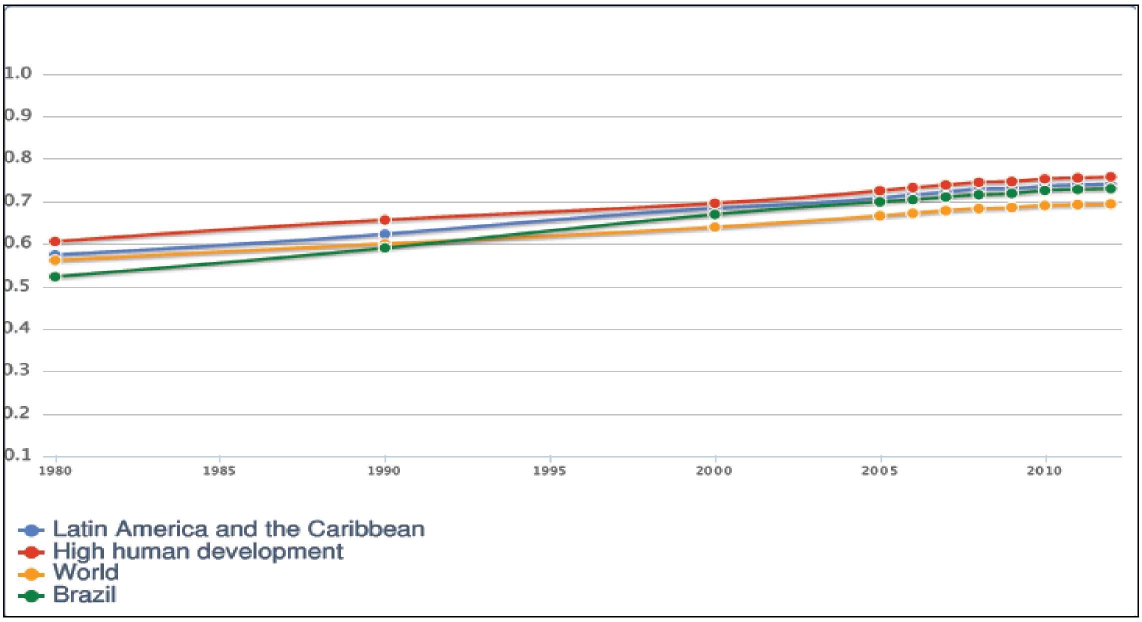
But this “win-win” does not materialize spontaneously, and the Brazilian case has been no exception on this. Brazil is the fifth largest (8.5 Million km^2) and arguably the most biologically diverse country in the World, even though a huge part of its biodiversity

remains unknown to scientists. Its economy is diversified, with important agricultural, industrial and service activities. More than 84% of the population live in urban areas (according to the 2010 Demographic Census), but the country has the largest areas of tropical forests in the planet.

The latest results from the Human Development Atlas in Brazil (UNDP 2013) indicated that Brazil's Human Development Index (HDI) nearly doubled, going from 0.493 in 1991, regarded as extremely low, to 0.727 in 2010, which stands for a high level of human development.

In regional terms, there was also main improvements, reducing the disparities between the relatively rich regions (South and Southeast) and the poor ones (North, Northeast and Centre-west). In 1991, 85.5% of the Brazilian cities had a very low HDI, but this percentage dropped to 0.6% in 2010, while 74% of Brazil's municipalities have achieved a high or medium HDI. Most significantly, no Brazilian city presented an index below what it was in 1991. In spite of these considerable advances, also a consequence of explicit policies to accelerate social inclusion through income redistribution and other policies aiming at the poor, social and regional disparities remain at very high levels, even if observed from a Latin American standpoint. Figure 1 shows that, in spite of all advances since 1980, Brazilian HDI remains lower than the Latin American average.

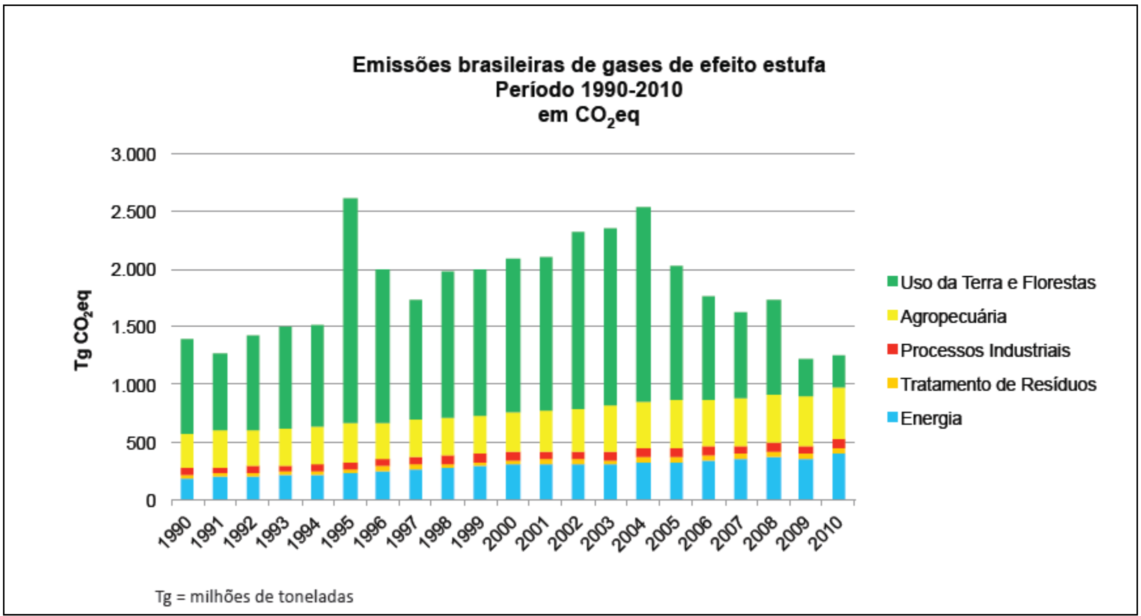
Figure 1. Evolution in the Human Development Index, Brazil and the World, 1980-2010



Source: UNDP (http://hdrstats.undp.org/en/countries/profiles/BRA.html)

These social imbalances present a very concrete face in environmental terms. One huge environmental problem has been positively addressed in recent years: the considerable reduction in deforestation, particularly in the Brazilian Amazon. Emissions from slash-and-burn associated with the land clearing process in the expansion of the agricultural frontier were historically the main source of greenhouse gases emissions (Figure 2 and Table 1). However, the increasing pressure to reduce deforestation has reduced this type of emission (22% of the total), which now occupies the third place, after agriculture (35%) and energy (32%).

Figure 2. Brazilian emissions of greenhouse gases, Millions tons CO_2 eq,1990-2010



Source: MCTI (2013)

Table 1. Brazilian emissions of greenhouse gases, Millions tons CO_2 eq,1990-2010

	1990	1995	2000	2005	2010
Energy	191543	232430	301096	328808	399302
Industrial processes	52536	63065	71673	77943	82048
Agriculture	303772	335775	347878	415713	437226
Forests	815965	1950084	1324371	1167917	279163
Residuals	28939	33808	38550	41880	48737
Total	1392756	2615162	2083570	2032260	1246477

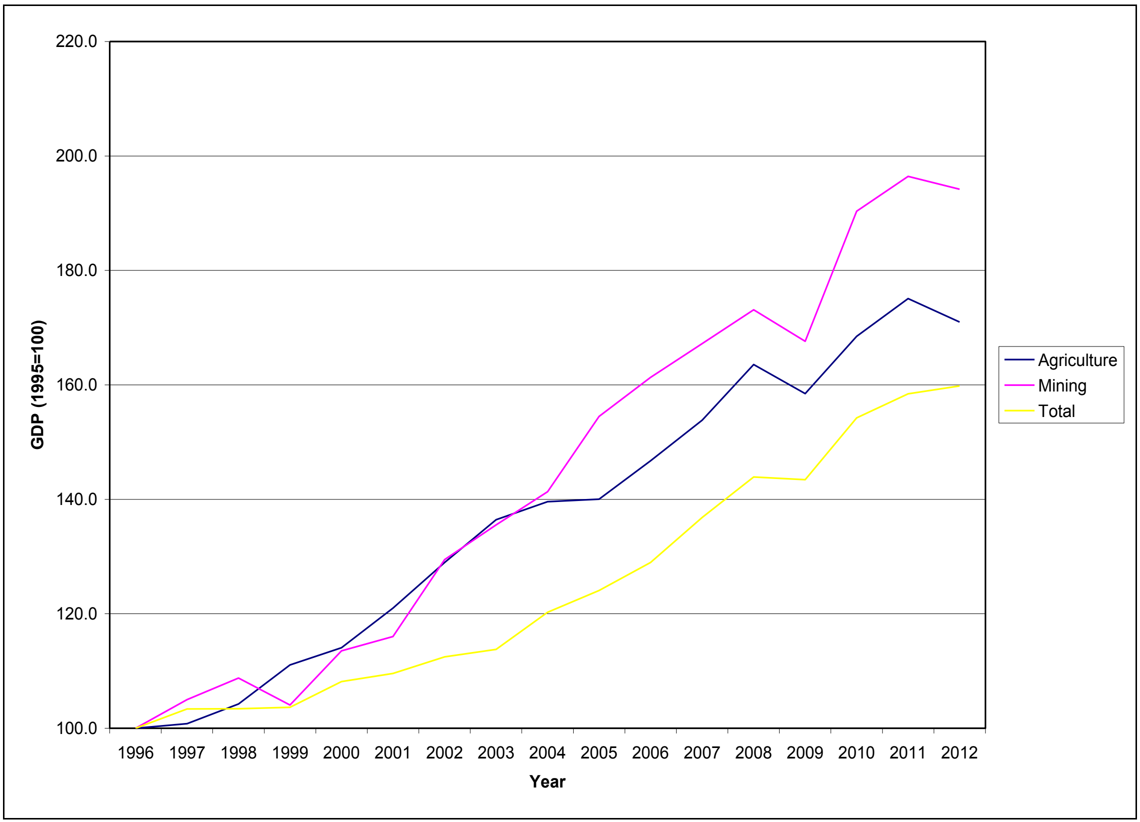
Source: MCTI (2013)

