UNEP

CBD

Convention on
Biological Diversity

Distr.
GENERAL

UNEP/CBD/COP/9/26
24 April 2008

ORIGINAL: ENGLISH

CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY
Ninth meeting
Bonn, 19-30 May 2008
Item 3.1 of the provisional agenda*

THE POTENTIAL IMPACTS OF BIOFUELS ON BIODIVERSITY

Matters arising from SBSTTA recommendation XII/7

Note by the Executive Secretary

I. BACKGROUND

1. Pursuant to paragraph (d) of appendix A to annex III of decision VIII/10, and following the recommendation of its Bureau, the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), at its twelfth meeting, considered the interlinkages between biodiversity and liquid biofuel production as a new and emerging issue related to the conservation and sustainable use of biodiversity. To this end a pre-session document entitled "New and emerging issues relating to the conservation and sustainable use of biodiversity: Biodiversity and liquid biofuel production" was prepared (UNEP/CBD/SBSTTA/12/9).

2. In recommendation XII/7, SBSTTA requested the Executive Secretary (i) to invite Parties and other Governments to provide relevant information on the impacts on biodiversity along the full life cycle of the production and use of biofuels and how these are being addressed; (ii) to compile, in collaboration with relevant organizations, additional relevant information on this subject; (iii) to identify options for consideration of this emerging issue in the programmes of work of the Convention, including the programme of work on agricultural biodiversity and the expanded programme of work on forest biodiversity; and (iv) to synthesize and submit the information resulting from the above activities for consideration at the ninth meeting of the Conference of the Parties.

3. The present note has been prepared on the basis of information submitted by Parties in response to notification 2007-082 as well as findings from scientific studies, reports and other documents, as well as contributions from relevant organizations.

4. After an overview of recent developments on biofuels (section II) this document examines the potential positive and negative impacts of biofuels on biodiversity over their entire life cycle including the end use of biofuels (section III), the production of feedstocks for biofuels (section IV) and the processing

* UNEP/CBD/COP/9/1.

/…

and conversion of feedstocks (section V). Section VI of this document explores possible options for considering biofuels and biodiversity through the expanded programme of work on forest biodiversity and the programme of work on agricultural biodiversity as well as other relevant components of the Convention on Biological Diversity. This is followed by conclusions (section VII) and suggested elements for a possible decision by the Conference of the Parties (section VIII).

II. INTRODUCTION

5. The term “biofuel” generally refers to any fuel derived from biomass, such as alcohols, biogas, fuelwood, vegetable oil and animal fats, which can be used as a substitute for fossil fuels. Though a variety of biofuels exist it is liquefied biofuels, such as ethanol and biodiesel, which have garnered the greatest attention as they can be used in the transportation sector. It is estimated that ethanol alone currently accounts for approximately 90% of biofuel use globally (13). For ethanol, the most common biomass sources are sugar cane and maize (or “corn”) while rapeseed and palm oil are the major feedstocks used in the production of biodiesel. However soybean, peanuts, jatropha, castor bean and coconut oil are also used for the production of biodiesel and wheat, sugar beet, sweet sorghum and cassava are used for ethanol (2, 30). It has been postulated that in the future it will be possible to use a greater range of lignocellulose materials, or so called second generation feedstocks, for biofuel production (37). These materials would include grasses, algae, woody plants and residues from the agriculture and forestry sectors.

6. Biofuel (ethanol and biodiesel) production exceeded an estimated 53 billion litres in 2007, representing a 43 per cent increase from 2005 (27). Among the renewable energies, biofuels dominated venture capital and private equity investment activity in 2006 with US$ 2.9 billion flowing into the sector – twice as much as the next strongest technology, solar, with US$ 1.8 billion (45). This recent increase in biofuel production and financing has been spurred by the desire for greater energy security and policies purported to respond to the growing concern over climate change (35).

7. The trade in biofuels has been increasing but it remains modest when compared to the total amount of biofuel produced globally. It was estimated that in 2005 10% of the world’s biofuel consumption was covered by trade (8, 9). The trade in biofuels is expected to grow as the consumption mandates, which some countries have set, will require that biofuels be imported from other countries (8). However currently there are no trade regimes specifically related to biofuels and tariff and non-tariff barriers may limit the amount of trade which occurs (9, 15).

8. Several countries have introduced policies to promote biofuel use, such as requiring that traditional fuels be blended with biofuels. A number of countries have also introduced policies which promote the domestic production of biofuels, such as the establishment of production subsidies or the introduction of import tariffs. Many of these policies do not take into account the type of biomass or production methods used in creating biofuels, nor the potential negative environmental or social impacts resulting from their production and use (8).

9. With the rising use of biofuels has also come debate regarding the potential positive and negative impacts of these products. While proponents of biofuels point to the potential for cleaner fuels, greater economic opportunities for farmers and rural communities, and a renewable source of energy, detractors argue that biofuels risk damaging biodiversity, marginalizing indigenous and local communities and creating more greenhouse gas emissions than they prevent. This debate is complicated by the fact that numerous types of biomass (or feedstocks) can be used in the production of biofuels. The dominant factors determining the environmental and biodiversity impacts of biofuels are the types of lands used for producing biofuel feedstock (forestland, cropland, marginal or degraded lands) and the feedstock production practices employed, including the plant species (crop, grass, ligneous biomass, crop residue) used. Depending on the feedstock used, where and how it is grown and the manner in which it is processed, the greenhouse gas balance, energy yields and environmental impacts of biofuels may differ

greatly (9, 37). Many aspects of the biofuel debate correspond to similar points made on the environmental impacts of (modern) agriculture generally.

10. Life cycle assessments are increasingly used to determine the positive and negative impacts of biofuels. However, depending on what assumptions and methods are used in estimating the impact of biofuels, the magnitude of the potential impacts can vary significantly. Further complicating the situation is the fact that biofuel technology and policies are evolving at a rapid pace. Given this complexity it is difficult to generalize the specific impacts of biofuels as each fuel type and system of production has different potential impacts, although recently published scientific studies suggest that most, if not all, biofuels may actually exacerbate greenhouse-gas emissions over the short to medium term and cause other environmental and social impacts (11, 28, 33).

