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BIOFUELS AND BIODIVERSITY: REPORT ON THE WORK IN RESPONSE TO DECISION X/37

Note by the Executive Secretary

EXECUTIVE SUMMARY

There has been progress in efforts to develop and apply tools and approaches to assist promoting the positive and minimizing or avoiding the negative impacts of biofuels production and use on biodiversity, and the associated socio-economic impacts. A number of important gaps remain, including: lack of consistency among, and incomplete treatment of biodiversity impacts in, life-cycle-analysis methodologies; lack of agreed definition, classification or quantification of "degraded" lands and related concepts, "waste" products, and "high biodiversity or conservation value" lands; lack of an agreed international regulatory framework to apply sustainability criteria; and limited attention to the socio-political drivers of biofuels policy, assessing biofuels against alternative renewable energy options, and impacts on biodiversity that affect related socio-economic conditions. In particular, there is the inherent difficulty of addressing the cumulative impact of biofuel activities through displacement effects brought about through indirect land, and other resource, use change.

Efforts are continuing to address many of these gaps. Tools and approaches already exist, and are increasingly, but not universally, applied to address project level and site-specific sustainability issues, including for locally sourced biofuels in international trade. Ways and means to mitigate indirect impacts of biofuels are being advanced, but they cannot fully eliminate it.

Various biofuels incentive measures, including subsidies, targets and mandates, are major drivers of biofuels development. The claimed economic, climate-change-mitigation or biodiversity objectives of many of these are not supported by recent scientific assessments undertaken by Parties. There are significant opportunities to adjust these measures to promote sustainability and evidence of attention to this by some Parties.

Sustainability of biofuels is a sub-set of, and depends on, achieving sustainability in all biomass-consuming and producing sectors. The key need is for effective strategic planning tools and approaches to address sustainable consumption and production under multiple resource pressures, and a policy mechanism responsive to them.

* UNEP/CBD/SBSTTA/16/1.

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SUGGESTED RECOMMENDATIONS

The Subsidiary Body on Scientific, Technical and Technological Advice may wish to recommend that the Conference of the Parties adopts a decision along the following lines:

The Conference of the Parties

1. *Welcomes* the efforts of many Parties, relevant organizations and initiatives in developing and applying tools and approaches to promote the positive and minimize or avoid the negative impacts of the production and use of biofuels on biodiversity, and *encourages* continuing efforts in these regards;

2. *Takes note* of the gaps in tools and approaches, and remaining uncertainties surrounding the sustainability of biofuels, identified in the present document (UNEP/CBD/SBSTTA/16/14), in particular the inherent difficulty of addressing the cumulative impacts of biofuel activities through indirect land-use change;

3. *Recognizing* that various incentive measures, including subsidies, the setting of targets or mandates for biofuels production and use, and associated trade measures, are significant drivers of biofuels expansion and therefore have impacts on biodiversity through land-use change, and associated greenhouse gas emissions, *urges* Parties and other Governments to ensure that these measures are evaluated against clearly defined objectives, including, *inter alia*, the Aichi Biodiversity Targets and the net reduction of greenhouse gas emissions, using appropriate tools, such as strategic environment assessment, and, where indicated by the outcome of such evaluations, to adjust these measures accordingly;

4. *Further recognizing* that the sustainability of biofuel production and use, with regard to biodiversity, is a particular aspect of the broader issue of sustainable consumption and production, including the management of land, water, energy and other resources, and that consideration of these matters will be necessary to achieve the Aichi Biodiversity Targets, in particular targets 4, 5, 7, 8, 14 and 15, *encourages* Parties:

(a) To consider these matters, in consultation with relevant sectors and stakeholders, when updating and implementing their national biodiversity strategies and action plans, and other relevant policies; and

(b) To make use of tools for strategic environment assessment and integrated land-use planning to address these matters;

5. *Requests* Parties and *invites* other Governments to report on progress in responding to paragraphs 3 and 4 above, *inter alia*, through their fifth national reports;

6. *Requests* the Subsidiary Body on Scientific, Technical and Technological Advice, bearing in mind relevant work in other forums, to assess the effectiveness of tools and approaches for strategic environment assessment and integrated land-use planning in assisting Parties to achieve the Aichi Biodiversity Targets, and to report on its findings for the consideration of the twelfth meeting of the Conference of the Parties.

I. INTRODUCTION

1. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) considered biofuels as an emerging issue at its twelfth meeting, held in Paris from 2 to 6 July 2007. The Conference of the Parties subsequently adopted decision IX/2 in which Parties, *inter alia*, agreed that biofuels production and use should be sustainable in relation to biological diversity; stressed that sustainability must necessarily take into account the environmental, economic and social pillars of sustainable development; recognized the need to promote the positive and minimize the negative impacts of biofuels production and its use on biodiversity and the livelihoods of indigenous and local communities; and noted the need to make use of existing tools and guidance under the Convention. At its fourteenth meeting, held in Nairobi from 10 to 21 May 2010, the Subsidiary Body considered further information on experiences on this topic. In decision X/37, the Conference of the Parties, *inter alia*, expanded further on the importance of developing and applying tools and approaches to promote the positive and minimize or avoid the negative impacts of biofuel production and use, in their full life cycle as compared to that of other types of fuels, including to address: land-use and water policies, and other relevant policies and/or strategies, in particular direct and indirect land-use and water-use change; changes affecting, among others, areas of high value for biodiversity and areas of cultural, religious and heritage interest so as to assist identifying areas where biofuels could be used or exempted from; and, the need for environmentally sound technologies and impact assessments.

