Memo: **Report**[1] **on BUS ticket no. 23**
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SUSTAINABLE IMPORTS OF BIOMASS FROM LARGE SCALE TREE PLANTATIONS IN BRAZIL

Definition of the problem
The large scale production of biomass in fast growing, short rotation tree plantations, e.g. in Brazil, is considered an option to meet the ambitious targets of the Dutch renewable energy policy. The production and trade in biomass will have to be in line with social, economic and environmental criteria of sustainable development, which should be worked out and tested in close cooperation with local stakeholders.

Questions
1. For which countries such certification systems can be worked out (e.g. Brazil)
2. How can the participation of local stakeholders be organized to prevent unwanted competition with other forms of land-use?
3. What will be socio-economic and environmental impacts of large scale biomass plantations?

Summary
The large scale production of biomass in fast growing, short rotation tree plantations, e.g. in Brazil, is considered an option to meet the ambitious targets of the Dutch policy on bio-energy and of the gradual transition towards a more bio-based economy. To release the pressure on existing forests, which serve multiple functions, the only way to increase biomass production on the long-term is through the establishment of fast growing tree plantations. Inevitably, this could have a large impact on the natural resources in the exporting countries, the exact consequences of which need to be analyzed in close cooperation with the local population and other stakeholders. Most actors agree that the production and trade in biomass will have to be in line with social, economic and environmental criteria of sustainable development. Important lessons can be learned from the current opposition in Brazil against the expanding area of Eucalyptus plantations to provide wood for charcoal production and for the pulp- and paper industries and from the ongoing 'soybean debate'(annex 1).

Benefits

Tree plantations offer numerous advantages when it comes to wood production. They are an efficient user of space and inputs in terms of the production of industrial wood per ha, offering easy harvest, allowing improved varieties, modern management practices, and shortened rotation periods, which make it a cheap production system (i.e. when not accounting for the loss of means of livelihood for local communities, in terms of conservation of flora and fauna, in terms of water resources and in terms of feeding local populations). Industrial plantations can produce a significantly larger volume of timber of more homogeneous quality, than natural tropical forests, but of course the quality of the wood is completely different. That is why natural forests continue to be exploited for a type of wood that is not available in plantations. Plantation timber is more adaptable to established industrial processes, particularly in the pulp and paper sector.[2] Aracruz Celulose in Brazil e.g records average growth rates of Eucalyptus plantations of 43m^3 per hectare per year on six-year rotations[3]. The importance of plantation timber to world markets is enhanced by the expected global shortage of industrial wood in the near future (which, by the way, is based on current overconsumption patterns which hardly can be considered sustainable).

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[2] http://www.cifor.cgiar.org/publications/Html/AR-98/Plantation.html
[3] Christian Cossalter and Charlie Pye-Smith 2003. Fast wood forestry: myths and realities, Bogor, Indonesia

An indirect positive effect of tree plantations on biodiversity is the assumed reduction of the pressure on natural forests. However, in reality this is not true: in many cases natural forests have been cleared to give way to plantations – particularly in Brazil. No matter how many hectares are planted with trees forests continue to disappear because the main cause of forest destruction is not primarily wood exploitation but land clearance for export-oriented agriculture (e.g. soy beans for The Netehrlands), cattle-raising and for dams and mining. The main land base for biomass plantations is primarily cleared and degraded forest lands, forest lands occupied by low-value commercial species or brush, marginal forest lands that have many physical limitations (e.g., poor soils, low rainfall, high elevations and steep slopes) and non-forest land, including extra-marginal cropland, savannah, and arid wastelands, which, by the way, can be of great value to local populations living in the area and for nature conservation. On the one hand, growing population pressure and increasing needs for food production makes it unlikely that biomass plantations will be grown on good cropland[4], but on the other hand plantation companies do not occupy lands with the type of physical limitations as described above: either the trees do not grow well in those environments (poor soil, low rainfall) and are prone to pests and diseases, or because they constitute a limitation to mechanisation (high elevations and steep slopes). Consequently, there are comparatively few cases where large-scale tree plantations have been established on degraded land[5].

