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THE RIO AGENDA REDEFINED: AGRICULTURE, FORESTRY AND ENVIRONMENT IN THE ERA OF BIOENERGY

by

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"The environment is where we live and development is what we all do in attempting to improve our lot within that abode. The two are inseparable." – Our Common Future (the Brundtland Report) (UNEP, 2007)

RIO FOLLOW-UP: OILING ONLY THE SQUEAKY HINGES?

If one assessed the importance of things by the column-inches in the popular and environmental press, the first impressions would paint an amazing scenario of our world today: fossil fuel already marginalised by biofuels; all of us and our world about to fried alive by global warming; species extinction so advanced that even our domestic animals risk extinction and we are ourselves spared only because the numbers show we are breeding like rabbits. Environmental advocacy has been honed to perfection in alarming our collective subconscious.

In this presentation, no alarmist signals will be given; it is taken as accepted conventional wisdom that not all is well with either the environment or with the world economy. For both environment and development, much needs fixing – some of it urgently, but deliberate thought and prioritisation rather than panic signals will probably be best for success. An overall point of worry is the inequalities among countries in the developed and developing categories, between industrial and developing countries, among regions, and among strata of society within any one country. Indeed, there are what some describe as "obscene" levels of contrast within individual companies, with Chief Executives of the top 500 companies earning 411 times more than the average workers compared to 107 times in 1990.[2] .

The presentation is based on awareness of myriad solutions being promoted and which cannot all be accommodated in a short note or slide show; therefore it mentions some selectively but focuses instead on raising some key questions. In essence: *the reality is that UNCED, whose main attribute is balance and logic, appears to have been tilted and redefined towards stressing action on the most visible and loud signals*. In line with newspaper column inches that imply atmospheric apocalypse and the need for climate change adaptation now, there is massive attention to this issue, at least in energy-linked responses. As the papers scream more about the energy crisis and how best to use crops as a solution, attention goes to the biofuel solution. The more muted prophesies about erosion of biological diversity, desert creep and progressive shrinking of forests and depletion of fish stocks appear to attract less visible (and perhaps even in fact less significant) efforts at corrective action.

UNCED follow-up also appears to be redefined by silence: little is said about the fact that the rich and comfortable show little willingness to tighten their belts – to reduce their levels of consumption, to use

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[2] Gross, D. 2007: ***Split by decision - special report "Why the rich are getting richer***". Newsweek, Nov 12 2007.

resources significantly more sparingly. They claim to use energy more efficiently but they still use a lot of it in proportion to their share of the world's population. Indeed, the rich save on one thing and then appear to diversify to new ways of over-consumption: they may use less power at home but they fly longer distances and more often for holidays or to supervise globalised business interests; they eat more exotic food, some of which has to be shipped far; they spend energy to cool food that took more energy to heat and heat what took energy to cool; they wrap their shopping more elaborately; they generate more waste, both industrial and domestic, etc.

On balance?: the Rio agenda may have been hijacked by topics within it that have the ability to attract positive media attention. Therefore, there is the possibility that those who know best how to access the media may be driving the post-Rio environment/development agenda than we realise. Such knowledgeable groups are very unlikely to be the poor.

Mindset change may be another challenge to post-Rio follow-up: when analysts and commentators look at fast-growing developing economies, they emphasize how much the new economic aspirants will deplete resources and never talk of the industrial countries to reduce their demands to accommodate the modest ambitions of others. Indeed, the spirants are often portrayed as irresponsible and greedy even though their total consumption remains dwarfed by the collective appetite of industrial countries. In fact, a few key industrial countries appear to keep "market" signals switched off regarding key consumables, including fuels – the prices they pay do not yet reflect scarcity or intent to moderate consumption so that other aspirants may also have a decent share.

THE AMBITIONS OF RIO

(1) Since the 1972 UN Conference on the Human Environment held in Stockholm, the relationship between economic development and environmental degradation has remained at centre-stage in policy dialogue. Action may not have been impressive but the collective conscience has been alerted and upon observing that the environment continued to deteriorate, the UN organised UNCED - the 1992 UN Conference on Environment and Development (Rio Summit) in 1992 to secure renewed commitment. The preparatory process gained much from the seminal analysis and advocacy of the World Commission on Environment and Development (the Brundtland Commission), which launched the concept of sustainable development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

Box 1: Selected Principles of the Rio Summit Declaration

Principle 1: Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 6: The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.**

Principle 8: To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 15: In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 16: National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Source: (UN-ECOSOC, 1992)

With 108 heads of State or Government in attendance, the Rio Summit gave witness to a hitherto level of shared preoccupation with sustainability of the way the world was managing its economic and environmental matters. UNCED adopted three major agreements aimed at promoting the "development with environment" paradigm: (a) The Rio Declaration on Environment and Development — a series of principles defining the rights and responsibilities of States – selected ones in Box 1; (b) Agenda 21 — its comprehensive action programme; and (c) The Statement of Forest Principles — a compromise text on one of the most contentious sectors at Rio. Furthermore, Rio opened for signature two legally binding Conventions – on climate change and on biological diversity. The Summit called upon the UN to negotiate an international legal agreement on desertification, to develop an action programme for sustainable development of small island states, to follow up the issue of preventing the depletion of threatened fish stocks, and to establish mechanisms for ensuring the implementation of the Rio accords. All of the Agenda 21 and basic principles of UNCED are inter-connected. Nevertheless a few chapters particularly linked to the topic of this paper can be targeted for highlighting what the ambitions of UNCED were in 1992:

- Chapter 3 (*Combating Poverty*) focused on providing all persons urgently with the opportunity to earn a sustainable livelihood
- Chapter 4 (*Changing Consumption Patterns*) highlighted the environmental stress caused by wastefulness and unsustainable consumption patterns of natural resources and energy by both the poor and the rich, although in different ways. It stressed that the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialized countries. It called for developed countries to take the lead in achieving sustainable consumption patterns while developing countries were to . . . avoid in their development processes repeating those unsustainable patterns (particularly in industrialized countries) that were unduly hazardous to the environment, inefficient and wasteful.. A pillar of action was to be influencing consumer behaviour towards responsible consumption patterns driven, *inter alia*, by "proper stimulus of prices and market signals that make clear to consumers the environmental costs of consumption for energy, materials and natural resources etc
- Chapter 8 (*Integrating Environment and Development in Decision-Making*) has a self-explanatory title. The thrust was to reverse the tendency to treat the environment as a "free good" or to pass its costs on to other parts of society, other countries, or to future generations; UNCED desired that mankind increasingly move towards prices that appropriately reflect the relative scarcity and total value of resources and thus contribute towards the prevention of environmental degradation; (*US oil policy*)
- Chapter 9 (*Protection of the Atmosphere*) focused on reducing greenhouse gases and erosion of the ozone layer through responsible practices in use of energy, conservation or enhancement of all sinks for greenhouse gases; and conservation and sustainable use of natural and environmental resources.
- Chapter 11 (*Combating Deforestation*) sought conservation, creation of additional resources, and sustainable use of forests. The chapter was supplemented by adoption of a non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests. "Greening" of the world was a prominent goal.
- Chapter 14 (*Promoting Sustainable Agriculture and Rural Development*) tackled the most extensive land use and how to enable it feed a population increased to 8.5 billion by the year 2025, with 83 per cent in developing countries. It offered "increasing production on land already in use" and "avoiding further encroachment on land that is only marginally suitable for cultivation" as key principles, yet with both to be followed without environmentally bad practices such as heavy use of chemicals.