2. In paragraphs 11 and 12 of decision X/37, the Conference of the Parties requested the Executive Secretary, taking into account ongoing work of partner organizations and processes, to analyse and summarize information on tools for voluntary use, including on available standards and methodologies to assess direct and indirect effects and impacts on biodiversity of the production and use of biofuels, in their full life cycle as compared to that of other types of fuels, and impacts on biodiversity that affect related socio-economic conditions, and bring gaps to the attention of relevant organizations and processes. In paragraph 13 of the same decision, the Conference of the Parties requested the Executive Secretary to contribute to, and assist with, the ongoing work of relevant partner organizations and processes. In paragraph 14 of the decision, the Executive Secretary was requested to report on progress on the subject to a meeting of the Subsidiary Body prior to the eleventh meeting of the Conference of the Parties.

3. In response to that request, the Executive Secretary issued notification SCBD/STTM/JM/DCO/76500 (2011-121) on 16 June 2011, inviting Parties, other Governments and relevant organizations to submit their experience and results from assessments of the impacts of biofuel production and use on biodiversity, as well as activities identified for them in paragraphs 7, 8 and 9 of decision X/37. As of the date of this note, submissions had been received from Brazil, the European Union (EU) (on behalf of the European Union member States: Belgium, Finland, France, Germany, the Netherlands and the United Kingdom), Norway and Switzerland. Submissions were also received from the following organizations: European Centre for Nature Conservation (ECNC), United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC), Swedish Board of Agriculture, United Nations University Institute of Advanced Studies (UNU-IAS), World Wildlife Fund for Nature International. The information supplied through this notification is available, as received, at https://www.cbd.int/agro/biofuels/responses.shtml.

4. The Executive Secretary has prepared an information document (UNEP/CBD/SBSTTA/16/INF/32) which provides further details of the work undertaken and includes a more detailed analysis of information submitted by Parties and relevant organizations. A number of these submissions contained information specifically on tools and this has also been made available at https://www.cbd.int/agro/biofuels/tools.shtml, together with other information sources on this subject. Further information on some tools is provided in the annex to this note. In addition, there is evidence of the Convention on Biological Diversity itself being used as a "tool" for the promotion of sustainable approaches to biofuels with regards to biodiversity, as implied in decision IX/2, as witnessed by explicit references to it in a number of important reviews as well as by some prominent biofuels-sustainability processes.

5. Section II of the present note focuses on the key issues identified and gaps in tools and approaches to address them. Section III provides brief information on the Global Bioenergy Partnership (GBEP) and the Roundtable on Sustainable Biofuels (RSB), and the contribution of the Executive Secretary to these. These are two examples of well-advanced initiatives attempting to address the issues identified in section II. Section IV draws conclusions and identifies the overarching need to assess biofuels policies in a much broader context of sustainable resource use; that is, as one activity among many needing to be assessed collectively in the context of the Strategic Plan for Biodiversity 2011-2020 and achieving all of the relevant Aichi Biodiversity Targets collectively.

6. A draft of this document was available for review for a period of ten days and comments received[1] were taken into account in finalizing this note.

II. PROGRESS IN BIOFUELS DEVELOPMENT AND KEY GAPS IN TOOLS AND APPROACHES

7. The annex to the present note provides an itemized summary of some of the more detailed technical information presented in the above-mentioned information document (UNEP/CBD/SBSTTA/16/INF/32). The following is a simplified narrative of this information, highlighting the key points that arise.

8. Scientific and other awareness of biofuels issues and solutions has rapidly advanced since the science of the topic was first considered by the Subsidiary Body at its twelfth meeting. Several important and useful general reviews have recently been published. Overall, there is good progress in approaches to address many sustainability issues. Some key issues remain, and although there is ongoing attention to these, some are unlikely to be resolved in the near term, if at all. The very diverse nature of biofuels continues to warrant caution when making generalizations; there are nearly always exceptions to most conclusions that can be drawn.

9. The benefits of dedicated bioenergy crops, where energy is the primary motivation for using the biomass in question, usually based on monocultures, remain the most controversial. In many well documented cases, this approach can lack sustainability, be in direct conflict with food security, and involve significant biodiversity loss. Moreover, in some cases they may deliver limited reductions, and even net increases, in greenhouse gas (GHG) emissions. However, there are exceptions and these invariably involve strong government commitment backed by effective programmes to move production towards sustainability (sugarcane in Brazil being the most widely quoted example). In parallel, there is increasing interest in opportunities for integrating bioenergy production from "waste" products or "surplus" biomass into existing agricultural and forestry systems and biomass refining and processing. Such approaches are, however, not without constraints (see below) and existing science reinforces the need for comprehensive life-cycle analysis across the board. In addition, emerging technologies are shifting energy conversion efficiencies and thereby potentials to mitigate, but not remove, some of the drawbacks with bioenergy, in particular land-use pressures.

10. One area of rapid advancement is with so called "second generation" biofuels, or ligno-cellulose technology, often accompanied by genetic modification of biological agents required to break-down cellulose. This technology has been cited as offering improvements in energy-conversion efficiency of biomass, and hence mitigation of impacts, including mitigating competition with foods since non-food sources of biomass can be used to derive energy (that is, essentially avoiding using plant oils and carbohydrates). However, the extent to which "waste" cellulose is available in farming and forestry systems is debated. Much of it is actually required to support soil functions and fertility and often directly supports other biodiversity. The extent to which ligno-cellulose technology reduces pressures on land is very much case specific. Some studies have suggested that ligno-cellulose derived energy from dedicated

[1] As of 15 February 2012, comments had been received from Canada, Mexico and the Secretariats of the Global Bioenergy Partnership and the Roundtable on Sustainable Biofuels.

bioenergy crops may require a larger land area, largely due to the fact that they do not produce beneficial co-products such as animal fodder, which would need to be grown separately.

11. There is also much interest in, and some optimism for, algal biofuels which could be 200 times more productive per unit area than a land-based crop. However, and depending on the technology adopted and location of production, algal biofuels can substitute land-use for wetlands-use impacts and illustrate the need for comprehensive life-cycle analysis that goes beyond land considerations.