The goods news is that the main problem has been addressed – even tough recent changes in forest conservation legislation were introduced by the pressure of agriculture sector, reducing the legal minimum requirements of forest conservation in private properties, and recent data suggest that the trend of reduction in deforestation has stopped. The bad news is that emissions from all other sources has increased, especially in energy (21% increase between 2005 and 2010, and 133% in the 1990-2010 period) and agriculture (5% and 61%, respectively). Therefore, a new green development agenda has to be set in the country, addressing the problems related to agricultural emissions and residuals, water and air pollution, poor transportation and other urban

infrastructure facilities, lack of sanitation and proper housing conditions, Therefore, Brazil faces a wide range of environmental problems, mixing problems that are typical of developed countries, associated with high degree of urbanization, waste and industrial pollution, and those of developing countries, such as deforestation and poor sanitation. To solve these problems, financial and human efforts will be required at levels that exceed considerably the resources that are currently destined to sustainable issues in Brazil (Young et al. 2012).

These problems were, somehow, hidden by the relative success of Brazil in social terms (the improvement in HDI, as discussed above) and in the economy in recent years. Indeed, there was a reversal from a condition of low rates of growth and very high inflation into a successful example of emerging market. Nevertheless, this boom in economic activity and investment has been accompanied by a structural change in its GDP and exports composition, with an increasing specialization in raw materials exports or products that are intensive in natural resources and energy. Figure 3 presents the evolution of agriculture and mining when compared to the total economy's GDP, from 1996 to 2012: it is clear that raw materials are the base of the Brazilian economy in this period.

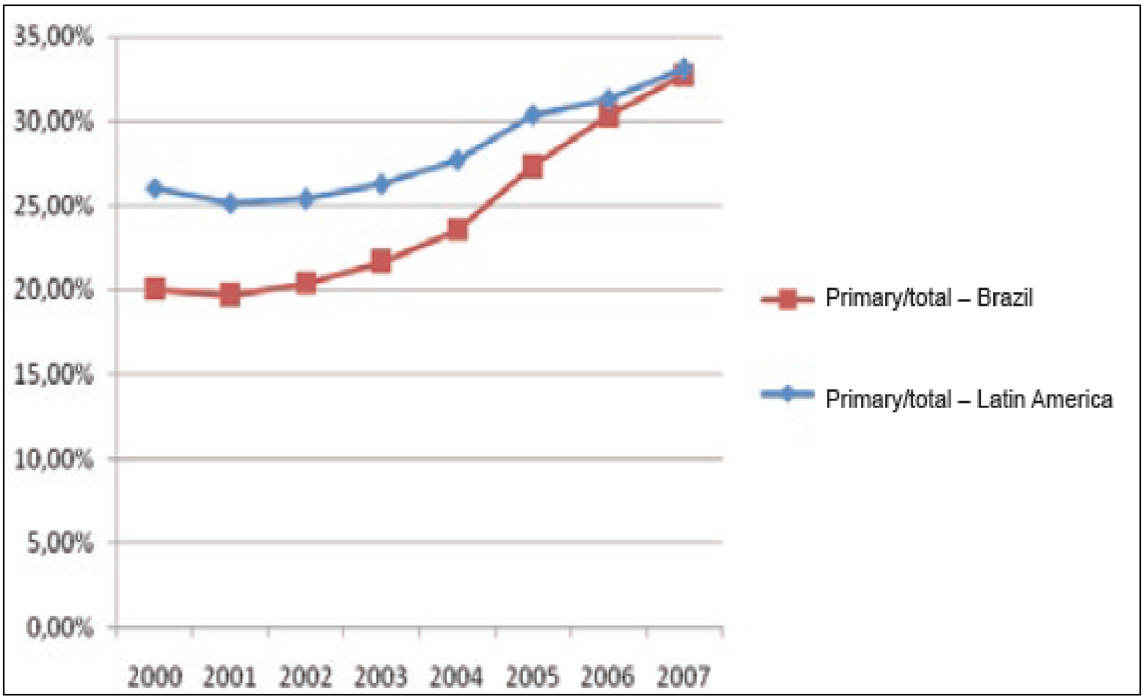
Figure 3. GDP evolution: agriculture, mining and total economy, Brazil, 1996-2012 (1995 = 100).



Source: Own elaboration, based on IBGE (Quarterly National Accounts)

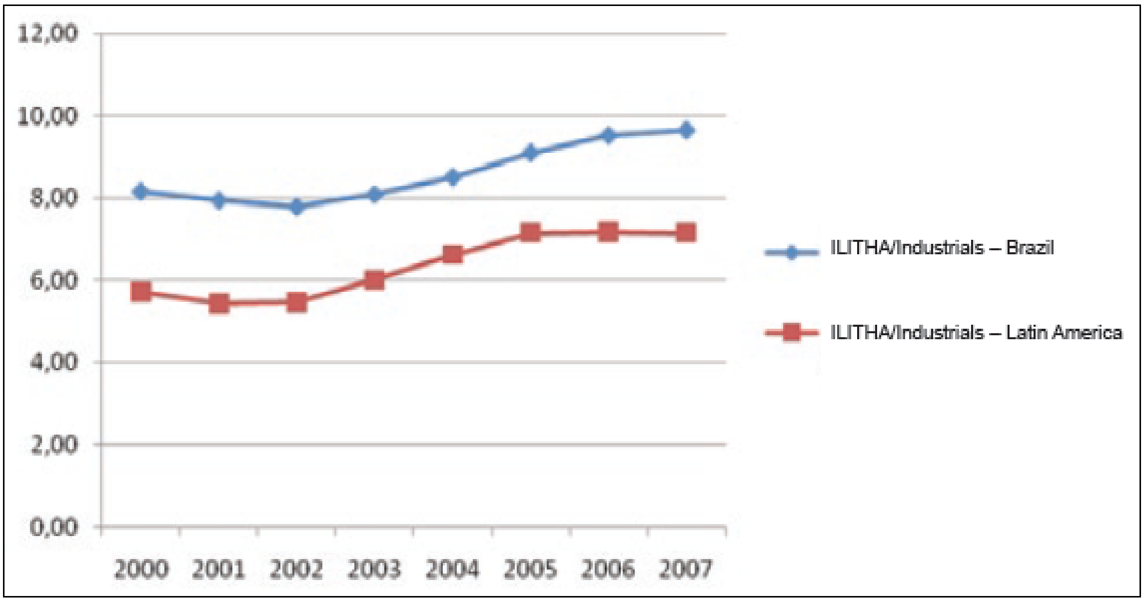
In the manufacturing industry, the best performance activities are associated with higher pollution potential (Young 2011, see figures 4 and 5), and there is an increasing share of carbon-intensive activities in the Brazilian export structure (Gramkow 2011). These results indicate that the Brazilian economy is getting more specialized in primary products without transformation (raw materials) and in pollution-intensive industrial sectors, exactly the opposite of what has been proposed by the green economy.

Figure 4. Participation of primary products in exports (%), Brazil and Latin America, 2000-2007



Source: Young (2011)

Figure 5. Average intensity of potential pollution of industrial exports (using ILITHA/IPPS coefficients), Brazil and Latin America (2000-2007)



Source: Young (2011)

The problems associated to the specialization in such commodities are not restricted to the environmental dimension. From a social standpoint, an economic model based on "mining" natural resources reinforces exclusion, since the economic benefits tend to be concentrated within a relatively small group (these activities are characterized as low-intensive in labor demand), while environmental degradation has worse effects to the poor (Young and Lustosa, 2001, 2003). One important example is the expansion of the agricultural area through deforestation: benefits go to those located at the "top-up" of the agribusiness chain, but at the cost of serious social imbalances, including the displacement of indigenous and other traditional communities displaced by the expansion of commercial large-scale agriculture, increasing violence in these areas due to land property conflicts, and health problems caused by infectious diseases brought by migration and air pollution caused by burning forests in the land clearing process.

Table 2 presents the relative share of each sector in terms of employment. It is clear that the importance of primary activities (agriculture and mining) has significantly decreased, even though these sectors are clearly expanding above the average of the economy (Figure 3).

Table 2. Participation in total employment, Brazil 1995-2009

	Agriculture	Mining	Manufacturing	Electricity, gas and water services	Civil construction	Commerce	Services	Public administration	Total
1995/99	24.6%	0.3%	12.3%	0.5%	6.5%	15.1%	30.8%	9.9%	100.0%
2000/04	21.4%	0.3%	11.9%	0.4%	6.6%	16.2%	32.8%	10.4%	100.0%
2005/09	16.1%	0.6%	14.0%	1.1%	6.5%	15.4%	34.7%	11.6%	100.0%

Source: Own elaboration, based on IBGE (Annual National Accounts)

As a consequence, income expansion is not translated in terms of jobs and wages creation within the primary sector. Indeed, the agriculture sector is responsible for the largest loss in jobs in the country: in 2000, the "Cultivation, forestry and logging" activities employed 12,160 thousand people, while in 2009 this number has been reduced to 11,729. In the same period, "ranching and fishing" has declined from 5,450 to 5,048 thousand people. Altogether, this means that the entire agriculture sector was employing less 833 thousand people between 2000-2009, in spite of an accumulated rate of growth of 39% in that same decade.