Worldwide about 10 million ha can be classified as fast growing, short-rotation tree plantations for the production of biomass, supplying pulpwood to the pulp- and paper industries, charcoal for the steel industry and wood fibres to the panel and board industry. Annually, this area increases with 0.8 to 1.2 million hectares each year[6]. However, Ranney (1994) notes that less than half of this planted area could be considered successful or commercially viable[7]. In his opinion, successful biomass plantations are characterised by:

- more than 80% survival of planted materials;
- annual productivity greater than 10-12 dry tonnes/ha of harvested wood and bark;
- uniformity in diameter, height and straightness;
- less than $50/dry ton in delivered cost.

Eucalyptus plantations, totalling 3 million hectares at present, make up 40 percent of all tree plantations in Brazil. Eucalyptus for pulp is grown in Brazil in 5 to 7 years rotations. Annually the Brazilian forest industry is planting over 300 million trees for the pulp and paper industry only.

Negative impacts

An increasing demand for biomass from industrialized countries could lead to increased production levels and exports of raw materials in Brazil, in a market situation, which is characterized by very few - if any - regulations. In the worst case scenario (which, unfortunately, is basically the most common scenario), it would imply an unequal development scheme imposed on the local populations, which could enhance existing conflicts in land use, depriving rural populations of a sustainable means of livelyhood and traditional sources of income, disrupting the local economy and changing the delicate power balance. Favouring export-oriented biomass production systems in the form of large scale, short rotation tree plantations (dedicated woody energy crops), by substituting areas previously used for agriculture, could have a negative impact on the availability of water, soil and the biodiversity of local ecosystems (flora and fauna). The most frequently cited negative environmental impacts are:

- reduced soil fertility
- increased erosion and compaction of the soil
- loss of natural biodiversity
- reduced groundwater reserves and stream-flow

[4] Couto, L and. Betters, D.R. 1996 Short-rotation eucalypt plantations in Brazil: social and environmental issues
[5] http://www.sinkswatch.org/plants.html
[6] Christian Cossalter and Charlie Pye-Smith 2003. Fast wood forestry: myths and realities, Bogor, Indonesia
[7] Ranney, J. W. 1994. "Short-rotation Wood Energy Crop Improvement and Commercialization in Tropical and Temperate Zones," presented at meeting on *The Potential of Biomass Products, Energy Utilization Forum*, June 10-12, Taipei, Taiwan.

- increase in fires and fire risks

Many environmental groups are concerned too about the use of fertilizers, chemical weed control and pesticides, applied to guarantee the productivity of monoculture tree plantations, causing e.g. contamination of water sources. The fast growth rate of Eucalyptus species tends to impose a high overall demand on water resources. Short rotation plantations of Eucalyptus, therefore, must carefully match water demand to availability, in order to avoid irreversible degradation of the sites. One of the most serious disadvantages of monoculture tree plantations is the danger of pest and insect attacks, as well as their susceptibility to fire. To some degree, pests and diseases can be controlled through proper planning and management: creating enough diversity is normally the best way to minimize this threat, but these measures are no remedy for the other social and environmental impacts.
Tree plantations usually create less jobs than the agricultural activities which they substitute. From a social point of view, in some countries large-scale industrial tree crops have already resulted in fierce opposition at the local level, mostly arising from pre-existing conflicts over land tenure. Besides, tree plantations may discourage more environmentally and socially acceptable forms of land use such as community based (agro)forestry.