12. Combining bioenergy, assuming limited adverse indirect effects, and carbon capture and storage using biomass raises the important possibility of removing greenhouse gases from the atmosphere in the long term—a necessity for substantial overall reductions of such gases.

Sustainability criteria and certification schemes

13. Currently, these lack comprehensive Life-Cycle Assessments (LCAs), particularly regarding indirect land-use change (iLUC), and this and other constraints, as noted below, necessitate a precautionary approach in developing and sourcing biofuels. There are concerns regarding the effectiveness of voluntary frameworks, especially under globalized conditions.

14. Identifying sustainability criteria, and the associated step of basing certification schemes on these, are receiving considerable support as tools to achieve the sustainability of biofuels. Voluntary standards are under development by various initiatives, industry or other interested groups such as NGOs, and often promoted by multi-stakeholder alliances. They typically set out criteria or principles that producers can adhere to in order to get accreditation to that standard. It has been suggested that the current diversity of standards calls for harmonisation to ensure agreed environmental aims are met. Market-based certification usually only covers a fraction of the product market, creating the appearance of sustainability whilst unsustainable production continues. There are, therefore, some calls for internationally agreed standards and frameworks, including for a mandatory regulatory framework under a United Nations agency or instrument. Most recognize the need to implement international standards without creating unwanted trade barriers, especially for developing countries. Some Governments are already applying their own and often more stringent standards.

15. Land expansion, and other impacts, from energy or food crops are similar. Food security can dominate agricultural objectives but is also dependent on sustainability. But a significant proportion of agricultural production does not support food security. Whilst some argue that biofuels should be regulated more stringently than other agricultural products, others, backed by most scientific evidence and argument, support equal standards being applied to all agricultural commodities, or at least beyond those meeting basic and essential human needs.

Life-cycle analysis (LCA)

16. There has been considerable attention to life-cycle analysis in recent years, although a number of unresolved gaps remain, in particular assessing impacts through land-use change, including its implications for greenhouse-gas emissions and other biodiversity considerations (discussed further below), and an erroneous assumption that bioenergy systems are always climate neutral. Reviews suggest that possibly less than one third of recent life-cycle analyses have presented results for impacts other than for greenhouse gases (e.g., acidification and eutrophication) and none have considered biodiversity. Bioenergy systems continue to be considered in many life-cycle analyses to be climate neutral because the carbon dioxide released from biomass combustion approximately equals the amount of that sequestered by biomass re-growth. Even disregarding land-use change, this assumption appears to be flawed since it does not necessarily factor in time-delays for recapturing carbon, particularly where mature woody products are concerned. The challenge is to measure greenhouse-gas contributions with unit-based indicators to be included in life-cycle analyses, including for indirect land-use change. The inherent difficulties to quantify this effect have so far hindered accurate estimations. Further guidance to address the large uncertainty and variability in life-cycle analyses, and to improve and standardize the methodology to allow for more comparable results between fuel types, is being developed, including by

both the Global Bioenergy Partnership (GBEP) and the Roundtable on Sustainable Biofuels (RSB) (see paras. 33-36 below).

Assessing biofuels against other renewable energy options in life-cycle analyses

17. Current life-cycle analyses tend to compare biofuels performance against fossil fuels and rarely against other renewable energies; even so, benchmarks and methodological standards for fossil fuels are not universally agreed. This is partly because fossil fuels represent the benchmarks regarding GHG emissions, but decision IX/2 refers to comparisons of biofuels with "other fuel types", and not just fossil fuels. Biomass has the lowest power density of all renewable energies, and therefore requires the largest amount of land per unit of energy derived. The science and technology of renewable energies is also rapidly advancing, including for alternatives to biofuels, and the economics is rapidly changing, for example, photo-voltaics are becoming increasingly competitive and "artificial photosynthesis" and technologies to produce liquid biofuels without using biomass have been demonstrated experimentally. Broader forums are discussing these wider energy issues, but the current uncertainties regarding life-cycle analyses of biofuels questions the extent to which these forums can undertake effective analysis of their comparative benefits.

Land use

Growing biofuels on degraded lands

18. Major gaps include definitions of "degraded land" (and similar terminology), limited attention to competition for degraded land and alternative uses of degraded land to capture and store carbon.

19. There is a lack of consensus on definitions, classification and quantification of this kind of land using multiple criteria (e.g. soil quality indices, current land use and environmental degradation), taking into consideration that some can have high biodiversity and livelihood value. There are examples where growing biofuels in such areas could reduce local land pressures and enhance the quality of degraded soil and the vegetation structure, and therefore habitat quality. However, outcomes differ significantly between crop and land types used. The economics of production remains an important issue since degraded lands are less productive and may require further inputs, particularly fertilisers and water, each with their own implications for relevant life-cycle analyses. Globally there is competition for degraded land for other uses, in particular food, but also forestry and urbanization. There is no scientific consensus on the implications of this. Based on gross figures there appears to be ample "degraded" land to meet all needs, and area is increasing. But it is not all equally viable and it is likely that in practice competition might remain. Because of this, the extent to which bioenergy production on degraded land mitigates indirect land-use change is currently conjectural. Regarding GHG mitigation, there is currently very limited attention to the option of restoring carbon storage by degraded lands (e.g. through reforestation, including approaches like REDD+) *versus* the greenhouse-gas benefits of growing energy crops. Currently, a policy of large scale use of degraded lands for energy crops to significantly mitigate land-use pressures or as the most efficient means to mitigate greenhouse gases could not be fully supported without further research and analysis involving comprehensive life-cycle analyses of all relevant options.