What has happened about these ambitions? Is the world still pursuing as balanced an agenda as it adopted? Has the entry of costly fuel and its biofuel response diverted the follow-up action? The sections below look at these questions, even if in anecdotal way.

WHERE HAVE WE GONE SINCE?

Environmental change and development challenges are caused by the same sets of drivers (population changes, scientific and technological innovation, distributional patterns, and cultural, social, political and institutional processes, and processes. (UNEP, 2007). As an indication of the pace of change: *Since the Brundtland Commission. World population has increased 30%, trade threefold. The drivers do not exert pressure equally everywhere*

Poverty

Placing man at the centre of concerns for development (UNCED principle No 1) should surely mean uplifting above poverty. In this sense, the post-UNCED period has seen considerable overall global improvement. According to the World Bank, due mostly to rapid growth in China and other Asia-Pacific economies, the proportion of people in the developing world living in extreme economic poverty (living on less than $1 per day) has fallen from 28 percent in 1990 to 21 percent in 2001.

The challenge remains in Sub-Saharan Africa, where GDP per capita shrank 14 percent, poverty rose from 41 percent in 1981 to 46 percent in 2001, and an additional 150 million people were living in extreme poverty.

There is also the growing challenge of increasing inequality in incomes and prosperity within regions, within countries, and within society and companies as "*winner-takes-all*" philosophies and economic systems take hold globally. Summarising the state of play in Newsweek, Gross (2007) stated that "*the rich are getting richer due to market forces – and to very human choices*". He quoted one observer as saying "*The top 10 to 20 percent is pulling away from the rest because of education, job skills and connections*". The returns to capital and management are far higher than to labour; consequently, even as the numbers of billionaires increases, the numbers of destitute also seem to climb and the middle class thins out. It is hard to say that UNCED would see both the super-rich and the new poor as being "at the centre of concerns for sustainable development" in the same way: the first group can control its environment while the other is often victim to it. The poor today, as in 1992, really have so many pressing survival challenges that environmental soundness may not float to the top as their priority.

Consumption patterns

In many ways, Chapter 4 of Agenda 21 (*Changing Consumption Patterns*) would, if fully implemented, probably make some of the most fundamental change in the approach to environment and development. It is abusive consumption, excess use of natural resources, wastefulness etc of the current developmental models that are causes of stress to the biosphere. A key dimension of consumption patterns is quantity: *since Rio, industrial countries have - despite their minority share of global population - continued to consume disproportionate shares of food, fuel, shelter, natural resources, packaging etc*. To meet demand for these products, they also pollute beyond their share or induce developing-world suppliers to pollute as they manufacture or farm to satisfy industrial-country consumer appetites.

Reviews of UNCED follow-up progress continue to be presented to the Commission on Sustainable Development but breakthroughs are relatively modest: almost complete replacement of ozone-depleting refrigerants with benign ones; some substitution of heavy-sulphur fuels with cleaner ones; in new industries, greater energy efficiency. On climate change, massive awareness-raising has led to post-Kyoto efforts to set firm goals and commitments. Research has also gone far and although there are no certainties, there has been partial breakthrough in getting countries to adopt a precautionary principle. This means doing nothing to worsen matters; and acting as if there is certainty of harm until proved otherwise. Part of the assessment has involved modelling of impacts (Box 2) on the basis of which speculative adaptation prescriptions are already being formulated.

"Consumption patterns" means little if it does not draw attention to the glaring contrasts in resource use between the rich (countries or individuals) and the poor. In this, it may be an unpalatable reality that society has tended to polarise more in wellbeing and its indices: a few have become extremely rich; many others have become relatively or absolutely abysmally poor. With the contrast in incomes has also come contrast in consumption patterns, in capacity to consume and to wreak havoc on nature.

Box 2: Climate change: modelled impacts on agriculture

The assessment of agro-ecosystem sensitivity to climate change (under the different socio-economic IPCC scenarios) by the FAO/IIASA Agro-Ecological Zones (AEZ) model is combined with a model of the global food system. Without going into methodological details and assumptions, indications are:

- Globally aggregated impacts are small (-1.5% – +2.6%) in terms of changes in GDP from agriculture: -0.8 – +3.1% over all regions).
- The agricultural GDP in developed countries would likely benefit from climate change.
- With the exception of Latin America, developing countries would face a decrease of GDP from agriculture due to climate change. Asia (-4% for high emission scenarios) and Africa (-2 – -9% for 3 of the 4 GCMs) would generally be negatively affected.
- North America could gain in all scenarios, as could the former USSR, from climate-induced changes in production conditions. Western Europe though, would lose in all scenarios.

In developing countries, 11 percent of arable land could be affected by climate change, including a reduction of cereal production in up to 65 countries, about 16 percent of agricultural GDP.

Source: (FAO, 2007a)

On the "low-progress" side, land-clearing and consequent deforestation continues to be rapid; waste generation, including of potentially recyclable materials continues, although in pulp and paper the ratios recycled are increasing. More fundamentally, three things emerge:

- pricing of key consumables, especially fossil fuels, do not yet reflect scarcity value in some key economies – indeed in many cases correct price signals are blunted by subsidies and other policy interventions;
- Over-harvesting of natural resources to meet insatiable appetites (fish, forests, minerals, etc) continues, often with public concurrence and even subsidies; and
- In attitudinal terms, mankind still measures "progress" by the extent to which too much is consumed – water, power, steel, concrete etc; those that drive fuel-guzzling SUVs are still objects of admiration. Accordingly, as two Asian mega-economies start to grow, the comment is rarely about how over-consuming western economies can reduce consumption so as to leave some resources for the emergent countries but more often a lament that these new entrants are seeking to catch up with consumption levels of the west and are being unfair to the world in having this ambition.

Land use

Regarding Chapters 11 and 14, which being land-using offer the bulk of space for biodiversity conservation (other than marine), the situation now is sobering (Box 3). Deserts continue to grow (Box 4).