Similar problems to the well being of poor families are also observed in mining and export-oriented industrial centers. Even though the relative share of the mining sector in total employment has doubled between 1995 and 2009, its share in total GDP has grown much more (from 0.9% to 2.3%) and this sector remains relatively marginal in terms of job creation. Moreover, these activities expand in relatively remote parts of the country without proper investment in housing infrastructure and sanitation conditions, and the poor who migrate to these areas tend to live in a periphery with increasing environmental degradation.

There are also losses in the economic dimension due to the increasing specialization in "brown" activities. The expansive cycle of growth in commodity prices conceals an old discussion about the long-term trends of the terms of trade: is that because commodities have shown an upward trend since the 1990s, in the long run they will always remain growing in relation to technology-intensive products?

In summary, since environmental issues are increasingly examined along the production chain, there is a considerable risk to specialize in "brown" activities where competitiveness is based on an unsustainable relationship with the environment, even if the commitments to sustainability are still restricted to voluntary agreements and limited initiatives of governments, business leaders and civil society organizations. Hence, the Green Economy requires a new competitive paradigm, and businesses have a key role in the transition to this new model.

Input-output analysis: job and wage creation per sector

In the previous section, it was shown that Brazil has faced a recent trend of increasing dependence on primary goods and pollution intensive exports, with negative consequences to the environment. It is often argued that increasing environmental damages are a necessary price that a developing country has to pay for increasing economic activity. The implicit hypothesis is that economic activity and environmental conservation are necessarily in opposition, thus policy makers have to decide in either to increase employment and income or to halt economic growth to preserve natural resources.

The concept of green economy challenges this perspective, arguing that activities associated to a low carbon, environmentally concerned economy would bring positive effects to the level of employment and income in both short and long term. The objective of this section is to present empirical support to this view, examining how the impact of the expansion of the same amount of final demand, but in different activities, would affect employment and wage generation. The methodology used is similar to the one used by Young (2011), based on the Leontief input-output model, but using the latest data available for the Brazilian economy: employment and wage coefficients using the 2009 National Accounts, and the 2005 Input-Output table.

Among other reasons, employment and wage generation were selected for the analysis because they are better indicators of "socially inclusive" growth, since they express welfare in better terms than the total expansion of value added (GDP) – considering the outstanding income concentration in Brazil, it is important to avoid measures of growth that do not consider the distribution of income.

The advantage of using the input-output model is the consideration of effects in the entire production chain. In order to make the results comparable, all of them are based in similar (unitary) expansion of final demand.

However, there are many limitations in the use of the input-output model. Technical coefficients and relative prices are assumed to be constant, as if the economy remains statistic during the period of analysis. Moreover, the level of aggregation within the existing classification makes the analysis difficult for certain activities. The most important example is in the estimates for the agriculture sector, which aggregates commercial, family and subsistence farmers. This approach creates a bias to overestimate employment impacts in agriculture: productivity of subsistence farming is very low, but the number of occupations is extremely high, so the overall employment effect in agriculture considers the expansion of ALL farmers, even though only commercial farmers respond to higher demand (as already presented in Table 2, employment in Brazilian agriculture is consistently diminishing, despite its value added and output growth).

In spite of all the problems related above, input-output exercises based on a real economy provide many important insights since they allow the consideration of inter-sector chains and are a much more effective way to simulate alternative growth

possibilities than purely speculative assumptions that are not tested about the consistency of their results.

The exercise simulates an equal expansion of one million reais (at 2009 prices) in the final demand of each economic activity. The total output associated to this expansion is represented by the Leontief $(I - A)^{-1}$ matrix. The expected increase in jobs (occupied personnel) was estimated by multiplying the job/output coefficient (ratio between employment and output value per activity) by the Leontief matrix (Equation 1).

$$\Delta N = (N/VP) \,.\, (I - A)^{-1} \qquad (1)$$

Where:

ΔN: Employment expansion in each sector

N/VP: Employment/Output Value

$(I - A)^{-1}$: Leontief Matrix

The increase in wages (excluding social contributions) was estimated in similar terms by multiplying the wages/output coefficient (ratio between wages, excluding social contributions, and output value per activity) by the Leontief Matrix (Equation 2).

$$\Delta W = (W/VP) \,.\, (I - A)^{-1} \qquad (2)$$

Where:

ΔW: Wages expansion in each sector

W/VP: Wages/Output Value

Table 3 present the results in descending order: at the top of the table are the sectors that present the highest wage or employment multipliers.

Table 3. Wage and employment creation effects per economic activity (from higher to lower impacts)

Sector	Wage	Sector	Employment
Public education	0.656	Other services	80.9
Private education	0.593	Agriculture, forestry and forest plantation	77.5
Public health	0.589	Ranching and fishing	70.5
Other services	0.516	Clothing and accessories	66.0
Public administration and social security	0.499	Maintenance and repair	55.7
Shoes and leather products	0.440	Accommodation and food services	52.2
Private health	0.404	Shoes and leather products	49.0
Business services	0.387	Wood products - except furniture	48.8
Wood products - except furniture	0.364	Food and beverage	45.4
Parts and accessories for motor vehicles	0.359	Tabacco products	44.2
Clothing and accessories	0.357	Textiles	41.5
Machinery and equipment, including maintenance and repairs	0.340	Private education	38.8
Other non-metallic products	0.326	Commerce	38.3
Commerce	0.325	Ethanol	37.3
Ranching and fishing	0.319	Furniture and products of diverse industries	33.8
Transportation, storage and postal services	0.315	Construction	33.4
Cars, SUV and utility vehicles	0.309	Public education	32.3
Accommodation and food services	0.305	Business services	30.1
Food and beverage	0.304	Private health	29.8
Metal products - except machinery and equipment	0.303	Other non-metallic products	26.4
Electrical appliances	0.302	Public health	24.6
Printing	0.301	Transportation, storage and postal services	23.8
Rubber and plastic products	0.300	Pulp and paper	22.1
Electric machinery, appliances and equipment	0.299	Others mining	21.0
Pulp and paper	0.297	Perfumery, hygiene and cleaning	20.3
Furniture and products of diverse industries	0.292	Metal products - except machinery and equipment	20.2
Other transport equipment	0.292	Printing	20.0
Trucks and buses	0.290	Public administration and social security	18.7
Textiles	0.286	Information Services	17.9
Construction	0.286	Rubber and plastic products	17.4
Tabacco products	0.282	Parts and accessories for motor vehicles	17.4
Finance and insurance	0.277	Machinery and equipment, including maintenance and repairs	16.8
Maintenance and repair	0.275	Chemicals - diverse	16.5
Paints, varnishes, enamels and lacquers	0.271	Cars, SUV and utility vehicles	16.0
Others mining	0.271	Electrical appliances	15.7
Information Services	0.267	Electric machinery, appliances and equipment	15.2
Chemicals - diverse	0.264	Equipment / instruments healthcare, measurement and optical	15.0
Perfumery, hygiene and cleaning	0.259	Agrochemicals	14.8
Pharmaceuticals	0.259	Electronic material and communication equipment	14.6
Equipment / instruments healthcare, measurement and optical	0.257	Trucks and buses	13.9
Electronic material and communication equipment	0.257	Paints, varnishes, enamels and lacquers	13.8

Agrochemicals	0.253	Other transport equipment	13.5
Oil and natural gas	0.245	Cement	12.9
Agriculture, forestry and forest plantation	0.242	Pharmaceuticals	12.5
Manufacture of steel and steel products	0.236	Office machines and computer equipment	12.2
Metallurgy of non-ferrous	0.235	Metallurgy of non-ferrous	12.2
Cement	0.230	Resin and elastomers	11.5
Ethanol	0.229	Chemical products	11.3
Resin and elastomers	0.225	Iron ore mining	11.1
Office machines and computer equipment	0.211	Manufacture of steel and steel products	11.0
Chemical products	0.209	Oil and natural gas	10.4
Electricity, gas, water, sewage and urban cleaning	0.203	Finance and insurance	9.1
Iron ore mining	0.201	Oil refinery and coke	8.9
Oil refinery and coke	0.178	Electricity, gas, water, sewage and urban cleaning	8.0
Real estate services and rental	0.045	Real estate services and rental	4.1

Source: Own elaboration, using IBGE 2009 National Accounts and 2005 Input-Output Table

The results vary considerably both in terms of employment and wage generation, indicating that the composition of the product (ie, the combination of economic activities that will grow above the average) affects considerably the social inclusion consequences of the same aggregate level of growth. The other conclusion, similar to the one previously presented by Young (2011), is that activities that are more identified with the green economy principles (services, such as education and health, and "light" industries) tend to present better results than the ones associated to the current specialization on primary activities (mineral extraction, for example) or relatively pollution-intensive industries (oil refinery, chemicals, metallurgy).

Nevertheless, the results are not linear for both wage and employment generation, and must be considered with care (especially because of the already referred aggregation problem). Another element to be considered is the dynamic effect: input-output models project current patterns to the future, keeping all technical parameters constant over time.