Direct land-use change

20. Guidelines, criteria or regulations to avoid direct land-use change from biofuels are well advanced in many forums but detailed assessments have revealed sometimes inadequate understanding of biodiversity values and associated land-use change risks. Tools and approaches to manage direct land-use change are relatively well developed and usually involve identification of areas where biofuels may or should not be grown, as reflected in decision X/37 paragraph 7, including identifying and avoiding areas with "high conservation value" (HCV), or the identification of "responsible cultivation areas" (RCAs), or similar approaches. There is little discussion in the literature of the relationship between the various biofuels standards and their varying levels of protection for "high biodiversity" lands and little consensus on how they should be defined and identified. Even if criteria for HCV lands (etc.) are agreed, many countries still have limited capacity to undertake the necessary inventories, monitoring or management. But the problem remains that limiting bioenergy crops to appropriate areas still promotes indirect land-use

change, including by expanding other crops into the inappropriate areas (unless land use by other crops is managed in the same fashion). Clearly, sustainability for biofuels cannot be achieved unless other land use activities are managed for sustainability in parallel.

Indirect land-use change (iLUC)

21. Indirect land-use change (iLUC) remains the key unresolved biodiversity-related issue, including for the assessment of life-cycle analysis for greenhouse gases. There are approaches to mitigate iLUC from biofuels, but it is not possible to eliminate it. A key requirement is to integrate biofuels and other biomass consumption and production policies and there are probably significant gaps in implementation of tools and approaches to address this need.

22. There has been much attention to iLUC in the recent scientific literature and by most bioenergy sustainability initiatives. Most quantification work has, so far, only focussed on GHG emissions from iLUC from liquid biofuel production. Even for this, as yet there is no clear consensus due to large ranges in results, different methodologies and key assumptions. Other aspects of iLUC, such as other resource use, particularly water, and especially biodiversity implications, remain poorly addressed. In addition to improving bioenergy conversion efficiencies, sustainable intensification of agricultural production, including for biofuels, is widely cited as a key to mitigate iLUC impacts because it offers the prospect of reducing land required for production. In theory, this could even reverse land conversion. Policy measures supporting this approach are illustrated in the submissions received from some Parties (in particular Brazil) and include various relevant national plans for agro-energy, including measures specific to key crops, supported by significant investment in research and development in a number of relevant areas to promote sustainable bioenergy, including building a mutually beneficial relationship between biofuels and biodiversity.

23. Because of difficulties in quantifying iLUC impacts, many "sustainability" processes and policies currently do not deal with the problem and thereby, some have argued, they promote further iLUC. In the short-term, the development of improved tools and approaches is shifting towards assessing iLUC in terms of risk management and attempting to guide existing policies to reward low-risk and discourage high-risk strategies.

24. Sustainability of biofuels production and use cannot be achieved without achieving, in parallel, sustainability of other biomass producing and consuming sectors. Global implementation in all land-based sectors would be necessary for this strategy to be effective. This highlights the importance of integrating planning for bio-energy and other production activities, which centre on using a more holistic framework for land-use planning (including other relevant production inputs such as water and chemicals etc.).

Incentives: targets, subsidies and other economic measures

25. There is a gap in attention to the influence of incentives, considering they are currently the major driver of biofuels policy at the macro-scale. Most evidence suggests that, so far, they have not delivered significant GHG benefits, are an expensive way to mitigate climate change and are responsible for much land-use change and therefore biodiversity loss. But realigning approaches offers significant opportunities to promote sustainability.

26. The development of biofuels has been largely driven by Governments through mandates, targets, subsidies and various other incentives, including through trade policies, which have come under considerable scrutiny as being insufficiently supported by science. Targets or mandates for biofuels use can have similar impacts to perverse incentives. Caution also needs to be taken with so called "carbon taxes". These may in themselves be an appropriate means of incentivising moves towards carbon neutral economies, but care needs to be taken that they apply to emissions from all relevant sources, not just fossil fuels. For example, the third edition of the *Global Biodiversity Outlook* includes a case-study noting that incentives that apply to carbon dioxide emissions from fossil fuels and industrial emissions, without applying them to other energy sources based on life-cycle analyses including an iLUC factor, have dramatic implications for increases in land use for biofuels, resulting in significant loss of natural

land cover (particularly unmanaged forest), and therefore probably also a significant net increase in greenhouse-gas emissions. [2]

27. Some reviews conclude that the scientific consensus is that, overall, biofuels to-date have performed poorly, in some cases negatively, in terms of climate-change mitigation and costs are exceedingly high. Subsidies in North America and the European Union, in costs per unit of carbon dioxide avoided, far exceed the carbon value in the European and United States carbon markets (even without adequately factoring in the effects on greenhouse gases caused by indirect land use change). There are reports of significant information gaps and inconsistent monitoring and reporting for biofuels subsidies, but subsidies have certainly increased dramatically in the last decade and are increasing. They were estimated to be in the region of at least US$ 20 billion globally in 2009, with the United States of America and the European Union together accounting for 80 per cent of this figure. Many reviews and assessments point to the opportunities to realign these incentives to better achieve social, environmental and economic objectives. There is some encouraging evidence of increasing willingness to address these issues, and in some cases actual policy change; for example, the application of some national and regional biofuels targets has recently been postponed, pending improved sustainability measures.

28. Understanding the impacts of incentive measures, and more clearly identifying their objectives, is essential to addressing whether and how policies need to be adjusted to achieve sustainability. No science-based forum of discussion can avoid in-depth consideration of this topic, despite the political sensitivities.

Other gaps

Impacts on related socio-economic conditions

29. Recent work on biofuels remains dominated by the natural sciences. Limited information on socioeconomic aspects of biofuels was provided in submissions received, including on the socio-economic impacts occurring through changes in biodiversity associated with biofuels production and use.