Box 3: Highlights on the state of biodiversity

A target agreed by all Parties to the Convention in the Hague in 2002 "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth." but biodiversity is being lost at all levels. The demand for resources at the global level now exceeds the biological capacity of the Earth by some 20%. The highlights of the situation are:

- Deforestation: since 2000, 6 million hectares of primary forest have been lost annually
- Marine and coastal ecosystems: in the Caribbean, average hard coral cover declined from 50% to 10% in the last three decades. 35% of mangroves have been lost in the last two decades
- Protected areas: cover some 13% of the world's land area but unevenly distributed, with only 2/5 of the world's ecoregions reaching the 10% benchmark; only half percent of marine areas are covered
- Abundance of species: 40% loss between 1970 and 2000; species present in rivers, lakes and marshlands have

declined by 50%
- Large fish: in the North Atlantic, their numbers have declined by 66% in the last 50 years

Source: (CBD, 2007)

Box 4: Highlights on the state of desertification and arid ecosystems

Worldwide, some 70 percent of the 5.2 billion hectares (ha) of drylands used for agriculture are already degraded and threatened by desertification. Desertification is a worldwide problem directly affecting 250 million people and a third of the earth's land surface or over 4 billion hectares. In addition, the livelihoods of some one billion people who depend on land for most of their needs.

Africa has two-thirds of its area desert or drylands; over 30 percent of the United States is affected by desertification; one quarter of Latin America and the Caribbean is desert and drylands. In China, since the 1950s, sand drifts and expanding deserts have taken a toll of nearly 700,000 hectares of cultivated land, 2.35 million hectares of rangeland, 6.4 million hectares of forests, woodlands and shrub lands.

Source: (UNCCD, 2007)

Forests

Forests, the most contentious of ecosystems at UNCED, has continued to generate interminable international dialogue under fora that started with the Intergovernmental Panel on Forests established after the first review in 1995 by the third session of the Commission on Sustainable Development (CSD3). In the Secretary-General's report to that meeting, some promising developments had been reported, many to do with awareness, policy change, and efforts at institutional improvement. The Secretary-General pointed to the following main areas of convergence but also of divergence:

- *All interest groups, without exception, endorse the goal of achieving SFM; they are, however, taking different paths towards it. The proposals of all groups would ultimately lead to the same goal of SFM, which involves achieving a balance between conservation and use of forests that does not damage their multiple ecosystem capacities and at the same time meets human development and social needs. Nevertheless, three years after UNCED, the deep convictions that interest groups in the sector hold concerning the kind of action that should be taken to fulfil this common goal do not fully coincide; in some cases, they remain markedly divergent.*

- *The main ways in which interest-group perceptions differ are the following: (a) they do not all have the same perception of the meaning of "unimpaired" forest and attempts to establish the "natural state" of the forest as an alternative have not settled the problem; there is no universally accepted definition of sustainability in forestry; (b) interest groups cannot agree on establishing boundaries to sustainability: some groups seek to ensure sustainable management of all forests everywhere, while others do not believe that to be possible; and (c) timetables for achieving SFM vary considerably: the impression is given by some interest groups that SFM must be achieved immediately, while others envisage a more progressive transition.*

- *These contrasting perceptions partly explain the lack of coherence in post-UNCED activity, as reflected in numerous sector meetings. High visibility has been given to intergovernmental processes, but non-governmental organizations and the private sector have also been active. Thus, much activity and debate has been confined to parallel forums that effectively isolate the three main constituencies: governments, non-governmental organizations and the private sector.*

The report could also have referred to mankind's inability to fund forest conservation and development at a meaningful scale: action programmes and national action plans continue to be prepared but many remain unfunded. The continuing threats are reflected in the progressive erosion of the resource base (Box 5); pressures on forests, which at present are largely in developing countries, could well expand significantly to industrial countries, should the economics of fuel drive demand towards alcohol made from cellulose rather

than mainly annual farm crops. The CSD3 review report of the Secretary General also brought to the attention of the Commission some three items with a political dimension, which had gained a particularly high profile or which affected the vital interests of groups of member States or interest groups (FAO, 1994):

- *The provision by Governments and concerned intergovernmental organizations of forums at the global and regional levels that are open to all interest groups for early consensus-building on forests, with a view to achieving an early convergence of purpose for subsequent concerted action among all groups;*

- *The direction of action to follow up the Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests, and the need or otherwise for its further elaboration into a legally binding instrument;*

- *The institution of a dialogue to address urgent trade and environment-related issues concerning products from all types of forests, with a view to accelerating the replacement of the current system of unilateral restrictions with a measured transition to trade based on products from sustainably managed forests, as measured through agreed criteria and indicators.*

Box 5: The state of forest resources 2005

Deforestation, mainly conversion of forests to agricultural land, continues at an alarmingly high rate – net change in forest area in the period 2000–2005 is estimated at –7.3 million hectares per year down from –8.9 million hectares per year in the period 1990–2000. Net forest loss is fastest in Africa and South America;

On average 104 million hectares of forests were reported to be significantly affected each year by forest fire, pests (including insects and diseases) or climatic events such as drought, wind, snow, ice and floods;

Plantation forests are increasing but still account for less than 5% of total forest area; (e) One-third of the world's forests are primarily used for production of wood and non-wood products while 11% of the world's forests are designated for the conservation of biological diversity;

Primary forests account for 36% of forest area – but 6 million hectares are lost or modified each year;

More than 300 million hectares of forests are designated for soil and water conservation

Source: (FAO, 2006b)

By now, more participatory ways of doing business are commonplace, even if formalised fora may not be. Indeed, many key forestry fora under the United Nations remain intergovernmental, with other major groups being allowed in as observers rather than principal stakeholders.

With regard to point (b), the idea of a Forests Convention does not seem to have gone through; there were always questions as to whether the Convention would have meant more effective action in practice and would have facilitated more significant mobilisation of funding than the non-legally binding processes have done so far. It may be recalled that implementation of Chapter 11 of agenda 21 (Combating deforestation) had a budget of US$31 billion to year 2000, of which some a fifth from international co-operation. According to one source (FAO, 1994. p 29) at that time, annual Official Development Assistance was some US$1.5 billion, less than 40% of the annual requirements. There was thus need for funding to increase at some 20% annually – this has yet to be seen – the average in the late 1980s was some 16% annually.

With regard to unilateral trade restrictions linked to environmental concerns (such as avoidance of tropical timbers) – no full and universally accepted solution is yet in place. The age-old argument that bans and restrictions fall under local government mandate and cannot be interfered with is often still applied. It may be noted that no environment-related trade restrictions or disincentives are reported for products that waste far more resources to produce steel, aluminium, etc), even when benign biological substitutes exist. The very local governments that are happy to ban tropical timber show little hesitation in allowing energy-intensive construction materials to continue being used in abundance (see Annex 3 carbon footprint comparisons of timber with other construction materials). A new development in use of environmental considerations to dislocate trade is "carbon-footprint" campaigns against air-shipment of tropical horticultural products to industrial-country markets (Box 6) – some believe this is a front for trade protectionism.

Box 6: Protectionism masquerading as carbon footprint concern?

Recent alarms with considerable potential to dislocate developing country trade relate to horticultural products especially cut flowers shipped by air from the tropics to industrial countries. Some NGOs (with a possible eye on protecting jobs at home?) have launched a high-profile campaign against what they claim to be the heavy negative "carbon footprint" of airlifted tropical products.