Opposition by local populations

Local populations are at the forefront of most struggles against plantations, whereas NGO's play an important role in disseminating information and providing analyses for local populations. The Third World Network is campaining against industrial tree crops in all cases where they are considered to be incompatible with improving the quality of life of local populations. Another example is the World Rainforest Movement, which in 2003 has issued a book on "Certifying the uncertifiable"[8]. The Brazil case study in this book stresses the concern of many NGO's about FSC-certification of large-scale tree plantations in Brazil. The Montevideo Declaration of June 1998 was a call for action to defend forests and people against large-scale tree monocultures, expressing the concern at the recent and accelerating invasion of millions of hectares of land and forests by industrial tree plantations. There are hundreds of NGO's who are actively opposing this plantation model. These environmental groups are now exerting considerable political pressure to make the establishment of Eucalypt plantations in Brazil unfavourable: a good example is the Alert Against the Green Desert Network, which was established 5 years ago, coordinating local communities and aid organisations in their struggle against the expansion of Eucalyptus plantations.[9] An example in South Africa is the Timberwatch Coalition, which has for years been involved in an anti-plantation movement in that country. The Latin America Network against Tree Monocultures, with focal points in all the countries in the region, was created in 2003 at the World Social Forum[10]. Other international actors actively opposing tree plantations are Friends of the Earth International, the Global Forest Coalition and Terra (in the Mekong delta).

Site selection for short rotation energy crops

One of the first challenges for any commercial activity requiring short-rotation energy plantations is to determine where suitable and available lands are located. A favourable site may allow a project to survive initial mistakes or miscalculations, while an unfavourable site requires great technical expertise, and even simple errors can result in major setbacks or failure. Unfavourable, low productivity sites usually lead to increasing expenses for road and harvesting infrastructure, increasing transport distances, less efficient harvesting, and greater potential impacts on the environment, society, and biodiversity.

Site selection and planning at the national, regional, and local level requires geographically located information on soils and geology, natural vegetation, current land uses, topography, watershed boundaries, stream/river systems, roads, local political jurisdictions, land ownership and tenure information, location of cultural and historical resources, location of nature preserves and rare habitats and species. It is also very valuable to have site-specific research data on the yields that can be

[8] http://www.wrm.org.uy/actors/FSC/uncertifiable.html
[9] Overbeek, W. 2004. Brazil: more pulp for export means more exclusion. WRM Bulletin 83, June 2004
[10] www.wrm.org.uy/actores/FSM/Quito.html

expected from the preferred species. Inadequate site preparation is the most common mistake made by companies and researchers initiating a new short-rotation tree crop project.

Key to producing low-cost biomass form energy plantations is the land base and the quality of sites, which determine to a significant extent the degree of site preparation necessary; the choice of species, spacings and cutting cycles; required cultural management and soil amendments (fertilization, weed control, animal control, and pest management); and fuel transport and logistics.
Economic studies have showed that the use of good cropland for energy plantations is more cost-effective than using marginal cropland or poorly stocked forest land. The additional cost of the land will be offset by lower establishment costs and, more importantly, higher biomass productivity. This is clearly the decision that investors would make, but it would be the worst decision from a social and environmental perspective[11].

The costs of plantation establishment in Northeast Brazil ranged some ten years ago from about $580 to $1170/hectare with maintenance costs varying from about $140 to $860/hectare over a seven-year rotation. [12] Much of the variation in establishment costs is due to planting costs. Carpentieri et al. (1993) cite planting costs ranging from $371 to $811/hectare for Northeast Brazil[13]. Localized variation in delivered feedstock costs can be illustrated by the data from Northeast Brazil, where average wood costs range from a low of about $1.00/GJ to $4.60/GJ, based on the use of high and low estimates for land, planting costs, and productivity differences, which in reality ranged between 3 and 21 dry tonnes/ha.(Carpentieri et al. 1993). The wood supply situation in northeastern region of Brazil, has a potential of transforming 197 million stères of roundwood each year into 19 thousand megawatts of energy per year, which is a tremendous potential[14].