30. Decisions IX/2 and X/37 recognize the potential for biofuels to have both positive and negative impacts on socio-economic conditions, including for indigenous and local communities. Both GBEP and RSB are making progress in developing indicators to assess this aspect. Numerous case-studies claim either positive or negative impacts but few rigorous social science based assessments of this topic have been made available. Some reviews claim that the socio-economic benefits of biofuels, so far, are generally unproven. Despite some examples of promoting socially responsible biofuels development, there are claims that in too many cases the reality is quite different. A common criticism is with some developments driven by multi-national companies and/or foreign investment, where local communities often lack knowledge, legal experience and capacity to negotiate equitable terms and ensure accountability. Solutions suggested include more widespread and enforceable corporate social responsibility, improved government oversight and support and incentives for smallholder biofuel schemes.

Socio-political drivers of biofuels policy

31. There are gaps in the information availability, and understanding of, the socio-political drivers of biofuels development. Whereas much of the biofuels discussion and analysis assumes that climate change mitigation is the main objective for biofuels, energy security can often be the key socio-political driver of biofuels policy. This is likely one factor explaining why some biofuels policies persist, despite concrete proof of lack of sustainability on environmental or economic grounds, or benefits in terms of climate change mitigation. Much of the literature implicitly assumes that biofuels benefit energy security, but this is probably not always the case, particularly where bioenergy policies shift import dependency from fossil fuels to biomass (whether for energy directly, or indirectly through substitution effects). No submission received assesses biofuels in any detail with regards to energy security, whereas most include considerable attention to climate-change mitigation, despite specific reference to energy security in

[2] Secretariat of the Convention on Biological Diversity, *Global Biodiversity Outlook 3*, (Montreal, 2010), figure 20.

decisions IX/2 paragraph 3 (b), and X/37, paragraphs 2, 3 and 4. This gap in current knowledge limits a full appreciation of the relevant drivers of biodiversity loss. The energy security benefits of biofuels can be expected to differ significantly according to scale and national circumstances.

Inconsistent terminology and descriptors of topics

32. There is inconsistent terminology between various biofuels constituencies. For example, a variety of terms is used by different stakeholders, such as "degraded", "unused", or "abandoned" land. A major knowledge gap is the lack of literature linking biofuels, ecosystem services and human well-being and tools to support decision-making based on this. Existing terminology is especially problematic regarding trade-offs at the socio-political level where socio-economic aspects are often described in tangible terms, often implicitly or explicitly ecosystem-services based (e.g., various descriptors for "labour", "income", "employment", "disease reduction", "energy"), but biodiversity is often described in more abstract terms (e.g., "species", "biomes", "conservation", "degradation"). A more comprehensive use of ecosystem-services-based assessments and language and can offer explanatory power to assist policy makers to identify trade-offs in biofuel production, and assist consensus-building for coordinated action.

III. THE ONGOING WORK OF THE GLOBAL BIOENERGY PARTNERSHIP (GBEP) AND THE ROUNTABLE ON SUSTAINABLE BIOFUELS (RSB)

33. To date, the contributions of the Executive Secretary to the ongoing work of relevant organizations and initiatives (decision X/37, para. 13) has focused on GBEP and RSB. A more detailed report of the work of these two initiatives is provided in the information document referred to above (UNEP/CBD/SBSTTA/INF/32). Both initiatives are advanced examples of practical attempts to apply the tools and approaches, and address gaps in them, as outlined above.

34. The Secretariat commenced informal collaboration with GBEP (http://www.globalbioenergy.org/) in January 2011, initially providing inputs on sustainability themes and indicators for water-related impacts via the GBEP secretariat, and was officially included as an observer on the GBEP Task Force on Sustainability in March 2011, and thereafter contributed to the work on other indicators, focussing on other biodiversity aspects. Priority areas for the immediate programme of work of GBEP include: facilitate the sustainable development of bioenergy; test a common methodological framework on GHG-emission-reduction measurement from the use of bioenergy; facilitate capacity-building for sustainable bioenergy; and raise awareness and facilitate information exchange on bioenergy. For current purposes, the most relevant activities of GBEP relate to its work on sustainability indicators. Consistent with decision IX/2 of the Convention on Biological Diversity, the GBEP has framed the topic of sustainability under the environmental, social and economic pillars of sustainable development, and 24 indicators to assess these are currently developed, although methodological issues remain with some indicators. This work of GBEP includes attention to biodiversity/environment considerations and is a significant contribution to assisting implementation of decisions IX/2 and X/37 as well as for the Strategic Plan for Biodiversity 2011–2020. A mapping exercise of the indicators reveals considerable, but not complete, coherence with the Aichi Biodiversity Targets (UNEP/CBD/SBSTTA/16/INF/32).

35. Some significant gaps remain; most significantly, iLUC is yet to be comprehensively addressed although efforts are under way to rectify this through the approach of identifying iLUC risk levels. Specific indicators for supportive measures (policies, incentives and trade) are also lacking, although the overall GBEP approach does give attention to the importance of such measures. It also remains unclear how necessary trade-offs between the various themes will be addressed (e.g., environment *versus* social and/or economic). Using ecosystem services based indicators throughout (either directly or through subsequent decision-making analysis) would assist quantification of comparisons in the longer term. The GBEP is currently enhancing its capacity-building, including supporting dissemination of sustainability approaches.[3] Substantial activities are already under way in West Africa and elsewhere, and further

[3] http://www.globalbioenergy.org/programmeofwork/working-group-on-capacity-building-for-sustainable-bioenergy/en/

capacity-building programmes will likely be implemented from 2012. These activities present some opportunities to explore synergies with capacity-building for national biodiversity strategies and action plans.

36. The Secretariat of the Convention on Biological Diversity officially joined Chamber 7 (international organizations etc.) of the Roundtable on Sustainable (RSB) (http://rsb.epfl.ch) in September 2011. Whereas the GBEP sustainability criteria are designed to assist broader policy development, RSB aims specifically to develop a practical certification system, to be used by individual producers, guaranteeing the social and environmental performance of biofuels backed by global sustainability standards (http://rsb.epfl.ch/page-67254-en.html). These standards contain 12 Global Principles and Criteria addressing: legality (which in theory implies compliance, as appropriate, with the Convention on Biological Diversity, although this is not specified); impact assessment and stakeholder consultation; GHG emissions; human and labour rights; local development and food security; conservation of biodiversity and ecosystem services; soil, water and air protection; use of hazardous technologies; and land rights. A key gap in RSB certification standards is with regards to iLUC and the RSB has created an Indirect Impacts Expert Group to recommend a strategy to address this issue.