In any case, one message becomes clear: there is no evidence that the economic activities that are more harmful to the environment, at least in potential terms, are not the better for social inclusion. Hence, it is a fallacy to consider that developing countries have to decide between economic growth and environmental quality. In many cases, the better results for employment and wage creation are exactly the ones in which the dependence on natural resources depletion and degradation are reduced. Therefore, there is no reason to believe that an "Environmental Kuznets Curve" has to be pursued

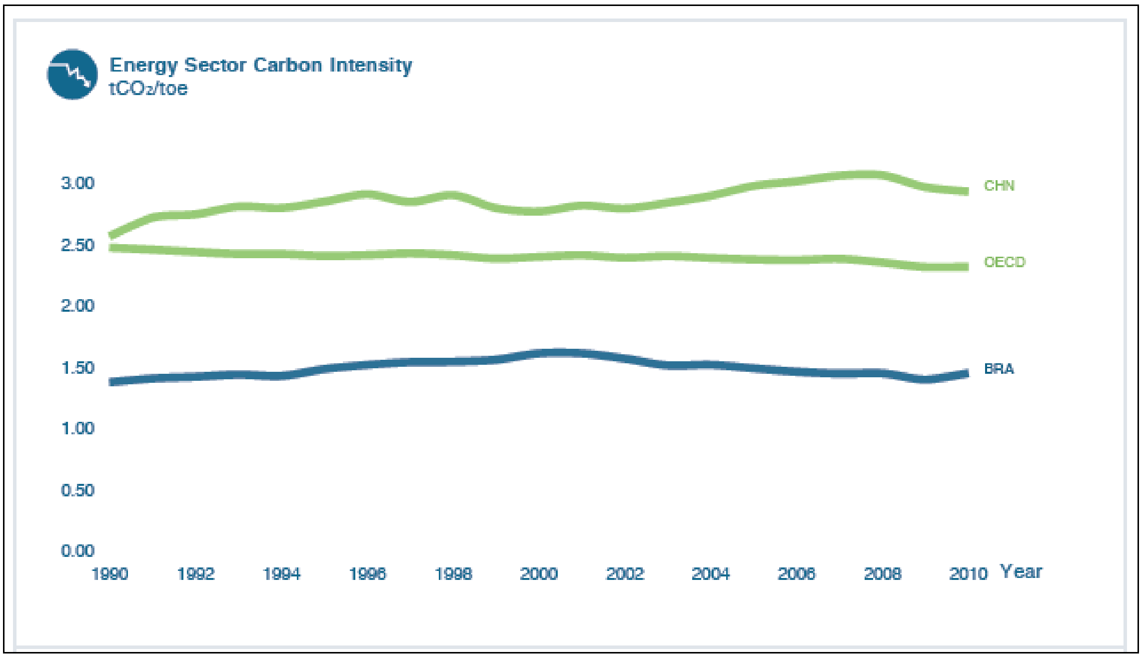
to achieve higher economic activity: more pollution and resource depletion would lead to less, rather than more, inclusive growth. Just the opposite: the efforts to "clean up" the economy might bring much better results in terms of social inclusion 9as already argued by Young 2011).

Green economy sectoral analysis

Wind power

Brazil has one of the least carbon-intensive energy matrices in the world. Figure 6 compares the carbon intensity of the energy sector in Brazil and the OCDE and China, as measured by the the International Energy Association (IEA): note that energy generation in Brazil emits about half of CO_2 equivalent per unit of energy (toe – tons of oil equivalent) when compared to China.

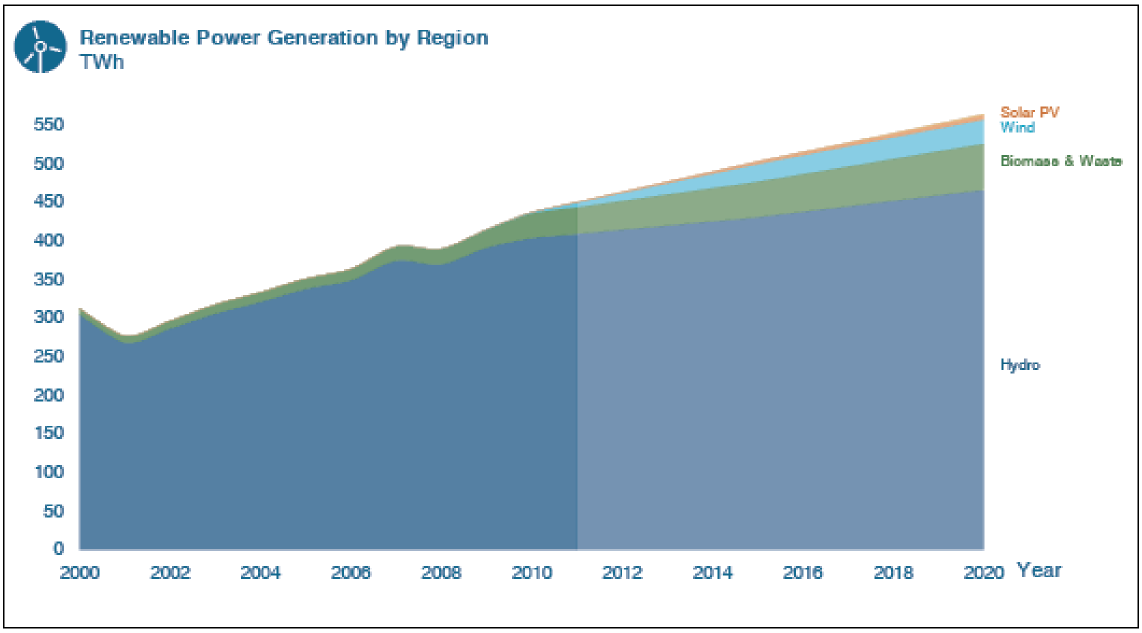
Figure 6. Energy sector carbon intensity, tons of CO_2 equivalent per toe (tons of oil equivalent), Brazil, China and OCDE, 1990-2010



Source: International Energy Association (http://www.iea.org/etp/tracking/esci/)

The main reason for the low intensity in carbon emissions of the Brazilian economy is the very large use of hydropower (Figure 7).

Figure 7.



Source: International Energy Association (http://www.iea.org/etp/tracking/renewables/)

However, there are many problems associated to the expansion of power supply by new hydropower units under the pattern of very large reservoirs historically adopted in Brazil. They involve environmental problems related to the disturbance of ecosystems by the dams, especially in the Amazon where most of the unexploited hydropower potential resides, social problems mainly related to the displacement of communities, and economic problems related to the transmissions costs due to the long distances between the location of new power units and the consumers (Oliveira 2012).

The projections by the IEA presented in Figure 7 forecast that wind power as one of the most important solution of the problem of expanding the supply of clean and renewable electricity. Indeed, there has been a fast expansion on wind power production in Brazil and in the world in recent years. This is associated to the accelerated cost reduction, consequence of technological breakthroughs, both at the production sites and distribution (smart grids), and to the specific incentives programs adopted to encourage this alternative power source, especially the adoption of “feed-in” tariffs system, where higher prices are paid for the introduction of alternative renewable energy sources (Pereira 2012).

In Brazil, in spite of the relative delay if compared to developed countries and China, the installed capacity grow from less than 30 MW in 2005 to more than 1000 MW at the

end of 2011, and expectations of surpassing 7000 MW in 2014 (Pereira 2012). The total potential for wind power generation in Brazil is officially estimated at 144 GW, or 270 TWh/year (about half of the national current electricity consumption), considering rotors at 50 meters high; but if rotors are established at 100 meters high, the potential power generation exceeds 300 GW, more than the hydropower potential (Pereira 2012). Therefore, wind power generation is potentially one of the most important source of electricity in Brazil. However, the knowledge about the sector remains relatively low if compared the hydropower, and specific characteristics of the wind power generation have to be considered.

One aspect is the problem of energy storage: in that sense, the wind power and hydropower can be understood as complementary in an integrated system. When the wind power stations are operating, they allow “water savings” in the reservoirs, which operates as a backup for the periods when the winds get down (Oliveira 2012, Pereira 2012).

This hydro-wind combination has the advantage to establish a resilient power system that is independent of emissions of fossil fuels at competitive costs (Losekann 2012, Pereira 2012, Oliveira 2012): in the energy auctions in Brazil, prices offered by wind power companies in the latest bids (since 2011) were always below the marginal cost to expand electricity supply (R$ 113/MWh), projected by the Brazilian government energy enterprise (EPE).

The good potential for wind power generation is explained by favorable geographical conditions, including the extension of the shoreline and the regime of trade winds in the Northeast. This is also an important feature for social inclusion: most of the potential is located in the Northeast, the poorest region in the country (Ferraz 2012, Pereira 2012).

However, an appropriate regulatory framework is necessary to the fulfillment of this potential. The establishment of the PROINFA (Program of Incentives for Alternative Sources) in 2002 was the first specific regime for alternative power generation, and established targets (and differentiated prices) of power supply to be accomplished by wind and other alternatives. There were delays in PROINFA implementation, due to problems of funding, machinery and equipment supply, environmental licensing, and the requirement of a minimum of 60% of national components, associated with the exemption of taxes on the remaining imported equipment. Specific solutions were gradually surpassed, including more flexibility to the 60% rule of national contents (that is concentrated mainly in the civil construction aspects of the projects). The final result

was the consistent decline in supply costs and the increasing capacity to dispute the electricity bids in competitive terms with conventional power sources (hydroelectricity and thermoelectricity).

The current situation is that wind energy remains competitive even in the absence of specific incentives, even though there are important challenges to be faced. One aspect is the correct estimation of the capacity factor (% of the time in which power is actually generated). Losekann (2012) argues that the new projects might have been overestimated in terms of their effective capacity, thus making the projects more expensive (less generation of energy per unit of money invested). On the other hand, there are technological breakthroughs that will reduce investment and production costs in the near future: it remains a relatively young industry, and there are good reasons to believe that the observed trend of declining costs per unit of output will persist overtime.