III. THE END USE OF BIOFUELS

11. One of the driving forces behind the increasing use and development of biofuels is that they offer a convenient alternative to petroleum-derived gasoline and diesel and the perceived potential to reduce greenhouse gas emissions thereby offsetting the impacts of climate change (12). Since climate change has been highlighted as one of the main drivers of biodiversity loss, the mitigation of greenhouse gas emissions would contribute to reducing the rate of biodiversity loss in the future (12). Among current technologies it appears that ethanol produced from sugarcane in Brazil, ethanol produced as a by-product of cellulose and whey production (as in Sweden and Switzerland), and the manufacture of biodiesel from animal fats and used cooking oil, can substantially reduce greenhouse gas emissions when compared with gasoline and mineral diesel (8, 26, 46). However, as discussed below, when the effect of alternative land-use strategies on carbon stores are considered, most biofuels lead to a net increase in greenhouse-gas emissions when compared to the use of gasoline or diesel.

12. The use of biofuels also has potential impacts on air quality. Given their different physical and chemical characteristics, there are considerable differences in the atmospheric emissions resulting from the use of biofuels as transport fuels (37). Generally, however, replacing a portion of petroleum fuel with a biofuel can reduce the emissions of sulphur, particulates, carbon monoxide and volatile organic compounds, but may increase emissions of nitrogen oxide, ethanol, and acetaldehyde, depending on what type of biofuel is used (9).

13. It is generally accepted that biofuels will have a limited ability to replace fossil fuels. Therefore progress towards a sustainable solution for transport requires an integrated approach which combines biofuels with other technological developments and broader transport policies (37).

IV. FEEDSTOCK PRODUCTION

14. Biofuel production has multiple environmental impacts that might affect biodiversity and depending on the context of their production and use the impacts of biofuels could either be positive or negative. Chief among these impacts is land-use change, which also greatly influences the extent to which biofuels contribute to the mitigation of greenhouse-gas emissions. A scenario, in which a significant proportion of global energy needs is provided by bioenergy by 2050, suggests that the biodiversity gains resulting from avoided climate change and nitrogen emissions were offset by the need for additional land use to provide biofuels (32). Other environmental impacts concern water consumption, the use of fertilizers and pesticides, and the possible invasiveness of some species used in biofuel production. In addition large-scale biofuel production also has socio-economic impacts.

A. Potential environmental impacts: land-use-change and climate change impacts on biodiversity

15. One of the most commonly noted environmental impacts of biofuel production is land-use change. The amount of biofuel produced per unit area of cultivated land differs noticeably among feedstocks (17, 26). Given the rising demand for biofuels globally and that this demand is expected to continue to increase over the next ten years (35), increasing amounts of land will likely be devoted to biofuel production. For example it is estimated that a 10% substitution of petrol and diesel fuel would require that 43% and 38% of current cropland in the United States and Europe, respectively, be devoted to feedstock production (14), or that the production of feedstocks increases overseas. The choice of feedstock, the place where it is grown and the cultivation practices used all play a significant role in determining if the production of a certain biofuel will have negative or positive impacts on the environment, and the magnitude of those impacts.

16. If crops are grown on degraded or abandoned land, such as previously deforested areas or degraded crop- and grasslands, and if soil disturbances are minimized, the production of feedstocks for biofuels could potentially have positive impacts on biodiversity by restoring or conserving habitat and ecosystem function. Further the use of degraded land for biofuel production is not likely to adversely affect carbon emissions. If multiple species are grown or if perennial species, such as grasses or trees are used the production of feedstocks could also have positive impacts on biodiversity in comparison to annual monocultures on arable land. For example short rotation coppice willow can be beneficial for some bird, butterfly and flowering plant species (37). In situations where energy crop plantations replace other monocultures the direct impacts on biodiversity are not likely to be significant. If the production of biomass for biofuel production replaces other land uses however the net impacts on biodiversity could be negative

17. Habitat loss is one of the major causes of biodiversity decline globally (21, 31, 44). The increasing demand for bioenergy could lead to both direct and indirect expansions of cultivated areas, resulting in further habitat loss and negative impacts on biodiversity, especially if forest, grassland, peatland and wetlands are used for feedstock production and if large monoculture plantations are created. It has been noted that, in some Organisation for Economic Co-operation and Development (OECD) member countries, the increasing demand for oilseed has already begun to put pressure on areas designated for conservation (35). Similarly the rising demand for palm oil has contributed to extensive deforestation in parts of South-East Asia (43). Further, as biomass feedstocks can be produced most efficiently in tropical regions, there are strong economic incentives to replace natural ecosystems with high biodiversity values with energy crop plantations (8).

18. Land use change associated with the production of energy crops would also affect carbon dioxide emissions. If energy crop plantations are established on degraded sites, the sequestration of carbon could be increased, thereby mitigating the impacts of climate change. Similarly if perennial crop species with large root structures were used and if these root systems remained in the soil after harvesting, the amount of carbon stored in soils could potentially be increased. The use of low input agricultural practices and high diversity systems on degraded lands could result in carbon being sequestered as a result of rising soil organic matter (38). Similarly biofuels derived from residues and waste products could have an overall positive effect on climate change and on biodiversity as no significant land use change would be required (33). However nutrient and carbon balances must still be considered when biomass residues, such as straw, are used for bioenergy production.

19. If energy crop plantations are established on forested land or carbon rich soils any reduction achieved through the use of biofuels could be negated or even greatly out-weighed by the release of greenhouse gases stemming from land-use change and the production of feedstocks. Processes such as draining wetlands and clearing land with fire are particularly detrimental with regard to greenhouse gas emissions and air quality (9). For example it is estimated that the drainage of peatlands in South-East Asia

can results in the release of up to 100 tonnes of carbon dioxide per hectare per year and if peatland soils are burned the amount of carbon dioxide released could be double or triple this value (37). The drainage and burning or peatlands in South-East Asia between 1997 and 2006 resulted in carbon dioxide emissions of, on average, 2,000 megatonnes per year (37). Such practices would also result in a loss of above- and below-ground biodiversity.