IV. CONCLUSIONS

37. There has been significant attention to improving tools and approaches to achieve biofuels sustainability, and ongoing processes are attempting to address many of the remaining gaps. Some biodiversity related issues regarding biofuels are already being, or potentially can be, addressed on a local scale using an impact assessment approach supported by various available tools. But the core issue is, however, addressing cumulative impacts, which requires a more strategic approach, including to the role of supporting measures. In the preamble to decision X/37, the Conference of the Parties already crystallized this key issue by acknowledging concerns that the deployment of biofuels technologies may result, *inter alia*, in resource over-consumption. This concern cannot be addressed by assessing biofuels in isolation, and neither can a sound science- or ethics-based case be made that such should be done. For this reason, some organizations and Governments already consider biofuels under the broader framework of sustainable agricultural (and as appropriate forestry) production. A number of other processes have highlighted similar needs; for example, various forums have undertaken or called for assessments of the food, energy, water and sustainable development nexus.

38. In essence, the key need is for integrated planning for the use of land and other resources, which achieves sustainability under multiple demands. Under the Convention on Biological Diversity this broader context is that biofuels be considered, together with other drivers and pressures, under the Strategic Plan for Biodiversity 2011-2020 and achieving the Aichi Biodiversity Targets collectively; in particular targets 3, 4, 7, 8, 11, 14 and 15. This requires an ability to assess multiple drivers, and their interactions amongst multiple targets and objectives, and to generate practical policy relevant guidance. This encompasses, *inter alia*, effective strategic environmental assessment, or related approaches, and, in particular, requires a responsive policy and management framework. Very limited specific information on this was provided in submissions. Relevant gaps have not therefore been comprehensively explored, and to do so extends well beyond the issue of biofuels alone. This note does, however, conclude that assessing gaps in tools and approaches within this broader context is a primary requirement.

Annex

SUMMARY OF THE KEY TOPICS IDENTIFIED, AND GAPS IN TOOLS AND APPROACHES

The information below provides a summary of the key gaps and tools and approaches to address them identified in the information note on work in response to decision X/37 (UNEP/CBD/SBSTTA/16/INF/32). The information is presented in condensed form in the present annex for the benefit of SBSTTA participants because the information document is available only in the English language. References and information on submissions are not comprehensive in this annex. More tools and approaches to address biofuels topics are available at http://www.cbd.int/agro/biofuels/tools.shtml; only a selection is provided in this table. The full reference citations are contained in the information document itself.

I. SUSTAINABLILITY CRITERIA AND CERTIFICATION SCHEMES

Development of international sustainable biofuels criteria, and standards and certifications schemes based on these, are intended to promote the sustainable production, conversion, use and trade of biofuels. Biofuels certification provides an independent seal showing the biofuel satisfies a certain standard.

COP decisions and Targets: Decision X/37, paragraphs 11 (a) and 12; Related to Aichi Biodiversity Target 4.

Tools and approaches available to address issue

- At least 29 initiatives (as of 2009) create, verify, and certify performance standards (UNEP 2009).
- The International Energy Agency (IEA) (2011) cites 67 initiatives developing criteria for biofuel sustainability.
- Regulatory standards (e.g. EU Renewable Energy Directive, United States Renewable Fuel Standard)
- Voluntary certification schemes for the agricultural and forestry products (e.g. International Sustainability and Carbon Certification (ISCC), Forest Stewardship Council (FSC), Roundtable on Sustainable Biofuels (including RSB tool, *cited in submission by Switzerland*)).
- Crop-specific voluntary initiatives (e.g. Better Sugar Cane Initiative, the Roundtable on Responsible Soy (RTRS) and the Roundtable on Sustainable Palm Oil (RSPO))
- Governments can apply their own and often more stringent standards (e.g. *submission by Switzerland*).
- Life-cycle analysis is a tool needed for development of criteria, standards and certifications schemes.
- United Nations-Energy Bioenergy Decision Support Tool (*Submitted by UNEP-WCMC*)

Gaps

- Lack of mandatory regulatory framework; most standards are voluntary.
- iLUC can only be addressed by certification and standards if all biomass products are certified (Dehue *et al.* 2011; *submitted by the Netherlands)*.
- Difficulties in selecting an appropriate certification scheme for biomass actors (NL Agency 2011; *submitted by the Netherlands*).

Proposed solution/recommendation

- Harmonize the current diversity of standards to ensure agreed environmental aims are met; e.g., develop an international mandatory regulatory framework under a United Nations agency (e.g.

Cramer Commission 2007; UNEP 2009; Buyx and Tait 2011; IEA 2011) or develop an ISO standard (Robbins 2011).

- Further develop standards and certification, and accompanying mechanisms to consider all relevant environmental and social impacts (including iLUC) and combine product and production-chain specific criteria with findings on the macro level (e.g. projections of overall biomass and related land use of a net importing country) (UNEP 2009)
- Apply equal standards for all agricultural commodities (FAO 2008).

II. LIFE-CYCLE ANALYSIS (LCA)

Assessing and comparing GHG emissions and environmental impacts of fuel types can inform on the performance of biofuels against other types of fuels.

COP decisions and Targets: Decision X/37, paragraphs 10, 11 (a), 12 and 14; Related to Aichi Biodiversity Target 19.

Tools and approaches available to address issue: Life-cycle analysis (LCA*)* is the main tool used to assess and compare biofuel alternatives against greenhouse-gas emissions and the environmental footprint, taking into account all stages of the biofuel lifecycle.