One aspect that is usually presented as a bad for the wind energy is the low capacity of job creation. As a matter of fact, one of the competitive advantages of the sector is exactly the little incidence of operational costs, including labor. But this is not a problem specific to the wind power sector: hydropower and other energy sources are usually characterized by high capital intensity and little labor demand. Pereira (2012), based on European studies, considers that the demand for labor will decline from the current 14 new jobs per each additional Megawatt (MW) installed, to 12 or 13 new jobs per MW in 2020.

The main possibilities for job creations are not located in the places were energy is generated but in the production of the equipment. This is another challenge for the sector in Brazil: the share of imported components remains relatively high, and most of the national contribution is located in the low technology activities, mainly civil construction. According to Podcameni (2012), policies for the expansion of the wind energy in Brazil focus mainly in the output generation, but are disarticulated and related to a regressive specialization of the national technological and production structure on the segment of wind energy and avoid an endogenous development on the sector. Her main conclusion is that a new stage for public policies is demanded for the sector: instead of establishing price or other incentives to expand output, the emphasis should be on the establishment of national innovation system to favor the development of national technology and high skilled jobs in the country. A similar approach is

considered by Pereira (2012): the policy focus should shift towards the technological control of the process.

In any case, it is consensual that the contribution of the wind power will increase in the total share of electricity in Brazil, and in the most optimistic scenarios, it can reach up to 20% of the total. This would represent a considerable advance in the capacity of expanding energy supply without the need for environmentally risky large hydropower projects or carbon intensive thermoelectricity.

The future of biofuels

Renewable energy is becoming increasingly more important due to its potential to replace fossil fuels and, therefore, contribute to reduce the expansion of the concentration of greenhouse gases in the atmosphere. There is great potential for the energy use of different types of biomass in developing countries. Brazil has assumed a leadership role since the implementation of the PROALCOOOL program, aiming at the substitution of gasoline by ethanol in 1970s and, later, by the National Biodiesel Production Program (PNPB) in the 2000s .

The comparative advantage of developing countries in biofuel production is due mainly to the availability of land and labor relatively low-cost, more favorable climate, abundance of water and exposure to sunlight that favor the rapid growth of the biomass. Additionally, the significant increase in oil prices seen in recent years contributed to foster the optimism about the potential of biofuels. Based on the above, biofuels are usually presented as solutions where "everyone wins" (win-win) for their potential to reduce emissions of greenhouse gases and also to increase economic activity and, directly or indirectly, reduce social problems.

Sugar cane is the primary raw material for ethanol production in the tropics, including almost all of the Brazilian production. An additional energetic advantage of sugarcane ethanol is the use of residual bagasse to generate heat and electricity through co-generation process – the contribution of sugarcane bagasse and other biomass sources (including fuelwood) represented almost 7% of total electricity supply in the Brazil in 2012 (EPE 2013). Likewise, various organic fertilizers can also be obtained from waste process for obtaining ethanol. Other vegetable products are also used as raw material in the fermentation process to produce ethanol - corn is the dominant crop for ethanol production in the U.S. and in the developed world.

The variety of raw materials for biodiesel production is even greater, but the current supply in Brazil is obtained mainly from soybeans and, at smaller scale, other oilseeds. In the Southeast Asia, oil palm (Elaeis guineensis) is an important raw material for the production of biodiesel but experiments with American species of palm (Elaeis melanococca G.) have been tried in the Amazon, but without challenging the main position of soy. It is also important to mention that the PNPB explicitly considered that half of the production of biodiesel in Brazil would come from castor oil ("mamona") to be cultivated by subsistence farmers in the poor Northeast region (it will be discussed later why such forecast failed almost completely, eroding the so-called "social component" of biodiesel program in Brazil).

For all the above reasons, biofuels are usually presented as the best "green" solution for replacing liquid fossil fuels – this is particularly true in the Brazilian case, where government officials and business leaders in the sector defend the expansion of cultivated areas with sugarcane and soy as sources of "green gold". Faced with this enthusiasm, relatively little criticism emerged about the "sustainability" of biofuels in Brazil. However, it is extremely important to question the foundations of the biofuels option, and to examine in which circumstances it follows the green economy principles.

The discussion about the future of biofuels requires the construction of scenarios and expectations about the behavior of the relevant variables. The usual convention is to project the future based on the present and recent past – following that perspective, the Brazilian government has projected that the competitive basis of the biofuel industry in the future will basically follow the same logic as today. In that sense, the development path for this alternative has already been set up in terms of economies of scale and scope, and the most important issues for its expansion are (i) availability of land at relatively low prices; (ii) logistics and mechanization; and (iii) comparative advantage when compared to fossil fuel alternatives.

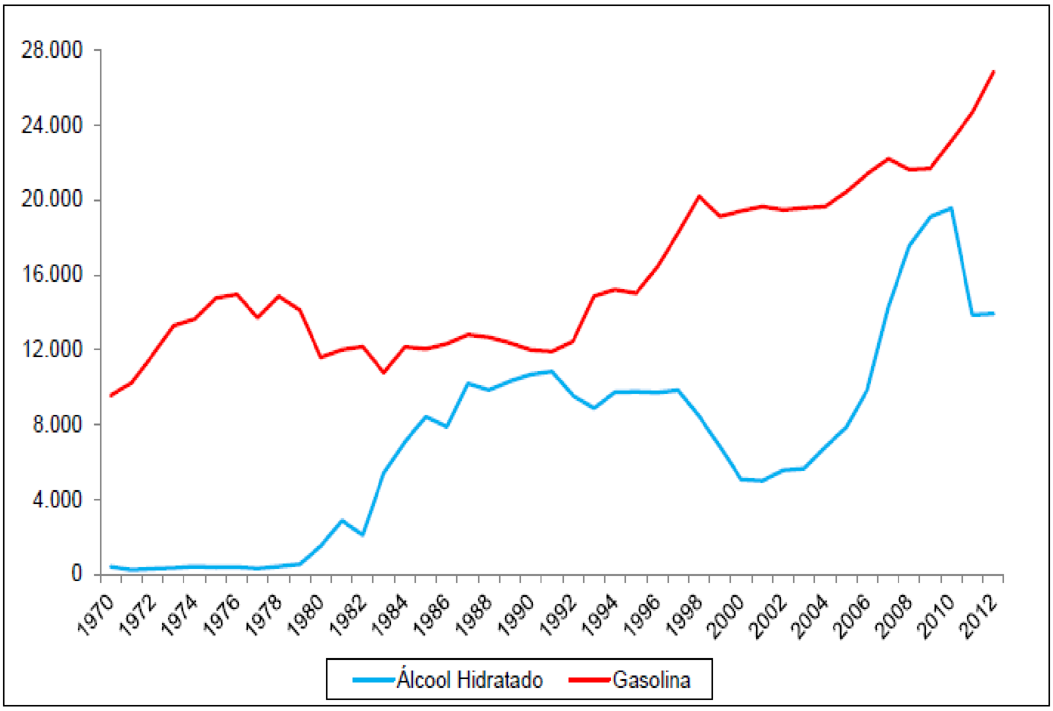
The main problems for that expansion would be related to the possibility of ever expanding the cultivation area, with subsequent effects on environmental issues, especially those related to increased deforestation pressure, the competition with food products (inducing less production and higher prices (and their consequences for the poor), technological challenges and the volatility of fossil fuel prices.

Therefore, one of the conditions for the economic viability of biofuels depends on high fossil fuel prices. But the prices of petroleum products are known for their instability

and uncertainty. In the short term, the volatility may be small, but in the long term it is hardly possible to predict with reasonable certainty prices for three or more years, the period necessary for investments in infrastructure to expand the supply of biofuels are fully ready and operational. The historical analysis of similar situations suggests that the instability will continue in the coming years, significantly increasing uncertainty about the profitability of biofuel projects.

This problem has showed up in recent years. Since the late 2000s, Brazilian energy policy has been of subsidizing fossil fuels in order to avoid inflation rise and, as a consequence, gasoline became more competitive than ethanol - most cars in Brazil now are flex fuel, which means that the consumer has the option to choose between the two fuels (as a rule of thumb, ethanol is attractive if its liter costs below 70% of gasoline's, considering the difference in their efficiencies). Figure 9 shows that, as a consequence, ethanol consumption has been reduced while gasoline's has increased since 2010.

Figure 9. Gasoline and hydrated ethanol production, Brazil, 1,000 m3



Source; Ferraz (2013)

The economic viability of biofuels also depends on the price of the alternative use of biomass. The prices of sugar cane ethanol are also influenced by the international price of sugar, and biodiesel interest depends on the behavior of prices of soybeans and other potential feedstocks. Similarly, the price of biofuels ultimately affects the food market ,

because of the diversion of production to energy production. This phenomenon has already happened in the corn market: the increased demand for ethanol in the U.S. which is obtained primarily from corn, significantly increased the international price of the product. That caused a wave of inflation in food prices that ended up affecting many developing countries, resulting in a series of protests related to food safety risks of the poorest populations. This issue is considered of minor importance in the Brazilian case since most of the expansion of cultivated areas is concentrated in pasture land that is being converted to cultivation. However, if deforestation is halted, the “production” of new pasture land is strongly reduced (cattle ranching is the most important first use of recently deforested land) and land use competition between pasture and cultivation might emerge as a more important issue in the near future.