20. Two issues need to be addressed before the efficacy of biofuels can be assessed: the net reduction in fossil fuel carbon emissions (avoided emissions) arising from the use of agriculturally derived first generation biofuels and the effect of alternative land-use strategies on carbon stores in the biosphere (28). Taking these factors into account, a study found that converting rainforests, peatlands, savannas, or grasslands to produce food-based biofuels in Brazil, South-East Asia, and the United States creates a 'biofuel carbon debt' by releasing 17 to 420 times more carbon dioxide than the annual greenhouse gas (GHG) reductions these biofuels provide by displacing fossil fuel use (11).

21. Many earlier analyses have failed to count the carbon emissions that occur as farmers worldwide respond to higher prices and convert forest and grassland to new cropland to replace the grain (or cropland) diverted to biofuels. Using a worldwide agricultural model to estimate emissions from land use change, a study concluded that corn-based ethanol, instead of producing a 20% saving, nearly doubles greenhouse emissions over 30 years and increases greenhouse gases for 167 years (33). Put differently, forestation of an equivalent area of land would sequester two to nine times more carbon over a 30-year period than the emissions avoided by the use of biofuels derived from crops cultivated on that land (28). Taking this opportunity cost into account, the emission cost of liquid biofuels exceeds that of fossil fuels. While these papers document the effects of land-use change on carbon stocks, such changes will also be correlated with direct and immediate losses of biodiversity, in addition to the longer term losses resulting from the additional climate change that results form increased greenhouse gas emissions.

22. There are situations where genuine savings in greenhouse gas emissions can be realized over relevant time horizons (of about 30 years or so). These include: (i) the use of residues and waste products for biofuels; (ii) the use of woody biomass as feedstock (28); and (iii) the cultivation of native grass mixtures or perennial oil plants on degraded lands and with low-external inputs (11, 38).

23. In addition, the cultivation of sugarcane for ethanol production in Brazil may have net benefits in terms of greenhouse gas reductions even when land use change is taken into account. Searchinger et al (2008) calculate that sugarcane cultivated on tropical grazing land could compensate for the carbon emissions from land use change in only four years. However longer pay-back times are indicated in other areas and it is suggested that this system, over a 30-year period, would just break even in terms of greenhouse gas emissions (11).

B. Other potential environmental impacts

24. In addition to the potential effects of land use change, the production of energy crops can also have impacts on water availability and quality. This aspect is a serious concern as the loss of biodiversity in inland water ecosystems is occurring almost twice as fast than in any other major ecosystem (5). Further water availability is regarded as a major challenge to sustainable development and is a component of Millennium Development Goal 7 ("Ensure environmental sustainability").

25. Several studies emphasize that the production of biofuel crops could have a negative impact on water resources, especially when traditional first generation annual crops are used (1, 5, 7). Certain crops, such as oil palm, sugar cane and maize, have high water requirements and relatively low water-use efficiency (26, 35). Further some cultivation practices such as harvesting agricultural residues, growing tree crops without undergrowth, and planting species that do not generate adequate litter, can reduce the ability of precipitation to penetrate the soil and replenish groundwater supplies (16). On the other hand, if crops with higher water-use efficiency, such as sugar beet and coconut, are used, pressure on water

resources in a given region may be decreased (26). It has also been suggested that biofuel crops could be used to treat wastewater or used in phytoremediation projects (1).

26. Increased biofuel production, especially based on conventional annual crops, may result in higher rates of soil erosion, nutrient leaching and biodiversity loss owing to the increased need for tillage (43). For instance, wheat, rapeseed and corn require significant tillage compared to oil palm and switchgrass (10, 40). However, if energy crop plantations are established on abandoned agricultural or degraded land, levels of soil erosion could be decreased because of increased soil cover. This would be particularly true where perennial species are used. For example, *Jatropha* can stabilize soils and store moisture while it grows (9). Other potential benefits of planting feedstocks on degraded or marginal lands include reduced nutrient leaching, increased soil productivity and increased carbon content (1).

27. While fertilizer and pesticide use varies among production systems, changes in crop rotations and the expansion of areas under crops for biofuel production has resulted in the increased use of fertilizers and water in selected OECD countries (35). The release of nitrogen from soils, resulting from the application of industrial fertilizers, is the largest single source of nitrous oxide emissions globally (37). Nitrous oxide has a global warming potential 296 times larger than that of carbon dioxide. Therefore, if the production of biofuel feedstocks requires increased fertilizer use, there could be additional detrimental climate change effects if the application of nitrogen is not managed appropriately. Further, if management practices are not changed to avoid the leaching and emission of eutrophicating nutrients, the increased use of fertilizers could also result in increased eutrophication of terrestrial and aquatic ecosystems, as well as the increased dry deposition of reactive nitrogen, both leading to a loss of biodiversity (21, 31). The increased use of pesticides would also have adverse impacts on biodiversity and the increased use of agrichemicals generally could create health hazards for communities living near areas where feedstocks are being produced (43). However if perennials and trees were used in the production of biofuels the need for agrochemical applications could also be reduced with positive impacts on the environment.

28. With regard to second generation feedstocks, it was noted that short-rotation woody crops will require more fertilization and potentially more tillage and that best management practices will need to be revised to reflect accelerated production cycles (34). On the other hand, grassy perennial energy crops, which require less agricultural inputs and less tillage, could decrease pressure on biodiversity and potentially increase biodiversity if they replace the use of annual crops (6). However as the technology related to second generation feedstocks is still in its infancy and not yet marketable the impacts of such technologies are still relatively unknown.