With a penchant for quoting statistics in a manner that can cause most injury, one analyst in Britain mentions, for example, that these products produce *"50% of all emissions from fruit and vegetable transportation. . ."* (McGregor, quoted in Malo 2007) conveniently neglecting to make comparisons not just for transportation but for the entire production and value-added chain from garden till consumer. Such a fuller comparison would more reasonably compare products from the tropics grown with natural sunshine against industrial-country products raised in fossil-fuel heated greenhouses.

If this were done, it is NOT obvious that the tropical products would come out worse, which is what happens if only the transport segment is compared.

In the area of conservation of biodiversity, the continuing greater use of plantation species (including rubber wood) was in some regions already taking some pressure off prime species or from scarce indigenous species in general (p4). An example of voluntary internal environment-linked trade restrictions within a number of developing (mainly Asian) countries involves banning timber harvesting in natural forests (FAO, 1998). A common observation is that imports then increase including from countries where only lax controls on irresponsible forest harvests exist. The question that has arisen from this has been one of whether it does not merely export the problem to weaker countries

Energy

Relative significance

The amount of energy consumed *per capita* is as good an index of economic progress as any, whether or not that energy is used efficiently or is environmentally benign. In fact, for energy more than for any other index of prosperity, excess and waste continue to be perceived as evidence of wellbeing rather than a negative, counter-UNCED index.

Accepting this reality for the moment, most energy – especially the commercial variety - is now consumed in industrial (rich) countries. Estimates of annual per capita energy consumption (in tons oil equivalent – toe) in 1990 was 1.5toe for the world; 7.5 (USA); 3.5 (EU); 0.9 (Latin America); and 0.5 (Africa) (Anonymous manuscript, undated). As prices of largely petroleum-based commercial fuels goes up, the pressure is on to secure substitutes, with biofuels a prime target alongside the hydro and nuclear options.

Overall, biofuels are, of course, only novel if one does not live in Africa. There, biological fuels in the form of fuelwood have for long accounted for well over 70% of energy use. But fuelwood has no dynamism; it is in commercial liquid biofuels that rapid changes are taking place due to high petroleum prices and to a desire for ecologically "cleaner"[3] liquid fuels. Box 7 lists some more direct policy and institutional drivers of the increased use of liquid biofuels.

At present, (World Bank, 2007) of the global fuel ethanol production of around 40 billion litres in 2006, about 90% was produced in Brazil and the United States; of over 6 billion litres of biodiesel, 75 % was produced in the EU. *The US used 20% of its maize crop to produce ethanol in 2006/7* and this thought to explain a maize price rise of 23% in 2006. In significance, fuels made from agricultural crops are low in proportion to the total energy demand – certainly below 5% globally, as the following numbers reveal how insignificant the crop fuels are in the energy sector (despite their demonstrated capacity to change the face of agriculture):

- Worldwide, biofuels account for just over 1% of transport fuels and is expected to be 5% or 6% by 2020 (World Bank, 2007);

- The entire US corn crop of 11 billion bushels would give only 30 billion gals of ethanol (21 billion gallons gasoline equivalent) vs. total 140 billion gallons gasoline used per year. *Since only a third of corn is expected to be diverted to fuel, the ethanol will offer about 5% of gasoline needs.* Biofuels do NOT therefore reduce US import dependency to a significant degree. It would be easier to use less oil (Doering, O. Purdue Univ ID340W, undated);

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[3] (De Matas, C. 2007) There are some protests at the assumption that biofuels are necessarily environmentally superior or benign. For example, de Matas argues that biofuels should be produced with very little (adverse) environmental impact: without toxic chemicals and with minimal soil erosion. . . . . conventional agricultural methods with high inputs of fertilizers and pesticides will produce negative energy and be unsustainable in the long run. He reports that to this end, "Germany is now cutting its subsidy on bio-diesel". Desmond refers to a recent OECD paper which reportedly asks "*whether biofuels are a cure that is worse than the disease they seek to heal*" and whether "*subsidizing governments could end up supporting a fuel that is more expensive and has a higher environmental impact than its corresponding petroleum product*.' Malo (Malo, M. manuscript 2007) suggests that since vast amounts of raw material are needed for biofuel production, monocultures and intensive farming may be the selected mode of production, which may cause environmental damage and undo some of the progress made towards sustainable agriculture.

- At an estimated 8 billion gallons in 2008, biofuels will be about 5% of US gasoline consumption; further growth will almost certainly require recourse to cellulose-based ethanol (Hurt, C. et al Purdue Univ ID339W, undated);

- Petroleum accounts for about 98% of EU transport fuels; biofuels comprise slightly more than 1%. In 2004, Western Europe consumed over 270 million metric tons (MMT), or approximately 89 billion gallons, of road transportation fuel (projected to reach in the EU 325 MMT by 2020) (Schnepf, R. et al 2007);

- In 2005, renewable energies accounted for only 6.5 % of energy use in the European Union. *I*n 1997 the EU set a target for 2010 of having 12% of its primary energy consumption derived from renewable energy sources, such as wood. In 2007, more ambitious targets were announced *for 2020, by when 20% of the energy* consumed should come from renewable sources. Yet *Replacing only one percent of the total primary energy consumption in EU 27 (1750 mtoe in 2005) would require over 90 million m³ of wood corresponding to about 1/8 of the Net Annual Increment (NAI) of Europe's forest* (FAO-UNECE-Univ Hamburg, 2007);

- In 2004, EU bioethanol production used 1.2 MMT of cereals (o.42%) out of total EU production of over 289 MMT of grains and 1 MMT of sugar beets (0.81%) out of 123.5 MMT of sugar beet production (Anonymous, 2007e);

- Brazil is the world leader in moving to modern biofuels: they take 27% of total energy consumption - 14% from wood and 13% from sugarcane. Sugarcane alcohol offers 20% of energy for transportation and provides 30% of automobile fuel requirements (Pinatti, D. et al, 2007);

Box 7: Anecdotes on drivers of liquid biofuels growth

General:

- Liquid biofuels for industrial applications which is currently gaining momentum was used since the early days of the car industry. However, when crude oil was cheaply extracted from deeper in the soil cars began using fuels from oil. Nevertheless, before World War II, biofuels were seen as providing an alternative to imported oil in countries such as Germany, which sold a blend of gasoline with alcohol fermented from potatoes. After the war, cheap Middle Eastern oil lessened interest in biofuels. But the oil shocks of 1973 and 1979 increased interest from governments and academics. The counter-shock of 1986 again reduced oil prices and interest.