Gaps

- Present LCA methodology is under development, not adequately standardized and has inconsistent assumptions between studies, which does not allow for comparable results between fuel types.
- LCAs often do not include much more than greenhouse-gas considerations. There is a need to assess acidification, eutrophication, toxicity, emissions of nitrous oxide, fertilizer use, summer smog, ozone depletion, abiotic resource depletion potential, direct/indirect land-use change and biodiversity aspects (*see France's LCA in submission, which includes some of the above*).
- LCAs ignore biogenic carbon dioxide emissions, which underestimates the importance of time perspective for climate change contribution (CO_2 remains in the atmosphere before it is captured in regrowth) and hinders accurate estimation of greenhouse-gas emissions (Cherubini *et al.* 2011, *Submitted by Norway*).
- LCAs provide insight but incorporate a large amount of uncertainty and variability. Decision-makers must recognize that LCAs are a process and not a product (McKone *et al.* 2011).

Proposed solution/recommendation

- Improve and standardize/harmonize LCA methodology on biofuels (Mandil and Shihab-Eldin 2010; UNEP 2009).
- Set reasonable guidelines and assumptions for methodological issues determining how to deal with uncertainty and variability in LCAs (e.g. data quality; data corroboration and validation; temporal, spatial and technological variability); as well as on allocation rules of impacts on co-products (e.g. nitrous oxide emission rates, land use, water-use, pollution, etc.) (UNEP 2009; McKone et al. 2011).
- Recognize that LCAs are a process and not a product when making decisions. LCAs provide insight but incorporate a large amount of uncertainty and variability (McKone et al. 2011).

III. GROWING BIOFUELS ON DEGRADED LANDS

Growing biofuels on "degraded" or "marginal" land could reduce land pressures, lower risks to biodiversity, and reduce greenhouse-gas effects and impact on food security. However, some "degraded" lands are important carbon sinks, and support high conservation value species and the livelihoods of local communities.

COP decisions and Targets: Decision X/34 on agricultural biodiversity, paragraph 5 (m); Related to Aichi Biodiversity Targets 5 and 11.

Tools and approaches available to address issue

- UN-Energy Bioenergy Decision Support Tool (Module 5: Land Resources) (*submitted by UNEP-WCMC*).
- Global Assessment of Human-induced Soil Degradation (GLASOD); developed by the International Soil Reference and Information Centre (ISRIC).
- Land Degradation Assessment in Drylands (LADA); developed by the Food and Agriculture Organization (FAO).

Gaps

- Lack of consensus on definition, classification and quantification of "degraded" or "marginal" land. Current definitions for "marginal" land focus on a single criterion: agroeconomic profitability (UNEP 2010; Gopalakrishnan *et al.* 2011).
- Database limitations: resolution of satellite imagery needed at the farm scale; and need to improve quantification of environmental data at the field level.
- Competition for degraded land for other uses (agriculture, forestry, urbanization) delivers potentially significant iLUC impacts; there is a lack of understanding of potential iLUC effects.
- Land may be not agroeconomically productive but may have biodiversity value, provide ecosystem services and store carbon; land may be marginal from an environmental standpoint, but still be agroeconomically productive.

Proposed solution/recommendation

- Agree upon an international definition, as well as criteria for the classification of degraded and marginal lands (Gopalakrishnan *et al.* 2011; UNEP 2010).
- Incorporate multiple criteria in classifying marginal land using soil productivity indices, current land use and environmental degradation; and develop methods to identify land that is marginal for conventional crops but not marginal for biofuel crops (Gopalakrishnan *et al.* 2011).
- Redesign landscapes to incorporate multifunctionality, providing sustainable economic development and ecosystem services (Gopalakrishnan *et al* 2011).
- Conduct further research, analysis and comprehensive LCAs of all relevant options to assess whether the use of degraded lands could be a viable option to mitigate iLUC and climate change.

IV. DIRECT LAND-USE CHANGE (LUC)

Direct land-use change (LUC) occurs when land (e.g. pasture land, forests, degraded land) is converted to agricultural land for the production of biofuels. Identification of land of high conservation value (HCV) can prevent expansion of biofuel production where it is inappropriate.

COP decisions and Targets: Decision X/37, paragraphs 6, 7 (a), 7 (b), 9, and 11; Related to Aichi Biodiversity Targets 5 and 11.

Tools and approaches available to address issue

- Land-use change considered in regulations and standards: e.g. European Union (EU), the Renewable Energy Directive (RED), Roundtable on Sustainable Biofuels (RSB).
- Use of "suitability and availability assessments" to select appropriate lands with the least risk for local communities and the environment, providing the lowest opportunity costs (UNEP 2010).

- Tools for identification of land of high conservation value: HCV Resource Network Toolkits (developed by ProForest/WWF-Ikea Co-operation); World Database on Protected Areas; Globcover (*cited in submission by UNEP-WCMC).*
- Identification of Responsible Cultivation Areas (RCA) (Dehue *et al*. 2011; *submitted by the Netherlands*).
- BioScore: European biodiversity impact assessment tool *(submitted by ECNC*).
- Module 1 of the Bioenergy and Food Security (BEFS) Project of the FAO.
- United Nations-Energy Bioenergy Decision Support Tool (Module 5: Land Resources) (*submitted by UNEP-WCMC*).

Gaps

- For example, by banning biofuel crops from land of high conservation value , cultivation of biofuel crops on existing agricultural land is encouraged; this promotes indirect land-use change by displacing agricultural crops to land of high conservation value.
- Most voluntary schemes rely exclusively on HCV to identify areas of biodiversity value (not consistent with the requirements of the EU Renewable Energy Directive) (Bowyer *et al*. 2010; *submitted by the United Kingdom*).
- Little consensus on how HCV lands be defined and identified (open to interpretation).
- Gap in literature on the relationship between various standards and their varying levels of protection for "high biodiversity" lands (Campbell and Doswald 2009; *submitted by UNEP-WCMC*).
- Lack of understanding of grassland issues, their biodiversity value and associated land-use change risks (Bowyer et al. 2010; *submitted by the United Kingdom*).