29. Another concern with regard to the production of feedstocks for biofuels is the potential introduction and establishment of alien invasive species (25). Several grasses and woody species which are potential candidates for future biofuel production also have traits which are commonly found in invasive species. These traits include rapid growth, high water-use efficiency and long canopy duration. It is feared that should such crops be introduced they could become invasive and displace indigenous species and result in a decrease in biodiversity. For example *Jatropha curcas*, a potential feedstock for biofuels, is considered weedy in several countries, including India and many South American states (19). Similar warnings have also been raised with regard to species of *Miscanthus* and switchgrass (*Panicum virgatum*). Other biofuel crops such as *Sorghum halepense* (Johnson grass), *Arundo donax* (giant reed), *Phalaris arundinacea* (reed canary grass) are already known to be invasive in the United States.

C. Potential socio-economic impacts

30. The production of biofuel feedstocks could have a variety of positive and negative impacts on socio-economic conditions. As the majority of feedstocks used in the production of biofuels are agricultural, the market for biofuels and agricultural products are closely related (8, 29). The rising demand for agricultural biofuels is translating into higher market prices for some woody materials and agricultural products (8, 14, 41, 43). The Agricultural Outlook 2007-2016, which for the first time

includes assumptions about biofuel production, forecasts that the rapid growth of the biofuel industry is likely to keep food prices high and increasing throughout the next decade at least (23). These primary commodity price increases can have ripple effects on related goods. For instance a sharp rise in soybean prices in mid-2006, caused by the replacement of soybean cultivation with corn cultivation for biofuel production in the United States, led to higher prices for animal feed and meat (41). High feed prices would favour monogastric livestock species with their better feed-conversion ratio than cereal-fed ruminants. More generally, increased commodity prices can have serious consequence for food-importing developing countries with implications for agricultural production and food security.

31. On the positive side, the need for greater amounts of feedstock could also potentially create employment opportunities, as reported for the Brazilian biodiesel production based on small-scale soya plantations, and thereby increase rural incomes as the harvesting of biomass tends to be a labour intensive process (8, 43). These opportunities are likely to be greatest when small-scale farmers are involved in production and when processing facilities are located near feedstock sources (9). However it has been noted, that as the production of biofuels tends to favour large-scale and industrial agricultural practices, farmers utilizing traditional agricultural methods may be effectively excluded from the production of biofuel feedstocks (43).

32. Higher food prices could help some food producers by raising the market price of their goods, thereby contributing to rural development (8). Further as many areas with high biomass potential tend to be low wealth areas, biofuels could provide significant socio-economic benefits to some developing countries (37). It has been noted that rising prices for food, particularly in the tropics and subtropics, could encourage investments in agriculture and forestry and thereby lead to greater efficiency in the agriculture and forestry sectors and improved food security (37). However, for such benefits to be realized there would likely need to be some form of technology transfer, including through South-South cooperation, to allow countries to make the most of arising economic opportunities guided by policies providing a framework for the use of these technologies in local rural development.

33. Importantly, the issue of trade-distorting domestic subsidies and import tariffs would also need to be addressed as these make it difficult for producers, particularly those from lesser developed countries, to compete in domestic markets (9). Domestic production is supported through border protection and production subsidies which keep prices artificially high and limit trade between more efficient producers in the tropics and domestic consumers in temperate zones. These sorts of subsidies and market access barriers may also result in countries using domestic biofuels which are less efficient than those produced elsewhere and, moreover, can have indirect negative effects on biodiversity in other countries. The latter case would arise if the potential export country reacts to the market access restrictions by focussing on crops whose overseas markets are less protected, but whose production is associated with even higher negative impacts on biodiversity (22).

34. A variety of incentives and policies are currently in place to directly and indirectly support the production of biofuels as well as influence their consumption. Domestic production of biofuels is primarily supported through border protection, such as import tariffs, and volumetric subsidies (8, 35). For example OECD countries which produce ethanol also apply tariffs which increase the cost of imported ethanol by at least 25% (8). Biodiesel imports on the other hand, face much smaller tariffs, ranging from 0% in Switzerland to 6.5% in the European Union (36). However, when biofuels are imported from countries with whom the importing country has a free trade agreement, these tariffs are often reduced or eliminated all together (8).

35. Reductions in excise and sales taxes are other common methods of supporting biofuel production. However, increasingly countries are moving away from these forms of subsidies and adopting volumetric subsidies and consumption mandates. It is important to note that, in most instances, volumetric and consumption mandates make no distinction between the biomass used in the production of biofuels (8), although environmental costs and benefits can differ depending how biofuels are produced. It has been

suggested that in order to ensure that only environmentally and socio-economically sound biofuels are used the promotion of biofuels, through subsidies and incentive measures, would need to be selective (46).

36. Current policies supporting biofuel production and use in developed countries have considerable cost implications. For example, the Global Subsidies Initiative found that subsidies in the European Union amounted to more than US$ 5 billion (18). The cost of obtaining a reduction of one tonne of carbon dioxide equivalent in developed countries was calculated to be of the order of US$ 500 to US$ 1000. This is many times more than the market price of greenhouse gas reductions (and some of those “reductions”, may in fact be offset by land-use changes not accounted for in these calculations).

37. The production of biofuel feedstocks also has implications for indigenous and local communities. Several reports have drawn attention to the issue of populations being excluded from plantations without their prior and informed consent and an apparent lack of consideration of traditional land tenure and rights (3, 4, 20, 24, 36). The chair of the United Nations Permanent Forum on Indigenous Issues recently warned that 60 million indigenous people worldwide face clearance of their lands to make way for biofuel plantations. In some cases indigenous and local communities themselves are removed from their traditional territories to make way for such development project. As indigenous peoples lose access to land and forest resources, they may be forced to clear additional lands to meet their subsistence needs and therefore have a negative impact on biodiversity. Moreover, land alienation and the curtailment of access and rights can destroy livelihoods, undermine traditional cultures, lead to a loss of traditional knowledge, and potential result in land use conflicts (9, 20, 42). Participants in the fifth Trondheim Conference on Biodiversity identified the strengthening of rights, particularly of indigenous peoples and local communities, over land, resources, ecosystem services and the benefits that arise from their use, both as a moral imperative and as social, economic and environmental necessities (39).