Rising price of petroleum (hence greater biofuel competitiveness):

- Crude petroleum has in the past year gone above US$60 per barrel; by now it has approached US$100. This is said to be high enough to trigger competitiveness of biofuels;[4]
- Depending on fossil fuel price, ethanol can break even at as high a corn price as US$5.60 per bushel; at US$60/barrel oil price, ethanol can pay back even within a year for a greenfield site. Output 1 billion gallons in 2006; expected 3 billion in 2007. Subsidy cost US$4 billion in 2007 so *calls are starting for cellulosic ethanol*. But interest is weak because corn-based is so profitable (Tyner W.E Purdue ID339W, undated).
- Recent UN reports show 38 of 50 poorest countries spending up to six times as much on fuels as on health and twice as much as on poverty reduction (The daily Monitor, 2007a).
- According to the EC, EU-produced biodiesel breaks even at oil prices of around 60 ($71.60) per barrel, while bioethanol becomes competitive with oil prices of about 90 ($107.37) per barrel. Impulse factors for the future could include: (a) sugar beet production now qualifies for both set-aside payments when grown as a non-food crop and for the energy crop aid of 45/HA on non-set-aside area; and (b) sugar used for the production of bio ethanol will be excluded from sugar production quotas (Schnepf, R. et al 2007).
- An attraction is that according to FAO, a barrel of bioethanol, for example now costs about half the price of a barrel of oil. With subsidies (as many developed countries are offering), biofuel competitiveness is assured. A fear is that biofuel production may take up the best lands and drive food production to fragile low-potential

[4] There are some who claim that the price of petroleum fuels to the consumer, especially in Europe, depends more on taxes than on the cost of a barrel of crude; through tasxes, they allege that European governments make more money on petroleum than the producer countries. Saudi Arabia made much the same point the last time there was a sharp change in crude prices. Some observers believe that Europe has a lot of room to absorb higher crude prices, since this element is a minor part of pump price.

ones.

Desire to capture subsidies:

- Biofuels not new in the US – started with US$0.40 cents / gallon ethanol subsidy from 1978; increased tax exemptions and various modifications which are nevertheless all subsidies, including on the cost of blending (Tyner W.E Purdue ID342W, undated).
- The subsidy cost of 20 billion gallons ethanol would be about $10 billion (while improving gasoline se efficiency would take up to US$3.6 billion only) (Doering, O. Purdue Univ ID340W, undated).

Strategic fear of excessive external energy dependence:

- US president George W. Bush said in his 2006 State of the Union speech that he wants the US to replace 75% of the oil it imports from the Middle East by biofuels by 2025 (Malo, M. manuscript 2007).
- The EU has developed a Biomass Action Plan (EC 2005), which suggests doubling the production of bioenergy by 2010 (FAO-UNECE-Univ Hamburg, 2007).

- In 2003, the EC established a goal of deriving at least 2% of EU transportation fuel from biofuels by the end of 2005, then growing the biofuels share by 0.75% annually until December 31, 2010, when it would reach 5.75%. In 2003, the EU's framework for the taxation of energy products and electricity was amended to allow Member States to grant tax reductions and/or exemptions in favour of renewable fuels under certain conditions (Schnepf, R. et al 2007).

Legislation:

- Concern at high petroleum costs is fuelling a frenzy of policy/legislative facilitation of biofuels production: a paper reports (The Daily Monitor, 2007) that new policies have been adopted in Argentina, Australia, Canada, China, Colombia, Ecuador, India, Indonesia, Malawi, Malaysia, Mexico, Mozambique, the Philippines, Senegal, South Africa, Thailand, and Zambia.
- New Zealand (Anonymous, 2007) has also done so. Mandatory biofuel use will begin in New Zealand next year, and will comprise 3.4% of fuel company sales by 2012.New Zealand sources for biofuels are likely to include tallow and potentially wood-waste, syngas derived from biomass, or algae grown on sewage ponds.
- Minnesota requires at least 20% gasoline to be renewable (Hurt, C. et al Purdue Univ ID339W, undated).

It is not worth reporting the significance of biofuel for many other developing countries due to their small overall consumption levels which easily make biofuels proportionately more significant. Several elements can be highlighted for biofuels and the potential for their significance in future:

- Their economic viability is dependent on high petroleum prices, i.e. it is partly a comparative viability;

- Even where production is high, they seem to be subsidised (not mentioned for Brazil where they are well-established) particularly in industrial countries;

- In Africa, their feasibility suffers much the same challenges as general agriculture: low productivity, poor infrastructure leading to high costs etc. Some believe, however, that in landlocked countries where delivery costs for already costly petroleum are high, biofuels may be a life-saver for Africa;[5]

- It is reported (Doering, O. Purdue Univ ID340W, undated) that at present there is direct competition with use of crops for food. It is reported for the US that to raise ethanol output to 31 billion gallons by 2015 is speculated. This would require 95.6 billion ha and would displace much soybean, so hitting the livestock-feed sector. The policy choices would then include whether to allow this or to contemplate reducing petroleum oil consumption by pricing it more in line with its scarcity value and full cost.

[5] One analyst argues that in landlocked countries facing high petroleum prices and its transport costs but where sugar cane can be produced efficiently may find biofuel worthwhile and viable. According to another, (Malo, M. manuscript 2007) in Africa, most of the infrastructure required to support a renewable energy fuel cycle dependent upon farm produced feedstocks has yet to be developed. No one knows whether bioenergy can be economically viable for farmer participation without government or state subsidies. Thus, bio energy is currently being asked to compete on an uneven playing field where its fossil fuel competitors (coal, oil and nuclear) are heavily subsidized.

- Beyond certain thresholds of competition with food supplies, political or moral opposition may strengthen to further tightening of food supplies, especially in food-deficit countries. Should the attraction of supplying feedstock for biofuel be so high that food aid is threatened, some dramatic impacts on habitually hungry least-developed countries could arise – either this could force them to support domestic agricultural improvement, or human starvation on unprecedented scale could result;

- Since technologically biofuels (ethanol) can be produced from perennial cellulosic plants (trees), the only reason this is not preferred at present is the higher production cost. In the event of moral concerns at food diversion becoming overwhelming, a scenario whereby subsidies are directed at tree-based ethanol is entirely plausible. In that case, two issues arise: whether this could accelerate deforestation; whether the subsidies would be within reach of poor countries or they would become as dependent on rich countries just as they are now on oil exporting countries for commercial energy.

Agriculture and Food Security

Chapter 14 of Agenda 21 (Promoting Sustainable Agriculture and Rural Development) was given much attention at UNCED due to the belief that it carries potential to uplift large numbers of the poor in developing countries, for which the sector is the most easily socially and economically accessible. The post-UNCED evidence on poverty reduction has, however, confirmed the importance of non-agricultural performance for uplifting the poor. China and (lately) India are responsible for the largest total reductions of poverty (World Bank, 2007) and neither has privileged agriculture to an extraordinary degree: living standards have risen dramatically over the last decades in Asia-Pacific - for China the poverty-destroying growth came largely from manufacturing; for India it has been high-performance services. Smaller East Asia and Pacific region countries have each had their own menus of interventions, with agriculture (not necessarily practiced in a fully environmentally benign way) significant in a number of them but dwarfed by more spectacular growth of manufacturing and services.

Replacing fossil fuels in energy application is, of course, not the only environmental benefit of using biological materials in energy or other applications. The lower Carbon release relative to competing materials, the greater capacity for carbon capture may be other benefits to factor in. Annex 3 shows some indicative numbers.