A more unequivocal criticism is related to the negative environmental impacts expected from the expansion of biofuels. Biomass production necessary to achieve the "green" fuels will require a significant amount of industrial and natural resources, which will bring several side effects. First, one must consider the increased demand for land for crops. In tropical countries, where increased production of biofuels will be more significant, this process will help to increase the deforestation and increase the impact of these countries in the emission of greenhouse gases, with negative effects on climate change, an obvious contradiction biofuels are called "green" to reduce carbon emissions from fossil fuels, but then stimulate emissions by deforestation (Fuser 2007, Alavarenga Jr and Young 2013). The direct effect occurs when the deforested area is converted directly or soy plantations, a phenomenon that is not the most usual. However, there are many uncertainties about the indirect effect, through the incentive to shift from livestock to areas where the price of land is much lower than in the growing regions. When the pasture is sold or rented to expand the cultivation of sugarcane, soybeans or other agricultural products, the benefit to the farmer is used to acquire land even higher in the agricultural frontier, especially in forest lands that are priced much lower market. In the future, if biofuel demand returns to an ascendant trend, it is possible that land conflicts will emerge, creating a risk for the continuation of the downtrend in deforestation.

Other negative impacts should also be considered: Carvalho (2011) estimates that if the negative externalities caused by burning cane straw in Brazil were considered, the profitability of ethanol would be reduced by about 25%. Moreover, the process of land preparation, cultivation and harvesting, processing and distribution of biofuels involves

diesel consumption and emission of pollutants. Manual cutting cane requires burning straw, which results in strong generation of local air pollutants. Finally, contrary to what is often publicized, the vehicle driven by biofuel is not less pollutant than gasoline-powered or diesel - what changes is generally the nature of the contaminant.

One usual argument in favor of biofuels is social inclusion because rural employment would grow, especially for the poorest, workers without qualification involved in the manual cultivation and harvest. This argument was strongly used in favor of the PNPB, which created special incentives to stimulate the small production of familiar base, with expectations that half of the biodiesel would derive from family farmers that would have used a mix of cultivations (especially castor oil), and not the soybean monocultivation. The original estimate provided by the Brazilian Government, when launching the program, was that 180 thousand employments would be generated, directly and indirectly, by the production of biodiesel in Brazil. This number was proven to be very oversized, and current Brazilian biodiesel remain almost completely based on mechanized soybean cultivation with little employment effects, as many criticized previously (Lucena and Young 2008, Alvarenga Jr. and Young 2013). Indeed, these results are more consistent with the declining trend of employment in Brazilian agriculture, presented in table 2.

A better understanding of the social effects of the biofuels expansion requires quantitative but also qualitative analysis. The strong speculation in land prices caused by the increase in biofuels demand exacerbates the tendency to land property concentration, and the expansion of monocultivation, based on mechanized equipment, further displace traditional farming. Finally, the very poor quality of jobs created, especially in the sugarcane harvest, where serious problems arise from the precarious conditions of temporary employments, induces the questioning of the acceptability of manual sugarcane harvesting. It is ironic that, in the beginning of the XXI century, the Brazilian government still defends the manual cut of the sugar cane as source of employment and development, although the areas where that activity has been established for almost five centuries remain among the poorest and less developed in the country.

There are also important technological challenges. In a series of articles in the Infopetro blog (http://infopetro.wordpress.com/), Bomtempo (2010 a, b) argues the biofuel industry of the future will be very different from today. His point is that, instead of

being based on a few products (ethanol and biodiesel) or production processes, there will be many more alternative technologies and business models. In other words, the future will be different from the present "first-generation" of biofuels, and the comparative advantages that Brazil (and other Latin American countries) presents today might disappear. In the long run, the technological component will be the most critical competitive factor, but there is little investment in innovation towards second or even third generation of biofuels:[4] Brazil currently has a very strong position in the markets for ethanol and biodiesel, which are relatively mature sectors (even though there is still room for evolution), but in terms of new products, the industrial structure is largely undedeveloped (Bomtempo 2010c, 2011).

If these other innovative options for biofuel production becomes economically feasible, at the cutting edge of technology, the Brazilian position will be fragile since its competitiveness is based on land and scale. As in the past , when the sugar cycle in the Northeast of Brazil changed from swing to absolute decline when cane plantations migrate to the Caribbean, the same can happen with, for example, competition in African agriculture with investments China and other countries.

The final message is that, even though important advances were obtained by biofuels production in Brazil, the country has done little to adapt if competitive circumstances change in the future. In 20 years this industry will probably be very different from what it is today, and the current practice of decision making based on the rough projections of the past can be very dangerous. There is a real opportunity to remain leader in a sector that will grow together with the green economy, but the lack of policy priorities is increasingly making this possibility more difficult.

The economics of protected areas

Protected areas are territorial units that receive special treatment because of their recognized natural, ecological and/or cultural values in terms of on-site conservation of species, populations and ecosystems, including systems and traditional means of

[4] First generation biofuels are made from the sugars and vegetable oils found in arable crops, which can be easily extracted using conventional technology. In comparison, second generation biofuels are made from lignocellulosic biomass or woody crops, agricultural residues or waste, which makes it harder to extract the required fuel. Third generation biofuels are expected to be obtained from industrial cultivation of algae or other biotechnologies. See http://en.wikipedia.org/wiki/Biofuel

survival for human communities, having legal status and different administration regimes. There are several kinds of protected areas, each of them with specific rules for management and level of protection. In Brazil, protected areas created for environmental protection are designed "conservation units" and are legally regulated by Law no. 9.985 of 2000, which regulates the National System of Nature Conservation Areas (SNUC).

Being a biodiversity superpower (UNDP 2010), Brazil has promoted significant expansion of the land covered by conservation units – tables 4 and 5 show that the total area devoted to conservation by the Federal and State governments reached 1,264 km^2 at the end of 2010, or 15% of the Brazilian territory.

Table 4. Federal conservation units, by groups and categories, 2010

Group/Category	**Number**	**Area (km2)**
Strict Protection		
National Park	67	245,756
Biological Reserve	29	38,091
Ecological Station	31	69,019
Natural Monument	3	442
Wildlife Refuge	7	1,840
Subtotal	137	335,147
Sustainable Use		
Environmental Protection Area	16	445
Area of special ecological interest	32	90,486
Extractive Reserve	59	117,552
National Forest	65	190,314
Sustainable Development Reserve	1	644
Subtotal	173	399,441
TOTAL	310	754,588

Source: Medeiros and Young (2011)

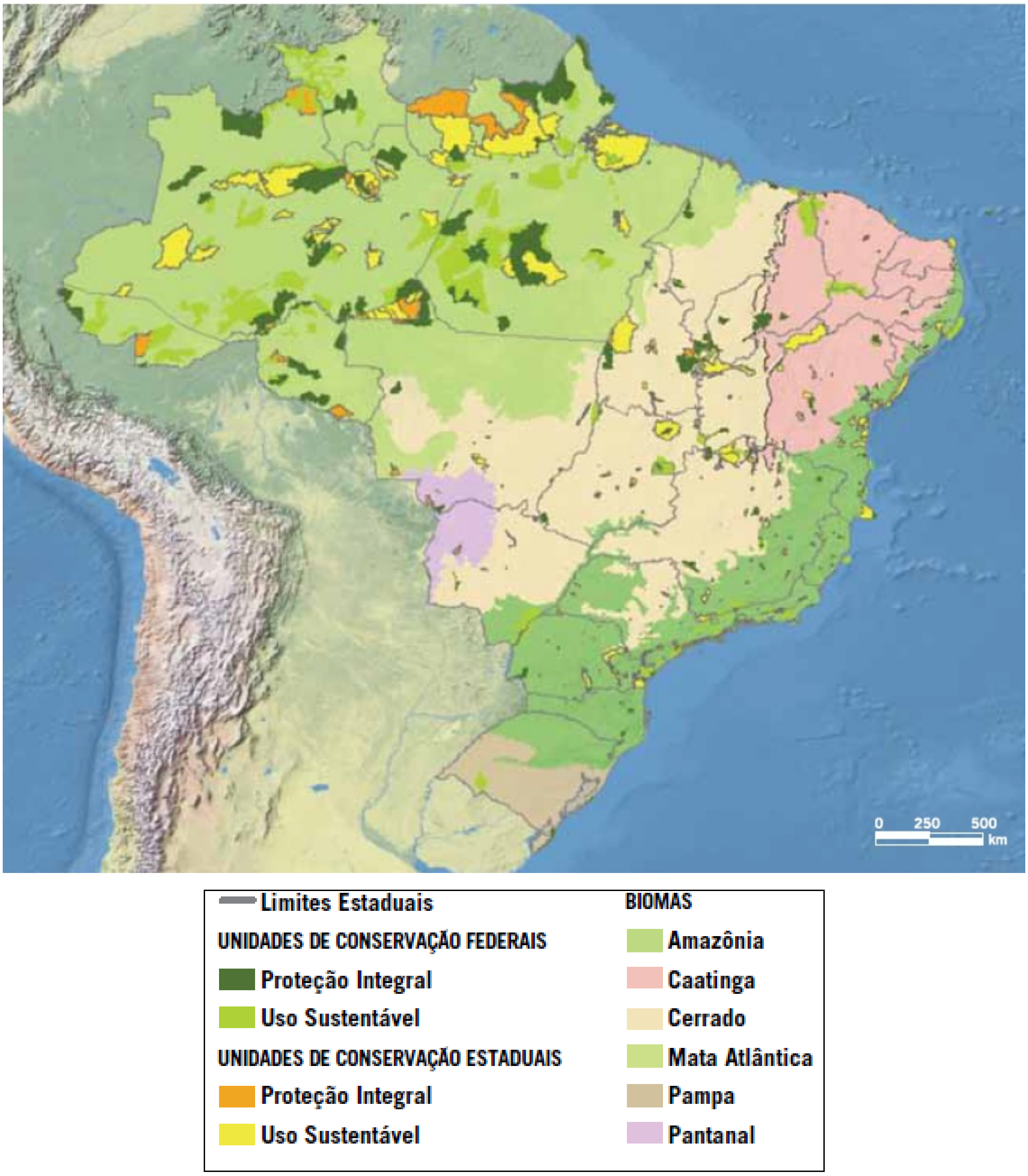
Table 5. State conservation units, by groups and categories, 2010

Group/Category	**Number**	**Area (km2)**
Strict Protection		
State Park	144	67,786
Biological Reserve	14	12,513
Ecological Station	47	44,771
Natural Monument	11	602
Wildlife Refuge	6	1,252
Subtotal	222	126,923
Sustainable Use		
Environmental Protection Area	19	103
Area of special ecological interest	109	186,510
Extractive Reserve	3	6,674
State Forest	17	93,959
Sustainable Development Reserve	18	95,288
Subtotal	166	382,534
TOTAL	388	509,457

Source: Medeiros and Young (2011)

But there are important regional differences: in the Amazon biome, conservation units cover 24% of its total area, while in the drylands of Caatinga conservation units occupy only 8% of the territory – figure 9 presents the distribution of the conservation units in Brazil.