V. PROCESSING AND CONVERSION

38. Feedstocks need to be transported to the location where they are processed and transformed into biofuels. Some of these processes are energy intensive and can generate significant waste. Further the development of infrastructure to support processing and conversion of biomass into biofuel can have a variety of impacts. Depending on the processes used the environmental impacts differ, as each process creates different types of wastes which need to be treated or disposed of. In general the methods for creating biofuels can be classified as biological, chemical or thermal. Biological processes create waste streams composed of micro-organisms, gases and regents. Further the effluent from the fermentation processes used in biological methods may be substantial (1). Chemical processes on the other hand create acids and residues while thermal processes tend to be noisy and odoriferous and produce wastewater, ash, tar and exhaust gases (37). Depending on how these wastes are managed they could have a variety of impacts on the environment, water and air quality and biodiversity. With regards to greenhouse gases, the largest source of emissions during processing is the production of methane during secondary fermentation processes (46). However the production of biofuels usually generates much less greenhouse gas than the cultivation of feedstocks and that methane can be contained by covering fermentation containers (46).

39. Though estimates regarding the amount of water used in the production of different biofuel crops are generally available, estimates regarding direct and indirect water usage along other parts of the supply chain are not (37). However, it is estimated that ethanol plants require between 3 and 6 litres of water for every litre of ethanol produced (35).

40. Where biofuels can be processed and used locally they have the potential to help meet local energy needs, encourage development as well as lessen dependence on oil imports (8, 14, 46,). Further the processing of biomass can be labour-intensive and the production of biofuels could therefore be a source of employment (8).

VI. OPTIONS FOR INTEGRATING BIOFUEL ISSUES INTO THE WORK OF THE CONVENTION ON BIOLOGICAL DIVERSITY

41. Biofuels can have a variety of impacts on biodiversity and socio-economic conditions. Given the cross-cutting characteristics of this emerging technology and its potential significant positive and negative impacts, the issue of biofuels should be integrated into relevant programmes of work under the Convention on Biological Diversity. Several of the Convention's programmes of work already implicitly cover issues related to biofuel production and provide the mandate for establishing specific priority activities.

42. In particular the expanded programme of work on forest biological diversity and the programme of work on agricultural biodiversity could serve as important entry points for the consideration of biofuels given the potentially positive and negative impacts that this technology could have on forests and agricultural systems. In addition, as the current expansion of biofuels is driven largely by public policy and subsidies, the programme of work on incentive measures is also highly relevant. Further, activities may be developed around the Convention's work on biodiversity and climate change.

43. Much progress could be achieved by applying the tools and guidelines which have already been developed under the Convention. These should be taken into account in the development of sound biofuel policy frameworks. They include *inter alia*:

(a) The ecosystem approach;

(b) The Addis Ababa Principles and Guidelines for Sustainable Use;

(c) The Guiding Principles on Invasive Alien Species;

(d) The Voluntary Guidelines for Biodiversity-inclusive Impact Assessment;

(e) The Akwé: Kon Voluntary Guidelines for the conduct of cultural, environmental and social impact assessments regarding development on sacred sites and on lands and waters traditionally occupied or used by indigenous and local communities;

(f) The proposals for the design and implementation of incentive measures, and the proposals for the application of ways and means to remove or mitigate perverse incentives;

(g) The application of the precautionary approach; and

(h) Efforts and approaches in private-sector engagement (decision VIII/17).

A. Options for integrating biofuel issues into the programme of work on agricultural biodiversity

44. Biofuel production, especially when based on agricultural feedstocks, is linked to several dimensions of agricultural biodiversity, including genetic resources and ecosystem services, and could be addressed through several activities of the programme of work on agricultural diversity, in particular:

(a) Activity 2 of programme element 2: "Identify and promote the dissemination of information on cost-effective practices and technologies, and related policy and incentive measures that enhance the positive and mitigate the negative impacts of agriculture on biological diversity, productivity and capacity to sustain livelihoods";

(b) Activity 3 of programme element 2: "Promote methods of sustainable agriculture that employ management practices, technologies and policies that promote the positive and mitigate the negative impacts of agriculture on biodiversity, with particular focus on the needs of farmers and indigenous and local communities"; and

(c) Activity 1 of programme element 4: "Support the institutional framework and policy and planning mechanisms for the mainstreaming of agricultural biodiversity in agricultural strategies and action plans, and its integration into wider strategies and plans for biological diversity".

B. Options for integrating biofuel issues into the expanded programme of work on forest biodiversity

45. Biofuels pose significant threats to forest biodiversity, primarily as a result of land conversion. The potential impacts of biofuel production could be monitored and addressed through several goals of the expanded programme of work on forest biodiversity. In particular:

(a) Goal 2 of Programme Element 1: "Reduce the threats and mitigate the impacts of threatening process on forest biological diversity";

(b) Goal 4 of Programme Element 1: "Promote the sustainable use of forest biological diversity" and

(c) Goal 1 of Programme Element 2: "Enhance the institutional enabling environment".

C. Additional opportunities for integrating biofuel issues into the work under the Convention

46. As the production of biofuels has potential implications for a variety of environmental and socio-economic issues, the topic of biofuels could be addressed by several other programmes of work under the Convention. In particular the programme of work on technology transfer and technological and scientific cooperation, the programme of work on traditional knowledge, innovations and practices, the programme of work on incentive measures and the programme of work on protected areas are relevant to this issue.

47. The Conference of the Parties at its seventh meeting recognized the need to remove policies or practices that create perverse incentives that lead to the degradation and loss of biological diversity, or to mitigate these perverse incentives, as a crucial element in national and global strategies to halt the degradation and loss of biodiversity. As noted above, the current expansion of biofuel production is spurred by subsidies, tariffs, fuel mixture obligations and other incentive measures. It may be particularly relevant to examine these incentive measures for possible perverse effects on the conservation and sustainable use for biodiversity. This could be considered as part of the in-depth review of the programme of work on incentive measures.