With agriculture not performing better in countries where purchasing power is too low to base food security on the market, about 25,000 people die every day of hunger or hunger-related causes, including many children (Anonymous, 2007a). This is one person every three and a half seconds. This is despite there being plenty of food in the world for everyone. For the developing countries to attain the World Food Summit (WFS) target of halving the number of undernourished people by 2015, their numbers must be reduced by 31 million per year between 2001–03 and 2015. Yet over some 14 years between 1990–92 and 2006, the reduction was only 3 million people, from 823 to 820 million (FAO, 2006a). By 2015, the total number of undernourished in developing countries is projected at 582 million – about 170 million short of the WFS target.. Sub-Saharan Africa would have 179 million hungry – more than double the WFS target.

It is against this background that a worrying post-UNCED development is arising: *worsening affordability of food*. When hunger is mentioned, it is well to remember the first UNCED principle "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life . . . " .. . . . .it is difficult to see how hungry people can be seen as well-served by a post-UNCED follow-up (within and outside agriculture) that cannot feed them or allow them to feed themselves.

With the best of environmental intentions, the world now wishes to rapidly reduce reliance on fossil fuels – converting agro products into fuels (maize, sugar, oil crops etc) is the preferred solution. The battle lines appear to be drawn over this – some believe it is a betrayal of the poor done in the name of the environment; indeed some are very emotional in this sense (Box 8). Others see the bigger picture and believe things will work out. Indeed, according to FAO, biofuel production can go hand in hand with food production, with increased incomes from biofuel cash being reinvested in raising farm productivity also for food (The Daily Monitor, 2007 - but see also Purdue Univ Doc ID346W, undated). Meantime, some anecdotes on link between crop diversion to biofuels and commodity prices may help; they are given in Annex 2.

Box 8: Biofuels from food crops - an emotional topic

According to one source (FAO, 2007c), Jean Ziegler, the UN Special Rapporteur on The Right to Food, said in a press briefing in New York on 26 October, "*It is a crime against humanity to convert agriculturally productive soil into soil which produces foodstuffs that will be burned into [as] biofuel*." Asked later to confirm, he said: "I stand by what I said - biofuel production is a violation of the right to food." He has argued that biofuels will only lead to more hunger in a world where an estimated 854 million people - 1 out of 6 - already have too little to eat. Ziegler told journalists that the 232kg of maize needed to produce 50 litres of ethanol could feed a child in Mexico or Zambia for a year. FAO has said that this . . . . description of biofuel production as a "crime against humanity" is regrettable. "FAO strongly feels that food security and environmental considerations must be fully addressed before making investments or policy decisions, and we are actively working to ensure this happens However, a moratorium that ignores the potential of biofuels to support rural development and assist the economies of developing countries would not, in our view, be a constructive approach to this topic." Another example of emotional statements reads "to fill the tank of an SUV (240 kg of maize = 100 litres of ethanol) could feed one person for a year. . ." (World Bank, 2007) .

THE FUTURE

Protecting balance in Rio follow up action

The intentions of UNCED, just as of the 1972 Stockholm Conference on the Human Environment were excellent and deserve to be implemented. The architecture of the UNCED Action Plan (Agenda 21) reflects the interconnectedness of the earth and between its environmental and development needs. True and lasting success must mirror this by ensuring adequate action also on many fronts - the evidence to date does not show this. Whether in terms of funding or policy adjustment, the achievement of balance between environment and development can benefit from applying attention to more than what is most topical in the papers: there are some slow but ultimately important irreversible losses occurring in the biosphere that need action as much as atmospheric dislocation by greenhouse gases.

What should be said is that *the UNCED ambitions do not require re-definition – they require implementation and in a balanced manner*. The question is how to motivate all countries both developed and developing to pay attention and take adequate and balanced action. Take the case of Africa: we begin to see a continent that has millions starving and yet is talking (and acting) with perhaps more energy about climate change than about food security – this cannot make sense and is - at best - strange given that hunger is more immediate and that Africa makes only single-digit contribution to greenhouse gases.

For Africa as for all other regions, casual observation suggests that *information* is an important factor in promoting action. It is perhaps information asymmetry and its accompanying imbalanced advocacy that is driving Africa to its surprising policy priorities on the UNCED front. It may be the same asymmetry (but in reverse) that is (a) causing Africa to <u>not</u> invest much in combating the slow-creep problem of desertification for which it is the leading victim, and (b) leading the global community <u>not</u> to act decisively on depletion of forest and fish stocks. If this is the case, the research / analytical community has an important role to play, which we shall come to later. Regarding selected UNCED decisions, what thrusts could allow the future to be more balanced?

Food security, global warming and deforestation

A situation where meeting Agenda 21 goals on climate change poses immediate threats to food security, especially for the world's poorest and weakest, cannot be considered sustainable. Thus the single-minded pursuit of environmentally more benign fuels by diversion of annual crops needs broadening out: two main avenues need study and early action:

More effort is needed on tree cellulose, which offers a denser energy density per land area than crops and does not directly take food out of peoples' mouths. The economics of this will require study but will also almost certainly justify public investment that is now instead subsidising crops diversion;

There is need for public policy change to deepen agricultural productivity fast. One key need is investment in water control, including irrigation. Water management for agriculture was a fundamental part of the "Green Revolution" which people condemn too easily and in too sweeping a fashion. Some observations:

a) To say that all use of mineral fertilisers and application of biotechnology (and generally scientifically improved breeds) are wrong while condoning the shipping of massive food aid from countries that have surpluses because they use adequate or excessive fertiliser and modified genetic stock is illogical. Again Africa: average fertiliser use stands at 8-9 kg per hectare while in the OECD countries and average closer to 120kg/ha is quoted; in parts of East Asia, averages exceed 250 kg/ha.

b) International aid agencies advise Africa strongly to avoid public subsidies for yield-enhancing inputs – they claim it will distort the international economy and that Africa cannot afford it anyway. Yet the same countries spend billions on logistics of shipping of food aid, a fraction of which could pay the entire cost of fertiliser and improved-breeds subsidies to create immediate food surpluses in Africa. Some environmentalists scream that if Africa (at under 10 kg/ha) increases its fertiliser use, it will pollute its water tables – how can 10kg/ha do this?

c) Analysis is needed and its findings publicised *as to whether it is environmentally better to allow poor farmers to deforest, to destroy biological diversity, and to cultivate on fragile slopes and arid lands than to offer them public support to afford yield-enhancing technologies (with public subsidies if necessary) in order to protect carbon-storing trees and forests*. What we have now is that small farmers are extensively cutting vegetation to get miserly yields. Alongside their unsuccessful efforts, the international community is supporting woodlots to capture carbon under Kyoto. *The question is, why not pay to avoid cutting the trees in the first place rather than to replant trees after the environment is first destroyed*?