The increasing price of the land and some new restrictions on plantations in south-eastern Brazil stimulated forest companies to begin local tree farmer programs to reinforce wood supplies. These programs, however, were not readily accepted by local farmers. Today, most of the forest companies in Brazil are adopting agroforestry as an alternative land use, mainly for their tree farmer programs. Agroforestry is likely to become a key point of plantation programs oriented toward the small farm operation.

Transports
Long distance transports of large amounts of woody biomass produced for export purposes to Europe, will place a major stress on Brazil's transportation system. However, it is certainly possible and very similar to other export commodities such as soy beans (see annex). A recent PhD study from the University of Utrecht indicates that imports of biomass from South-America to The Netherlands is economically more viable than importing it from other countries in Europe, in spite of the considerable transport distances (and without accounting for the externalities): on average the total production and transportation costs amounted to 40 euro per dry ton from Brazil against 70 euro per dry ton from Europe[15]. Alternatively, the biomass could be converted into energy carries with a higher energy content, such as ethanol, methanol, hydrogen or Fischer-Tropsch diesel, prior to their shipment to Europe. This would further reduce transportation costs.

Conclusion
When planning to establish large areas of fast growing, short rotation tree plantations in Brazil for the production of biomass for export purposes, significant problems are likely to occur. The fact is, that

[11] Personal communication from Ricardo Carrere, coordinator of the World Rainforest Movement
[12] Couto. L., et al. 1993. "Agroforestry as an alternative to reduce establishment costs of short-rotation eucalyp plantations in southeastern Brazil," in *Opportunities for Agroforestry in the Temperate Zone Worldwide*, proceedings of Third North American Agroforestry Conference, August 15-18, , Iowa State University, Ames.
[13] Carpentieri, A. E., E. D. Larson, and J. Woods, 1993. "Future Biomass-Based Electricity Supply in Northeast Brazil," Biomass and Bioenergy, 4:149-174.
[14] Couto, L and. Betters, D.R. 1996 Short-rotation eucalypt plantations in Brazil: social and environmental issues.
[15] Carlo Hamelinck. 2004. PhD thesis, University of Utrecht, The Netherlands

each year the area of fast-growing tree plantations in the world expands by around one million hectares, whether we like it or not. It cannot be denied that the planting of large areas of eucalypts, acacias, pines and poplars has sparked off a lot of controversy. Some claim plantations have already destroyed the environment and displaced small farmers. Others say they will help protect natural forests and provide economic growth. No matter how good or how bad these plantations are going to be managed, even in a sustainable way, the controversy will remain. Given this delicate and complex problem which has not only a technical, economical and environmental aspects to it, but also an ethical, political and social dimension, the question is valid: would **you** like to become involved in large scale tree planting programmes in Brazil? It certainly is not easy to answer this question with a straight 'yes'or 'no'.

We hope that this 'quick scan' has presented some of the pro's and con's of the ongoing debate on fast-growing tree plantations. Focussing on a particular area in Brazil (case study) would be helpful to put the plantation issue into a practical and realistic perspective, allowing e.g the feed back of local governments and NGO's.

Follow-up?

1. Make a list of challenging statements on plantation forestry; ask for feedback from the BUS
2. Present these statements to a selected number of NGO's and invite them to react
3. Formulate a draft vision on tree plantations for the sustainable production of biomass for the export and discuss it with in a broader platform, e,g participants of the Transition on Biomass

Reaction from the World Rainforest Movement

Dear Leen,

Thank you for requesting our input regarding your quick scan on tree plantations for biomass.

Let me raise a crucial question first: has the Dutch government analysed all the possibilities for reducing energy consumption, improving energy efficiency and developing alternative energy sources in The Netherlands itself, or is it simply trying to access cheap energy (externalizing costs to other countries) while portraying itself as environmentally-friendly (using biomass instead of fossil fuels)?