D. Development of international sustainable biofuels criteria, standards and certifications schemes

48. One potential measure to further promote the positive impacts and reduce the negative impacts of biofuel production is the development of biodiversity-related sustainability criteria, standards and certification schemes. Such schemes can promote the sustainable production, conversion, use, and trade of biofuels. Several Parties and international organizations, including the Global Bioenergy Partnership, the United Nations Environment Programme, the Food and Agriculture Organization (International Bioenergy Platform) and the International Energy Agency, as well as the International Biofuels Forum and the Roundtable on Sustainable Biofuel, are currently developing guidelines related to this subject. Further several international non-governmental organizations such the World Wide Fund for Nature, Friends of the Earth and Greenpeace have already proposed criteria or certification models.

49. In order to be effective any sustainability criteria, standards or certification schemes for biofuels should be integrated into sound policy frameworks. There is a need to ensure that any such schemes are consistent with existing environmental and development policy frameworks, in particular the National Biodiversity Strategies and Action Plans and the global commitment to significantly reduce the rate of biodiversity loss by 2010 and development plans and poverty reduction strategies and plans.

50. Similarly it could be possible to learn from existing criteria, standards and certification schemes such as the Round Table on Sustainable Palm Oil or the Forest Stewardship Council. One lesson from existing schemes, is that while they can be effective in promoting sustainable production in markets that are sensitive to environmental issues, their overall beneficial effect can be undermined if goods from unsustainable production can still be sold in other markets. There is thus a need for such criteria, standards and certification schemes to be developed and adopted globally. Moreover, given the global effects of biofuel production as mediated through commodity prices and consequent land-use change, such criteria, standards and certification schemes would need to fully account for such indirect effects on biodiversity. This would be a very challenging task.

51. The certification of biofuels cannot be the only vehicle to translate effective sustainability standards into practice however. Due to the restrictions to biofuel production, displacement effects can still occur, even if full compliance with standards is achieved in the certification scheme. As explained above, specific support policies may also generate indirect negative environmental and biodiversity effects, possibly in other countries. Therefore, additional policies and policy reforms are needed to safeguard against negative environmental and socio-economic impacts. Emerging decision support tools, such as the Food and Agriculture Organization's recently launched Bioenergy Assessment Tool or their emerging Bioenergy Environmental Impact Analysis framework, could assist government decision making in this regard.

VII. CONCLUSION

52. Biofuels are promoted for several reasons: energy security and import substitution; support to agricultural producers/income generation; and to contribute to reducing greenhouse gas emissions. Significant uncertainties remain over the impacts of biofuels on biodiversity, climate change, and livelihoods. Potential positive and negative impacts vary depending on how and where biofuels are produced and used. Further, the diversity of feedstocks and processes used in the production of biofuels means that the impacts can vary from product to product. An examination of the impacts of biofuel production and use on biodiversity would therefore need to examine each biofuel system on its own merits and against sustainability criteria.

53. There currently appears to be no clear scientific justification, either from a climate change mitigation or biodiversity perspective, for broad scale policies that promote biofuel production such as production subsidies, import tariffs or minimum requirements for the use of biofuels in transport fuels. Rather, policies, subsidies and tax incentives would need to be selective for each biofuel system so that only environmentally and socio-economically sound biofuels are promoted. Moreover, biofuel policies need to be couched in sound policy frameworks that include transport and land use change policies, and broader approaches to renewable energy and increasing energy efficiency.

54. The application of tools and guidance already developed under the Convention, including the ecosystem approach, strategic environmental assessment, and proposals for the application of ways and means to remove or mitigate perverse incentives, could inform a coherent approach to the formulation of biofuel policies.

55. Criteria, standards and certification could be developed to help identify and promote biodiversity-friendly biofuels and these could draw on existing approaches and efforts.

VIII. DRAFT DECISION

56. The Conference of the Parties at its ninth meeting may wish to adopt decision along the following lines:

The Conference of the Parties,

Taking into account the high importance and complex nature of the issue of biofuel production for biodiversity;

Recognizing the potential positive and negative impacts of biofuels on biodiversity along the full life cycle of production and use, depending, inter alia, on the mode and place of production, the agricultural practices involved and the policies in place;

Noting recommendation XII/7 of the Subsidiary Body on Scientific, Technical and Technological Advice which provides a preliminary analysis of the potential positive and negative impacts of biofuels on biodiversity and human well-being; and

Recalling decision 13/CP8 of the United Nations Framework Convention on Climate Change and decision 12/CP.6 of the United Nations Convention to Combat Desertification on enhanced cooperation between the Rio conventions;

1. *Urges* Parties and other Governments, in consultation with indigenous and local communities, and relevant organizations and stakeholders to develop policy frameworks for bioenergy and especially liquid biofuel production, that contribute to the mitigation of greenhouse-gas emissions and avoid negative impacts on biodiversity, including impacts in other countries, taking into account the full life-cycle of biofuel production and use, including land-use change and indirect effects through displacement of production and impacts on commodity prices, and to review, and if indicated, adjust existing bioenergy policies, in particular incentive measures. In doing so, countries are encouraged to make use of the relevant tools and guidance developed under the Convention;

2. *Encourages* Parties and other Governments, indigenous and local communities, and relevant stakeholders and organizations, to contribute to ongoing efforts to develop criteria, standards and certification schemes relating to the production and consumption of sustainable biofuels in order to prevent and minimize potential negative impacts on biodiversity along their full life cycles, including land use change and indirect effects through displacement and impacts on commodity prices and *requests* the Subsidiary Body on Scientific, Technical and Technological Advice, as a potential contribution to efforts to develop criteria, standards and certification schemes, to develop specific elements as related to the objectives and relevant provisions of the Convention on Biological Diversity and to report to the Conference of the Parties at its tenth meeting;

3. *Invites* the United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification and other relevant organizations and partners to collaborate with the Convention on Biological Diversity on the issue of biofuel production and consumption, in order to consider opportunities for sustainable cultivation and utilization of energy crops and ensure that issues related to the conservation and sustainable use of biodiversity are adequately taken into account.

Annex

REFERENCES

1. Berndes, G. (2002). Bioenergy and water - The implications of large-scale bioenergy production for water use and supply. Global Environmental Change 12: 253-271.

2. Brown, L.R. (2006). Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble. Earth Policy Institute. Available from http://www.earth-policy.org/Books/PB2/index.htm.