d) The example of rich countries on agricultural practices is not the best: despite much fanfare about organic agriculture, the great bulk of their farm products come from "business as usual" mass production of commodities supported by massive public subsidy. When poor countries try to expand what is often already biological agriculture (many cannot afford "polluting" chemicals in the first place) protectionism comes in: certifiers have to come at great cost from developed countries to agree that the crops are indeed organic, which is beyond the economics of smallholders;

e) In fisheries, again the rich countries are still heavily subsidising unsustainable levels of fish capture both at home and in waters under the exclusive economic zones of poor countries, the access to which they basically bully poor countries to offer – global governance seems powerless to correct this;

f) Food security can be achieved by increasing production and access to food, by economic development to confer purchasing power, or by reducing demand. On all fronts – all three being in UNCED declarations – the world's post-Rio efforts cannot be described as energetic despite the first Rio principle being "Human beings are at the centre of concerns for sustainable development":
   - Agricultural production problems have already been described above
   - Economic development is faster for a very few countries. In Africa (again!) it is mainly the mineral-rich countries that are booming and this often as a result of environmentally and economically unsustainable exploitation of their metals, oil, forests, offshore fish stocks. Protectionism continues to make achieving economic success through fair trade rather than (so far unsuccessful) aid very difficult
   - Demand may be partly getting contained by keeping the word's poor at low incomes but their numbers are not being assisted to reduce or slow down in expansion. Not enough attention is being paid to the population challenge.

g) Specifically on <u>forests</u>, the problems of lack of consensus on what is sustainable forest management, at what pace to seek it, how to engage non-governmental actors etc remain largely in place today as at the Rio Summit. Indeed, after CSD3 an interminable debate started on forests under the Intergovernmental Panel on Forests IPF). The IPF later transformed itself into a successive series of the Intergovernmental Forum on Forests (IFF) but consensus remains elusive to this day. Even the idea of replacing the non-legally binding statement on forests with a legally binding convention or similar has stalled and can probably be pronounced dead. The idea first mooted by CSD3 of a forum specifically on forests/environment issues has never taken off as a separate mechanism but IPF/IFF has been so wide-ranging that its dialogue has touched everything under the sun without solving anything in a decisive manner.

Information, research and analytical agendas

The *media* appears to have become a major force for policy decision-making: the media can cause a jump towards addressing climate change, towards combating unjustified subsidies, towards unfairness in trade, towards population control, towards combating wanton fish capture and forest deletion. If it wished, the media could probably whip up a frenzy to attract attention to "slow-creep" problems such as desertification. Instead, it chooses to pick, say, climate change; the democratic countries in particular must follow what the media highlights. It may, in fact be responding to market prospects (Box 9).

Box 9: In the key constituency, fuel matters more than food

Media follows business principles: making a profit drives, all else follows. This being the case, a primary target of media work is the industrial countries who are major consumers of information and are known to have capacity to act on what they are made to be excited about in their own countries or in the poor countries whose policies they can influence through aid dialogue and conditionality.

In the case of attention to energy versus food, the outcome can be easily predicted. *Food is a small part of both household and national budgets in rich countries; fuel accounts for more.* Threats to food supply with thus elicit less reaction and investment (including public policy intervention) than threats to affordable fuels. Thus, especially since too much food is already being produced by industrial countries, they can be expected to more readily act on media alarm-bells on need for biological substitutes for fossil fuels.

Ensuring that the media conveys balanced attention to the Rio agenda may thus be one of the best investments to regain the spirit of Rio. It is important not just to generate *reliable and professionally sound information* based on analysis of what really matters (irrespective of its initial media appeal) but to then convince the media to see it as interesting enough to feed to an already inundated reading and viewing public and to policy-makers.

This Conference is in celebration of the 35th Anniversary of IIASA, an internationally renowned centre for looking at complex dynamics of change. This organisation can make tremendous contributions of fundamental importance for promoting understanding of what matters so as to provide counterweight to the mass of existing speculative information. Centres like IIASA can help to separate what is merely interesting or titillating to the public imagination from what is important and what sequence of action makes best sense. There will be need for such analysis if future follow up to UNCED and its successors is to become more balanced than to date.

On the information front, one can pick a specific topic to illustrate what centres such as IIASA can more forcefully assist with in future, ensuring that in doing so they can carry the media's attention. The issue of diversion of crops to biofuels and its potential to dislocate the food prospects of the poor could be selected for greater attention. The research community could redouble its efforts immediately into technologies, policies/strategies for feasible biofuels manufacture from tree cellulose and non-food renewables.

The topic of forests for energy generally could also be looked at more vigorously partly due to opportunities the Kyoto protocol has opened up. On this issue, FAO and the UN Economic Commission for Europe have recently highlighted some of the research and analysis that may be needed (Box 9). Similar agendas can be developed for other Agenda 21 chapters that are not having an adequate share of media promotion.

An important area for advocacy (and therefore also for underlying analysis) is on what can give an incentive to the powerful economies to see that it is in their self-interest to get collective action also by countries too poor to afford all their own required action not just on "topical" but all Rio commitment. Market-based solutions that are often touted these days will not do this alone (UNEP, 2007) and external aid alone has also not so far necessarily gone where it would have done the most good. The four scenarios recently developed by UNEP[6] offer a framework for analysis and advocacy that could help (UNEP, 2007).

Box 9: Areas for research and analysis – example of forests[7]

Information:

a) Re-design of traditional analysis of wood supply and demand (centred on wood removals from forests for supply to industries) so as to also include comprehensive outlets, including for energy end-uses.

b) Systematically assessing the potential wood supply from sources outside the forest (woody biomass outside the forest, wood residues and recovered wood – in forest and post-consumer);

[6] The UNEP scenarios: Markets first; Policy First; Security First; and Sustainability First.

[7] Adapted largely from adapted from FAO-UNECE-Univ Hamburg, 2007.

c) Improving the accuracy of the conversion factors used to estimate wood needs to produce a given quantity of product: this is said to be possibly the largest single source of discrepancies in Europe.

d) Determining more accurately the overall energy efficiency and efficiency levels in wood processing industries and end-use.

e) Reducing uncertainty of productivity estimates, conversion coefficients of processes and utilisation for forests and their products.[8]

f) Information on wood use for energy in private households (quantities/origin/qualities), small CHP plants, or internal energy generation.

g) Current and future contribution of short rotation coppice.

h) Upscale economic analysis of various technologies for tree-based cellulosic ethanol production and prospects for its becoming a mainstream fuel (+ assessment for sustainable forest management)

Policies:

a) Setting out clear bioenergy policy goals to help defining the role of forests in energy supply. At present, policies rarely define the share of wood in renewable energy supply.

b) Crafting sustainable policy support to "next-generation" cellulosic biomass feedstock (now comparatively costly) to help realise its potential to dramatically expand the resource base for producing biofuels in the future (without excessive recourse to food crops) (FAO, 2007);

c) Analysing policy incentives for increasing biological fuels from forests so as to reduce direct competition with food production, particularly in food-deficit developing countries

[8] For example, one paper reports major divergence among estimates of fuelwood and charcoal requirements: for year 2020 one projection gave 4.5 billion m^3 and the other gave only 2.5 billion m^3 (Duinker et al, 1998).