From your draft it becomes apparent that the real motivation for this idea is simply economic: accessing vast amounts of cheap and homogeneous raw material. This is exactly the same motivation of the pulp industry's plantations in developing countries and – if implemented - would exacerbate the current struggles against plantations in Brazil, or in any other country.
The idea is simplistic and looks at only one issue – the substitution of fossil fuels by biomass - while ignoring all the social and environmental problems it would generate if implemented at the necessary scale to meet an important part of the energy currently being used in The Netherlands. It would imply the appropriation of large areas of land in a country like Brazil, which already has acute land tenure problems and where both landless peasants and indigenous peoples are claiming for lands. For such a scheme to be successful (from an economic perspective), those plantations would need to be established near the coastal areas (because the wood or the transformed energy would be aimed at export and transport costs would need to be kept low). These are precisely the areas which are being claimed by large numbers of landless people. Additionally, those plantations would generate less jobs than any other possible uses of the land – as already proven in existing pulpwood plantations- and would therefore result in the further expulsion of rural populations.
From an environmental perspective, large-scale tree monocultures have already proven to be – in Brazil and in every single country where they have been implemented - detrimental to local biodiversity and have depleted water resources. Would this be considered as "environmentally-friendly"?

From all the accumulated experience regarding large-scale, fast-growth tree plantations, the only possible suggestion on this plan to produce biomass abroad based on this type of plantations is that it should *never* be implemented.

It is, therefore, fair to raise the question: Why is the Dutch government not planning to cover degraded land in the Netherlands with fast-growing tree plantations to provide biomass? I'm sure we could find a couple of

experts from Brazil who would find that around 75% of the countryside in the Netherlands is, in fact, degraded and therefore more suitably used for fast-growing tree plantations (the logs could perhaps be shipped to Brazil to feed Brazil's pulp mills). This would of course sound ludicrous to most Dutch people … and the same can be said about how your idea can sound to Brazilian people.

Ricardo Carrere, coordinator World Rainforest Movement
Date: August 18, 2004

ANNEX 1: THE SOYBEAN DEBATE

When considering the potential development of large areas of energy crops supplying the export market, there are lessons to be learned from the development of soybean production in Brazil over the past decades. Apart from technical barriers related e.g. to production and transportation, Brazilian soybean production is facing increasing opposition from NGO's, who question the large scale land clearing and its negative socio-economic and environmental impacts for the local populations[16]. The same problems may be expected when trying to establish hundreds of thousands of hectares of fast growing, short rotation tree plantations for biomass production[17].

Brazilian's soybean production potential

In the seventies major soy importers - Japan and Europe - began seeking alternative sources of animal feed protein. Attempting to encourage the growth of soybeans in Brazil, Japanese investors bought land in Brazil for soybean production. Since then, soybean production has increased from 5 million metric tons in 1973 to about 38 million metric tons in 2001 (table 1). Today, Brazil is the world's second largest soybean exporting country. In 2004 the Brazilian soybean production exceeded 60 million tons, which may very well double in little more than 10 years time, just as it did in the past 3 years.

Table 1: Top Producers of Soybeans in 2001 (million metric tons)

USA	Brazil	Argentina	China	India	Canada
79	38	26	15	6	3

Soybean production in 1970 was predominantly in the southern states of São Paulo, Paraná, Santa Catarina and Rio Grande Do Sul. Increases in soybean areas in these states has come at the expense of rice, peanuts, potatoes, corn, cotton, coffee, and grazing land. The most spectacular growth in Brazilian soybean areas has occurred in the state of Mato Grosso and the cerrado area of central Brazil.[18] The Brazilian cerrados are responsible for half of the current production, making a whole region dependent on a single crop.
The cerrado area often is defined as a wasteland with stunted twisted trees. The cerrados are not rainforests. The soils of the cerrado are highly acidic, saturated with aluminium, deficient in phosphorous and have low water-holding capacity. However, the soils in the cerrados proved to be deep and well drained with excellent physical characteristics suitable for mechanized crop production.