3. Colchester, M., Jiwan, N., Andiko, Sirait, M., Firdaeus, A.Y., Surambo, A., Pane, H. (2006). Promised Land: Oil-palm and Land Acquisition in Indonesia – Implication for Local communities and Indigenous people. Forest Peoples Programme, Perkumpulan Sawit Watch, HuMA and the World Agroforestry Centre. Available from http://www.forestpeoples.org/documents/prv_sector/oil_palm/promised_land_eng.pdf.

4. Committee on the Elimination of Racial Discrimination (CERD). (2007). Consideration of reports submitted by State Parties under Article 9 of the Convention. Concluding observation of the committee on the elimination of racial discrimination – Indonesia. Presented at the 71st session of the Committee on the elimination of racial discrimination. Available from http://www2.ohchr.org/english/bodies/cerd/docs/CERD.C.IDN.CO.3.pdf .

5. Comprehensive Assessment of Water Management in Agriculture. (2007). Water for Food, Water for Life. Earthscan: London, U.K., and International Water Management Institute: Colombo, Sri Lanka. Available from http://www.iwmi.cgiar.org/Assessment/.

6. Cook, J. and Beyea, J. (2000). Bioenergy in the United States: Progress and Possibilities. Biomass and bioenergy 18: 441-455.

7. De Fraiture, C., Giordano, M., Yongsong, L. (2007). Biofuels and implications for agricultural water use: blue impacts of green energy. Internation Water Management Institute: Colombo, Sri Lanka. Available from http://www.iwmi.cgiar.org/EWMA/files/papers/Biofuels%20-%20Charlotte.pdf.

8. Doornbosch, R. and Steenblik, R. (2007). Biofuels: Is the Cure Worse than the Disease? Round Table on Sustainable Development. SG/SD/RT(2007)3. Available from http://www.rsc.org/images/biofuels_tcm18-99586.pdf.

9. Dufey, A. (2006). Biofuels Production, Trade and Sustainable Development: Emerging Issues. International Institute for Environment and Development. London. Available from http://www.iied.org/pubs/pdfs/15504IIED.pdf.

10. FAO (2008). Bioenergy Environmental Analysis (BIAS); prepared by Oeko-Institut/IFEU for FAO. Rome (forthcoming)

11. Fargione, J., Hill, J., Tilman, D., Polasky, S. and Hawthorne, P. (2008). Land Clearing and the Biofuel Carbon Debt. Science, 319(5867), 1235 - 1238. Available from http://www.sciencemag.org/cgi/content/abstract/1152747.

12. Firbank, L.G. (2008). Assessing the Ecological Impact of Bioenergy Projects. BioEnergy Research Published on-line 26 January 2008. Available from http://www.springerlink.com/content/r5668x542208h473/fulltext.pdf.

13. International Energy Agency (IEA). (2007). IEA Energy Technology Essentials: Biofuel Production. International Energy Agency. Available from: http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1918.

14. International Energy Agency (IEA). (2005). Biofuels for transport: An international perspective. International Energy Agency, Paris. Available from http://www.iea.org/textbase/nppdf/free/2004/biofuels2004.pdf.

15. International Energy Agency (IEA) Bioenergy Task 40 (2006) Opportunities and barriers for sustainable international bioenergy trade and strategies to overcome them. Accessible from http://www.bioenergytrade.org/downloads/t40opportunitiesandbarriersforbioenergytradefi.pdf.

16. Kartha, S. (2006). Environmental effects of bioenergy. In Bioenergy and Agriculture: Promises and Challenges. Hazel, P. and Pachauri, R.K. (eds). A 2010 Vision for Food, Agriculture and the Environment – Focus 14. International Food Policy Research Institute.

17. Koh, L.P. (2007). Potential habitat and biodiversity losses from intensified biodiesel feedstock production. Conservation Biology 21 (5) 1373-1375.

18. Kutas, G., Lindberg, C., and Steenblik, R. (2007). Biofuels—At What Cost? Support for Ethanol and Biodiesel in the European Union. Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD) Geneva, Switzerland. Available from http://www.globalsubsidies.org/IMG/pdf/Global_Subsidies_Initiative_European_Report_on_support_to_Biofuels.pdf.

19. Low, T. and Booth, C. (2007). The Weedy Truth About Biofuels. Invasive Species Council: Melbourne, Australia. Available from http://www.invasives.org.au/downloads/isc_weedybiofuels_oct07.pdf.

20. Marti, S. (2008). Losing Ground: The human rights impacts of oil palm plantation expansion in Indonesia. Friends of the Earth, LifeMosaic and Sawit Watch. http://www.foe.co.uk/resource/reports/losingground.pdf.

21. Millennium Ecosystem Assessment. (2005). Ecosystems and human well-being: Island Press: Washington, Covelo, London.

22. Morton, D.C., DeFries, R.S., Shimabukuro, Y.E., Anderson L.O., Arai, E., Espirito-Santo, F.dB, Freitas, R., Morisette, J. (2006). Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon. Proceedings of the National Academy of Science, 103(39), 14637-14641. Available from http://www.pnas.org/cgi/content/full/103/39/14637.

23. Organisation for Economic Co-Operation and Development (OECD) – Food and Agriculture Organization of the United Nations (FAO). (2007). OECD-FAO Agricultural outlook 2007-2016. OECD Publication: Paris, France. Available from http://www.oecd.org/dataoecd/6/10/38893266.pdf.

24. Oxfam International (2006). Bio-fuelling Poverty: Why the EU renewable-fuel target may be disastrous for poor people. Oxfam Briefing Note. Available from http://www.oxfam.org.uk/resources/policy/trade/downloads/bn_biofuels.pdf?m=234&url=http://www.oxfam.org.uk/resources/policy/trade/downloads/bn_wdr2008.pdf.

25. Raghu, S., Anderson, R.C., Daehler, A.S., Wiedenmann, R.N., Simberloff, D. and Mack, R.N. (2006). Adding Biofuels to the Invasive Species Fire. Science 313 (5794), 1742.