Annex 1: Selected anecdotes on status of biofuels development

Brazil

- Brazil has achieved great success in the past (27% of total energy consumption - distributed in 14% from wood and 13% from sugarcane) with the reforestation project for pulp, charcoal (siderurgic plan), and sugarcane for alcohol (20% of energy for transportation) (Pinatti, D. et al, 2007). Ethanol contributes 20% of the energy consumed for transportation and power and provides 30% of automobile fuel requirements. No increase in the Ethanol Programme is expected, and a big effort is needed to maintain the present level. The tendency is to decrease consumption by pure alcohol-powered cars and to increase cars using the 22% gasoline/alcohol mixture. Ethanol production employs 700,000 workers with an income of U.S. $6–7 billion/year.

- Use of biofuels for electric energy generation from biomass is, however, presently negligible; a new technology called the BEM (Biomass–Energy–Materials) Programme based on prehydrolysis can change this. Costs compete with hydroelectric and fossil fuel energy. The technology of the BEM Programme forms a technical-economic basis for the Clean Development Mechanism established by the Kyoto Protocol with the cost in the range of U.S. $10.00/tC compared with a cost of U.S. $580.00/tC in Japan, U.S. $180.00/tC in the United States, and U.S. $270.00/tC in Europe using other technologies than reforestation.

Other developing countries/regions

- In ACP countries, availability of affordable feedstocks may often be a challenge: economics are often not competitive with fossil fuels. Promising cost levels are for, e.g. jatropha biodiesel in Zambia (Rivailland R. et al, 2007).

USA

- Biodiesel is mostly used as an extender only in the US: total about 75 million gallons produced in 2005 (compared to total 63 billion gallons of all fuels). Biodiesel is projected at 225 million gallons by 2015; its economics are much weaker than for ethanol and it is at a disadvantage against fossil diesel despite a US$1 /gallon subsidy (Gray, A. Purdue Univ ID340W, undated).

- Breeding soya (currently 56 gallons / acre) for greater oil yield could help but reduction in farm-economy vital soya meal would hit meat prices – feed is a key economic output of soya. Canola (rapeseed) in Europe yields 111 gallons/acre.

Europe

- The EU produced an estimated 768 million gallons of biofuel in 2004 (80% biodiesel, of which half by Germany) compared with U.S. biofuel production of 3.4 billion gallons (mostly ethanol) – 23% EU/US (Schnepf, R. et al 2007).

- Biomass constitutes the largest source of renewable energies in the EU (66%), and wood is the major source for biomass (80%). Under its Biomass Action Plan (EC 2005), the EC suggests doubling the production of bioenergy by 2010 (FAO-UNECE-Univ Hamburg, 2007).

- EU biofuel production is impeded by its high production costs relative to fossil fuels. To date, the most important biofuel produced in the EU has been biodiesel with an 80% share of biofuel production in 2004. Bioethanol has accounted for the remainder. The major feedstock for EU biodiesel production is rapeseed oil, while bioethanol is generally produced using a combination of sugar beets and wheat (Schnepf, R. et al 2007).

Annex 2: Anecdotes on impact of diverting crops to biofuels on commodity prices

- (7b) As of June 2007, global expenditures on imported foodstuffs look set to surpass US$400 billion in 2007, almost 5 percent above the record of the previous year. (7b) Rising prices of imported coarse grains and vegetable oils – the commodity groups that feature most heavily in biofuel production[9] – account for the bulk of the increase. Import bills for these commodities are forecast to rise by as much as 13 percent from 2006.

- There are downstream impacts on meat and milk products: by March 2007, poultry export prices in dominant producers United States and Brazil increased by 20 percent and 14 percent respectively from their 2006 annual averages. (7b) Mid-2007 prices of dairy products were at historically high levels and the FAO price index of traded dairy products had risen by 46 percent since November 2006.

- demand for biofuel crops also causes increased prices for other crops competing for the same land even if they are not fuel crops themselves; of the meats, poultry and eggs were hit fastest.[10] The effect on overall inflation in industrial countries is small (only 1.2-1.8% higher than otherwise in the US) because food is a small share of overall spending.[11] About half of the additional food inflation is in the animal production sector, especially poultry (Purdue Univ Doc ID346W, undated).

- The FAO food price index in July 2007 stood at its highest level since 1990 and was nearly 70% higher than in 2000 (The Daily Monitor, 2007b).

- (7d) As of October 2007: The total cereal import bill of the low income food deficit countries (LIFDCs) is forecast to increase considerably for the second consecutive year, reaching an all-time high of US$28 billion in 2007/08, up roughly 14 percent from last year's already high level. Despite major production increases especially in the US and Latin America, *cereal stocks (especially wheat) would be at historic lows* - the lowest in 25 years.

- (36c) As of November 2007: the latest *Food Outlook* report advises that soaring petroleum prices have driven up prices for agricultural crops by raising input costs and by boosting demand for crops used to produce biofuels.

[9] The *OECD-FAO Agricultural Outlook 2007-2016* says: in the *United States*, annual maize-based ethanol output is expected to double between 2006 and 2016. In the *European Union* the amount of oilseeds (mainly rapeseed) used for bio-fuels is set to grow from just over 10 million tonnes to 21 million tonnes over the same period. In *Brazil*, annual ethanol production is projected to reach some 44 billion litres by 2016 from around 21 billion today. *Chinese* ethanol output is expected to rise to an annual 3.8 billion litres, a 2 billion litres increase from current levels.

[10] In rich countries, these are main poor people's protein foods.

[11] The reverse in most poor countries.

Annex 3: Carbon footprint anecdotal data

Relative environmental footprint of biological materials in various applications

(1) 1 m3 of wood stores about 1 ton of CO_2

(2) Approximate Greenhouse gas emissions (kg CO_2 equivalents per unit) (estimates from bar chart):

- *Window-frame*
  - Aluminium 500
  - Steel 420
  - PVC 250
  - Wood 120
- *Materials substitution in transmission lines*
  - Treated wood: 4tonnes CO_2 per km
  - Concrete: 17 tonnes/km
  - Tubular steel : 38 tonnes/km

(3) Biofuels: cumulative avoided emissions per hectare over 30 years (mt/ha) (estimates from bar chart):

- Sugar cane to ethanol 60
- Wheat to ethanol 15
- Sugar beet to ethanol 40
- Maize to ethanol 15
- Rapeseed to biodiesel 15
- Woody biomass to biodiesel 60
- Tropical forest to cropland 200
- Tropical cropland to forest 175
- Temperate cropland to forest 100
- Temperate cropland to grassland 25

(4) Agriculture:

- Biomass for energy produced in agricultural land may cause indirect emissions reductions of 70-1,260 Mt CO_2-eq./yr (at US$ 20/tCO_2) by 2030.
- In addition, emissions reductions of 770 Mt CO_2-eq./yr can be achieved through energy efficiency

(5) Forests:

- Indirect emissions reductions of 40-4,000 Mt CO_2-eq./yr (at US$ 20/tCO_2) can be achieved by 2030.

Source: (Schlamadinger, B. 2007)

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