Figure 9. Distribution of conservation units in the Brazilian territory (2010)

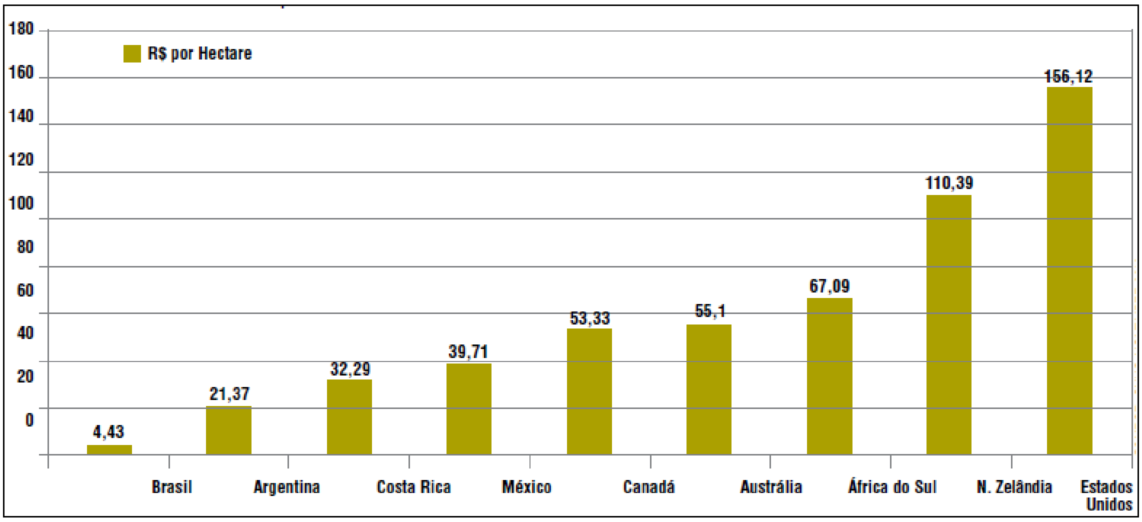


Source: Medeiros and Young (2011)

These protected areas provide very important ecosystem services for the country and the entire planet. Nevertheless, they remain perceived by most politic groups and decision makers, at both the public and private sectors, as an "obstacle" to development because they would represent restrictions to economic activities, especially in the most remote areas where conservation units are larger. Because of this negative perception, the management of conservation units receive much less human and financial resources,

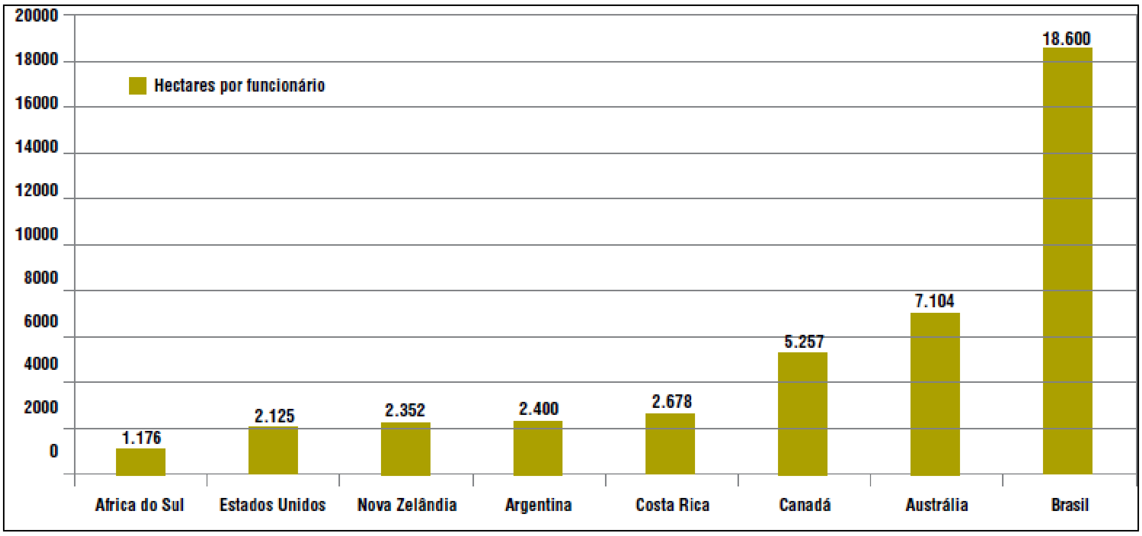
even if compared to developing countries standards – figures 10 and 11 show that the budget and personnel devoted to protect conservation units are much lower than what is being invested in other countries.

Figure 10. Investment (2010 R$) per hectare in conservation units in different countries



Source: Medeiros and Young (2011)

Figure 11. Hectares per employee in conservation units in different countries

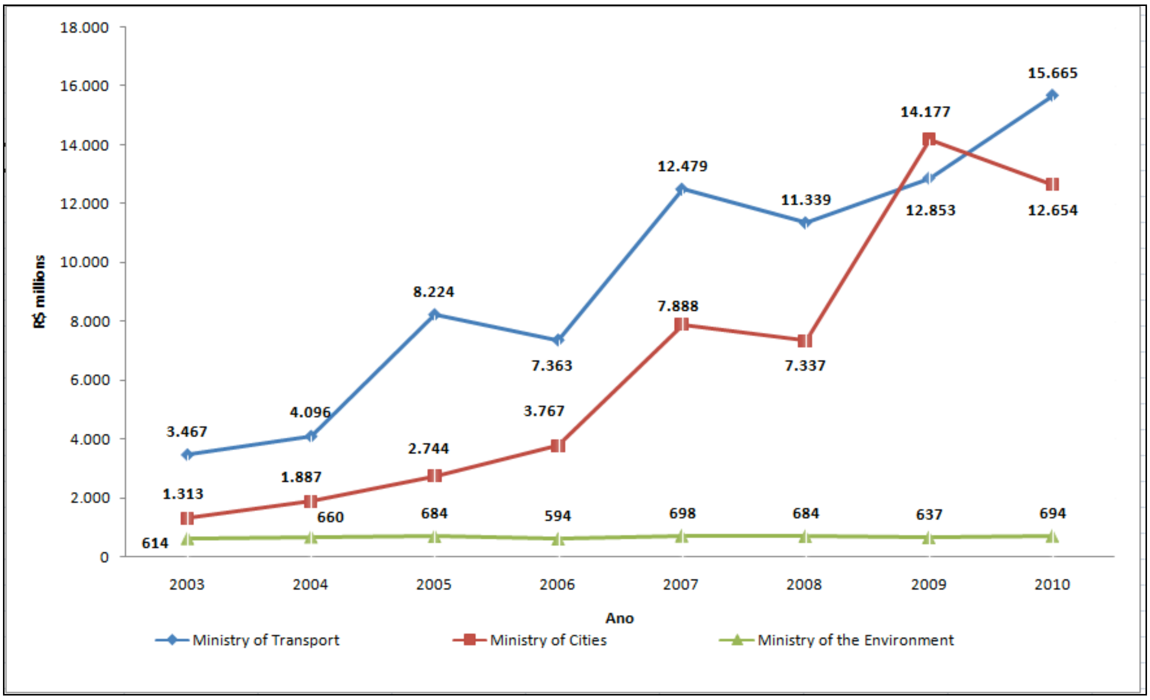


Source: Medeiros and Young (2011)

The main reason is that the expansion in the number and area of protected areas has not been followed by an equivalent increase in the budget dedicated to nature conservation. This follows a more general trend of relative decline in the budget allocated to environmental protection - Young et al. (2012) showed that public funding for

environmental protection is not growing at the required levels in order to catch up the increasing pressure created by infrastructure investments (Figure 12).