26. Rajagopal, D. and Zilberman, D. (2007). Review of Environmental, Economic and Policy Aspect of Biofuels. Sustainable Rural and Urban Development Division of The World Bank. Policy Research Working Paper 4341. Available from http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/09/04/000158349_20070904162607/Rendered/PDF/wps4341.pdf

27. REN21. (2008). Renewables 2007 Global Status Report. REN21 Secretariat and Worldwatch Institute, Washington, DC. Available from http://sefi.unep.org/fileadmin/media/sefi/docs/industry_reports/RE2007_Global_Status_Report.pdf

28. Righelato, R and Spracklen, DV. (2007) Carbon Mitigation by Biofuels or by Saving and Restoring Forests? Science 317 (902), 902.

29. Schmidhuber, J. 2006. The effects of biomass use on world agricultural markets. Paper prepared for the "International symposium of Notre Europe", Paris, 27-29 November 2006. Available from http://www.fao.org/es/esd/BiomassNotreEurope.pdf

30. Scientific and technical Advisory Panel of the Global Environmental Facility (GEF-STAP). (2006). Report of the GEF-STAP workshop on liquid biofuels. United Nations Environment Programme-GEF. Available from http://www.gefweb.org/documents/council_documents/GEF_30/documents/C.30.Inf.9.Rev.1ReportoftheGEF-STAPWorkshoponLiquidBiofuels.pdf

31. Secretariat of the Convention on Biological Diversity (SCBD). (2006). Global Biodiversity Outlook 2. SCBD: Montreal. Available from http://www.cbd.int/doc/gbo2/cbd-gbo2-en.pdf.

32. Secretariat of the Convention on Biological Diversity (SCBD) and Netherlands Environmental Assessment Agency (MNP). (2007). Technical Series 31: Cross-roads of Life on Earth — Exploring means to meet the 2010 Biodiversity Target. Solution oriented scenarios for Global Biodiversity Outlook 2. Secretariat of the Convention on Biological Diversity, Montreal. Available from http://www.cbd.int/doc/publications/cbd-ts-31.pdf

33. Searchinger, T, Heimlich, R,. Houghton, R. A., Dong, F. Elobeid, A., Fabiosa, J., Tokgoz, T., Hayes, D., and Yu, T. (2008) Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change. Science. Published on-line 7 February 2008. Available from http://www.sciencemag.org/cgi/content/abstract/1151861.

34. Shepard, J.P. (2006). Water quality protection in bioenergy production: the US system of forestry Best Management Practices. Biomass and Bioenergy 30 (4), 378-384.

35. Steenblik, R. (2007). Biofuels – At What Cost? Government Support for Ethanol and Biodiesel in Selected OECD Countries: A Synthesis of Reports Addressing Subsidies for Biofuels in Australia, Canada, the European Union, Switzerland and the United States. International Institute for Sustainable Development. Manitoba, Canada. Available from http://www.globalsubsidies.org/IMG/pdf/biofuel_synthesis_report_26_9_07_master_2_.pdf

36. Tauli-Corpuz, V. and Tamang, P. (2007). Oil Palm and Other Commercial Tree Plantations, Monocropping: Impacts on Indigenous Peoples' Land Tenure and Resource Management Systems and Livelihoods (E/C.19/2007/CRP.6). Permanent Forum on Indigenous Issues, Sixth session. New York, 14-25 May 2007. http://www.un.org/esa/socdev/unpfii/documents/6session_crp6.doc

37. The Royal Society. (2007). Sustainable Biofuels: Prospects and Challenges. RS Policy document 01/08. The Royal Society, London. Available from http://royalsociety.org/displaypagedoc.asp?id=28632

38. Tilman, D. Hill, J. and Lehman, C. (2006). Carbon-Negative Biofuels from Low-Input High-Diversity Grassland Biomass, Science 314 (5805), 1598-1600.

39. Trondheim Biodiversity Conferences, (2007). Chairman's report on the Trondheim/UN Conference on ecosystems and people – biodiversity for development – the road to 2010 and beyond. October 29 - November 2, 2007. Available from http://www.trondheimconference.org/attachment.ap?id=4635

40. United Nations. (2007). Sustainable Bioenergy: A Framework for Decision Makers. UN-Energy. Available from http://esa.un.org/un-energy/pdf/susdev.Biofuels.FAO.pdf

41. United Nations Conference on Trade and Development (UNCTAD). (2007). Trade and development report 2007. UNCTAD/TDR/2007. United Nations Conference on Trade and Development, Geneva. Available from http://www.unctad.org/en/docs/tdr2007_en.pdf.

42. United Nations Development Programme (UNDP), (2007). Human Development Report 2007/2008 - Fighting Climate Change: Human Solidarity in a Divided World. United Nations Development Programme, New York. Available from http://hdr.undp.org/en/media/hdr_20072008_en_complete.pdf

43. United Nations Environment Programme (UNEP). (2008). UNEP Year Book 2008: An Overview of Our Changing Environment. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme, Nairobi, Kenya. Available from http://www.unep.org/geo/yearbook/yb2008/report/UNEP_YearBook2008_Full_EN.pdf

44. United Nations Environment Programme (UNEP). (2007). Global Environment Outlook 4: Environment for development. United Nations Environment Programme. Available from http://unep.org/geo/geo4/report/GEO-4_Report_Full_en.pdf

45. United Nations Environment Programme (UNEP). (2007). Global Trends in Sustainable Energy Investment 2007. Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency in OECD and Developing Countries. Available from http://sefi.unep.org/fileadmin/media/sefi/docs/publications/SEFI_Investment_Report_2007.pdf

46. Zah, R., Böni, H., Gauch, M., Hischier, R., Lehman, M. and Wäger, P. (2007). Life Cycle Assessment of Energy Products: Environmental Assessment of Biofuels – Executive Summary. Empa, Swiss Federal Institute for Materials Science and Technology, Technology and Society Lab: St. Gallen, Switzerland. Available from http://www.bfe.admin.ch/themen/00490/00496/index.html?lang=en&dossier_id=01273