About 46 percent of the cerrados (234 million acres) are suitable for large-scale crop production. The rapid growth in soybean production in the cerrados has been made possible by modern mechanical, chemical and biological technologies. The mechanical technologies allow relatively inexpensive clearing of virgin cerrado land for crop production and for low-cost soybean planting, cultivation, harvesting, and drying. On average, virgin cerrado land can be put into production for about U.S $620,- per hectare. Fertilisation has corrected the low fertility, high acid soils through the application of limestone, phosphate fertilizers and trace minerals. However, correcting these soil deficiencies is relatively expensive.

Transportation problems

While Brazil has a large advantage in soybean production over the US, its transportation costs will likely remain much higher than U.S. transportation costs. Brazil's distribution system is antiquated by U.S. standards: about 80 percent of Brazil's soybeans are trucked to market. Trucking distances can range up to 800 miles to the market. The quality of most roads is poor and a substantial portion of the

[16] Seminar on Sustainable Production of Soy: a View on the Future Industry - NGO dialogue on soy production initiated Hhttp://www.aidenvironment.nl/?uodPage=newsitem&uodNewsitem_Id=news_7H
[17] Hhttp://www.wwf.ch/default.cfm?contentstring=4111&spr=deH
Hhttp://www.omroep.nl/rvu/sites/nep/2003/groenegoud.htmlH
[18] http://www.extension.iastate.edu/agdm/articles/others/McVOct00.html

nation's highways are dirt surfaced. Brazilian railroads too are in poor physical condition after years of neglect under government ownership. Even though it is modernizing, Brazil's railroad system is likely to remain a limited capacity, high cost mode of transport for years to come. The development of the three navigable rivers (the Rio Madeira, the Hidrovia Paraguay – Parana, and the Hidrovia Araguaia – Tocantins) may solve many of the transportation problems facing Brazil's soybean industry.[19]

The Rio Madeira offers the best hope for improving grain transportation in Brazil, because it is a free-flowing navigable river that is already in full operation. Nine-barge tows move up and down the Rio Madeira, each barge carrying 2,000 tons. A modern barge loading facility is located at Porto Velho and a small, but modern barge-to-ocean vessel transfer facility is located at Itacoatiara on the Amazon River. The Madeira waterway has a capacity to move between 2 and 3 million tons annually without investments in the river. Thus, the Rio Madeira has opened the *New Frontier* in Mato Grosso to world soybean markets. Sapezal is the center of the new soybean producing area in Mato Grosso. Soybeans have to be transported to Itacoatiara on the Amazon River where the soybeans are loaded into ocean vessels. These vessels must travel up to 1,000 miles to reach the Atlantic Ocean. Almost all of Brazil's soybean exports go to Western Europe.

Increased soybean supplies will place a major stress on Brazil's distribution system, but despite these transportation problems, Brazil's land clearing and soybean production will likely continue at a high rate and Brazil's soybean exports will continue to grow.

Viewpoint of NGO's

The Dutch NGO's *Both Ends* and *Aid Environment* have done a lot of work on assessing the pro's and con's of soybean production in Brazil. In this so called 'soybean debate', which has been going on over the last decade, numerous barriers have been identified, partner organisations have been consulted, discussions have been set up about trying to bridge the gap between the poor and the rich and to solve the controversy between the agricultural use of land and nature conservation. The increased competition for productive land is a very complex problem involving many stakeholders. Frequently, local farmers have lost their livelihood and employment because soy bean companies have bought the lands where they used to work and live. Many studies have recorded the social and environmental impacts of large scale soybean production schemes.

Conclusion

For dedicated energy crops, which are likely to be established on a large scale in Brazil to supply the export market for Europe, similar barriers and problems may be expected. It would be very unwise to neglect the ongoing discussions and campaigns against industrial monoculture crops, which involve intensive land clearing, preparation of the soil, fertilisation, chemical weeding, use of pesticides, mechanized harvesting and long distance transports. The more so, when they prove to be incompatible with improving the quality of life of local populations.

[19] http://www.extension.iastate.edu/agdm/articles/others/McVeyNov00.html