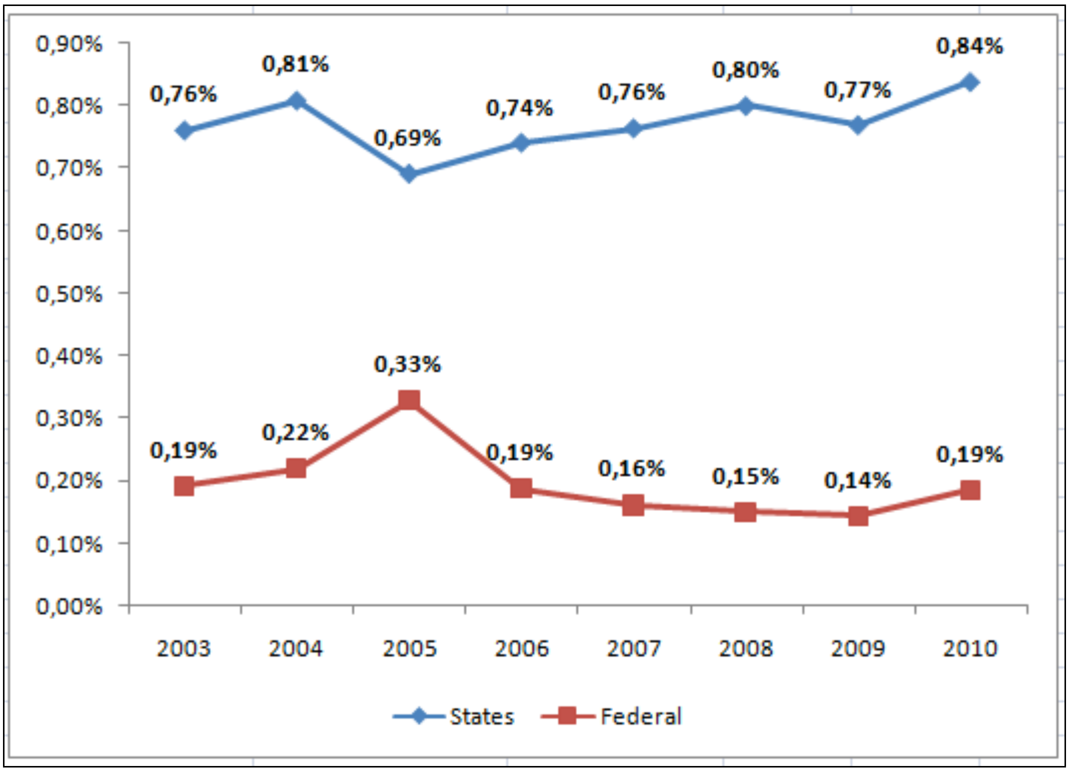
Figure 12. Discretionary expenditure of the Federal Government for selected ministries (2010 R$ Millions)



Source: Young et al. (2012)

The problem is particularly serious in the Federal Government, which is becoming a minor player when compared to State Governments (Figure 13). On the one hand, this has a positive aspect since State governments are more sensitive to local issues – and the negative consequences of changes in the provision of ecosystem services are better perceived locally. On the other hand, however, there are huge discrepancies between the Brazilian States about the importance of nature conservation and the capacity of enforcement of the legislation and environmental standards. This may lead to a very heterogeneous scenario where the status of conservation units and other aspects of environmental policy would vary considerably between the 27 Brazilian States.

Figure 13. Evolution of the relative share of expenditures in Environmental Management in total budget (2003-2010)



Source: Young et al. (2012)

The situation can become even worse if the present pressures by the lobby of rural producers and landowners in the Brazilian Congress are successful in changing the rules for the creation and definition of the area of conservation units (and indigenous territories): the "ruralista" lobby wants to move the final say on the subject from the Executive to the Legislative power, where the participation of politicians associated to environmental causes are very minor if compared to the very high presence of politicians linked to the landowners (an imbalance that became evident when the Brazilian Congress reduced the environmental safeguards in the Forest Code by a very comfortable difference, even though opinion polls were very consistent showing that most of the population opposed to these changes).

In order to reverse this perception, the Brazilian Ministry for the Environment, in alliance with many NGOs, has demanded studies that show that forest conservation would bring positive, rather than negative, impacts in the economy. Among them, the study by Medeiros and Young (2011) has specifically focused on the economic contribution of conservation units to the Brazilian Economy. The main results are the following:

- The production of timber in the Amazon's national and state forests, from areas managed according to the model forest concession, has the potential to generate between $ 1.2 billion to $ 2.2 billion per year, more than all of the native timber currently extracted in the country.

- Rubber production in the 11 Extractive Reserves identified as producers, results in R$ 16.5 million per year, whereas the production of Brazil nuts has the potential to generate R $ 39.2 million per year, considering only 17 of the Extractive Reserves analyzed. In both cases, these gains can be increased significantly if the conservation units receive investment to develop their productive capacity.

- Visitors in the 67 existing National Parks in Brazil have the potential to generate between R$ 1.6 billion and R$ 1.8 billion per year, based on estimates of the projected flow of tourists (approximately 13.7 million people, including Brazilians and foreigners) by 2016, the year of the Olympic Games.

- The sum of estimates of public visitation in federal and state conservation units considered by the study indicates that if the potential of the units are adequately exploited, some 20 million people will visit these areas in 2016, with a potential economic impact of approximately R$ 2.2 billion that year.

- The creation and maintenance of Brazilian conservation units has prevented the emission of at least 2.8 billion tons of carbon, with a monetary value estimated of at least R$ 96 billion, and the estimated value for the annual "rental" of the carbon stock whose emissions were prevented by conservation units totals ranges from R$ 2.9 billion and R$5.8 billion per year.

- In relation to the different uses of water by society, 80% of the country's hydroelectricity comes from sources that have at least one tributary downstream of a conservation unit, 9% of drinking water is directly collected in conservation units, 26% is collected from sources downstream of conservation units, and 4% of the water used in agriculture and irrigation is taken from sources inside or downstream of protected areas.

- In watersheds and water sources with the greatest forest cover, the cost associated with treating water for public supply is less than the cost of treatment in areas with low forest cover.
- In 2009, the actual revenue of “ICMS Ecológico” (Ecological VAT) passed on to municipalities by the existence of protected areas in their territory was R $ 402.7 million. The potential revenue for the 12 states that do not yet have legislation on Ecological VAT would be $ 14.9 million, assuming a rate of 0.5% for the criterion “conservation unit” that the municipalities are entitled to.

These results are a clear evidence that the benefits provided by conservation units largely exceed the current spending in their protection, even if the benefits of other important environmental services are not considered by problems of their valuation, including the protection of human settlements against landslides, floods and other accidents, the conservation of fishery resources and biodiversity conservation per se - the major goal of conservation units. The main conclusion is that the investment in the expansion and improvement in management conditions in conservation units are very feasible from an economic perspective: benefits exceed costs, when externalities (consequences for the entire society) are considered.

In more general terms, the problem is the disregard of the fundamental principle of environmental regulation in a green economy: the "internalization of externalities". There are some minor advances in the adoption of economic instruments for environmental management, especially where payments for forest conservation are established in watershed conservation programs (MMA 2011). But there remains strong resistance against the incorporation of environmental externalities in product pricing. In the rural sector, it is often argued that pricing the externalities reduces the competitiveness of exports, worsening external circumstances and hurting economic growth and employment. Since there is no willingness to pay for the negative externalities, there are no funds to finance those who generate positive externalities in schemes of payments for ecosystem services (PES).

Internationally, carbon markets are the most quoted example of economic instruments for environmental management. The proposal for credits from the Reductions of Emissions from Deforestation and Forest Degradation (REDD) would have created a new window for carbon markets in Brazil, but resources will not be available until the

new rules for the successor of the Kyoto Protocol are established and carbon markets recover their original dynamism. However, at that time the declining trend of deforestation in Brazil would have reduced significantly the additionality of REDD schemes – in other words, most of the possibilities of financing PES via REDD will be gone (even though new systems may appear willing to finance forest carbon stocks, rather than flows (May et al. 2011).

Final comments

The current structure of environmental management in the country remains based on "command and control" instruments. Even though the Brazilian environmental protection system can be considered as relatively advanced if compared to other Latin American countries, important issues remain unresolved, and the indicators of environmental quality in Brazil are still well below satisfactory.

This is due, on the one hand, the lack of investment in infrastructure and urban services (sanitation, public transportation, garbage collection, public housing), the persistence of large pockets of poverty (proliferation of slums and other degraded environments, as well as advance agricultural frontier in deforested areas) and consumption patterns that result in worsening of environmental conditions (the fast growing fleet of private cars is the most glaring example). Environmental aspects are still poorly integrated in the formulation of public policies, and the problem is compounded by the lack of information about the extent and significance of the problems resulting from environmental degradation. But the dynamics of erratic economic growth, rapid urbanization and the crisis of the state can be identified as part of the question, the management model adopted also proved inadequate to address several problems.

Therefore, the actual environmental managers recognize the need to seek more efficient ways to control. There is growing consensus on the need to ensure greater flexibility to the economic agents, and seek new sources of funding that are directly related to the causes of environmental problems.

The process of redistribution of income in Brazil has brought positive impacts both for employment generation and for improving the quality of life. But it has not been

enough: deeper changes are needed so that the momentum is maintained in the long term. The transition to a Green Economy creates a unique opportunity to redefine the direction of Brazilian development. Combined with advances in education, housing and citizenship, in general, the investment required for this transformation can simultaneously increase economic activity in the short term (eg, the need for reordering of large cities) and bring more “authentic” competitiveness in productive sectors, through innovation and professional qualification.

But this requires a redirection of economic efforts, which are currently focused on the model of exporting raw materials or commodities that largely have their competitiveness based on spurious factors, with unsustainable use of natural resources and no significant effects for social inclusion. In other words, the desired transition to a Green Economy will not take place without structural reforms, changing the role of the Brazilian state and the regulatory framework for this to happen.

This includes:

• The internalization of externalities through the implementation of the polluter-pays principle;

• The re-orientation of procurement policies, with the adoption of sustainability criteria and emphasis on socio-environmental certification; and

• The re-orientation of the principles of macroeconomic policy making, stressing the quality of growth rather than the quantity of growth, including principles for "green" taxation and finance.

Only this way Brazil can move towards an economy where the aggregate value will occur by increasing efficiency and innovation, instead of providing the lowest cost of agricultural or industrial fostered by public policy misguided investments in large projects infrastructure that cares little about the social costs of long-term consequences.

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