Proposed solution/recommendation

- Develop comprehensive land-use planning and management systems, and multi-level planning (global, regional and local) (UNEP 2010).
- Include a bottom-up approach in suitability and availability assessments (rather than just mapping), taking into account land tenure and customary rights; and implement a cross-sectoral and participatory approach, including community involvement and stakeholder consultations (UNEP 2010).
- Practice sustainable agriculture, reduce agricultural inputs and restore degraded lands, all of which can alleviate pressures on biodiversity from LUC (UNEP 2010).
- Enhance the efficiency of yields and production of biofuels, rather than expanding onto more land to meet energy demands (Savage *et al.*, 2008; Fairley 2011; *see e.g. from Brazil's submission*).

V. INDIRECT LAND-USE CHANGE (iLUC)

Biofuel feedstock production often displaces activities on land (e.g. for food production) to other areas, causing indirect land-use change (iLUC) and potentially negative impacts on carbon stocks and biodiversity. Indirect land-use change includes displacement effects across national borders; displacement effects across substituting crops; and competition for land between non-substituting crops.

COP decisions and Targets: Decision X/37, paragraphs 6, 9 and 11 (a); Related to Aichi Biodiversity Targets 5 and 11.

Tools and approaches available to address issue

- United States Renewable Fuel Standard (RFS) and EU Renewable Energy Directive (RED) include some limited consideration for iLUC (e.g., RED provides a bonus feedstocks that have not displaced food production and have been cultivated on "degraded" or "marginal" land).
- RSB (http://rsb.epfl.ch) created an Indirect Impacts Expert Group.
- Low Indirect Impacts Biofuels (LIIB) Certification Module (based on the RCA methodology) is a private sector initiative under development, coordinated by Ecofys, working on practical solutions to iLUC at the project level (Dehue *et al.* 2011; *submitted by the Netherlands*).

Gaps

- No standards or criteria currently exist that can prevent iLUC from happening (Bertzky *et al.* 2011; *submitted by UNEP).*
- Existing and developing sustainability standards and criteria for biofuel production are to date unable to avoid iLUC in ecosystems that are not of high carbon value (Bertzky et al. 2011; submitted by UNEP).
- In general, emissions from iLUC are lacking in most LCAs, creating large uncertainties and underestimation of GHG emissions (Dehue *et al.*, 2011; *submitted by the Netherlands*).
- Comparing the limited LCAs that included iLUC resulted in no clear consensus on the size of the total emissions from LUC or iLUC, due to large ranges of results and differences of methodologies and key assumptions (Dehue *et al.*, 2011; *submitted by the Netherlands*).

Proposed solution/recommendation

- Manage and limit direct LUC to help mitigate iLUC through long-term global implementation of integrated land-use planning and monitoring for bio-energy and other production activities (Dehue *et al.* 2009; 2011; *submitted by the Netherlands*).
- Document assumptions and intermediary results more comprehensively in LCAs for a better comparison between models to calculate iLUC (Dehue *et al.* 2011*; submitted by the Netherlands*).
- Produce biomass on "unused land" ("land that does not provide provisioning services"); increase land productivity and use integration models, especially in developing countries (e.g. *see Brazil's submission)* (RCA methodology in Dehue *et al.* 2009).
- Revise, assess and delay existing subsidies and mandates that are driving biofuel expansion and indirect land-use change (Gallagher 2008).

VI. INCENTIVES: TARGETS, SUBSIDIES AND OTHER ECONOMIC MEASURES

Targets, subsidies and mandates for biofuel production and use are intended as a means, *inter alia*, of reducing reliance on fossil fuels and reducing GHG emissions. They are a major driver of biofuels development.

COP decisions and Targets: Decision IX/2, paragraph 3(c); decision X/37, paragraph 8; Related to Aichi Biodiversity Target 3.

Tools and approaches available to address issue: Studies by the Global Subsidies Initiative (GSI): http://www.globalsubsidies.org/research/biofuel-subsidies

Gaps

- Some are insufficiently supported by science.
- Subsidies, targets and tariffs do not tend to take into account whether the biofuel is sustainable or not, obscuring the connection between a biofuel's sustainability and cost.

- Land-use needs are not suitably taken into account when designing policies.
- No organization tracks, reports or monitors biofuel subsidies on an annual basis or in a consistent way; there is a need for assessment of gaps regarding relative investments in beneficial vs. perverse incentives.
- Research and development projects often have benefits for only one sector.

Proposed solution/recommendation

- Establish yearly, mandatory and standardised reporting and evaluations of the effectiveness of subsidies and policies in relation to sustainable development, so that Governments can subsequently reform or eliminate them (GSI 2010).
- Abolish all tariffs, phase out costly subsidies and transition to climate policy focused on the "polluter pays principle". Fossil fuels should be restricted with pollution and carbon taxes or a cap-and-trade system (GSI 2010).
- Prepare strategic environmental assessments (SEA) and economic assessments on policies/subsidies with regards to sustainable biofuels objectives.

VII. INCENTIVIZING RESEARCH AND DEVELOPMENT

Incentivizing research and development in the right direction has the potential to deliver a public good across many sectors.

COP decisions and Targets: Decision X/37 paragraph 10; Related to Aichi Biodiversity Targets 3 and 19.

Tools and approaches available to address issue: Studies by the Global Subsidies Initiative (GSI): http://www.globalsubsidies.org/research/biofuel-subsidies

Gaps

- Research and development projects often have benefits for only one sector.
- Limited information, unable to assess levels of investment in innovative approaches *versus* business as usual.

Proposed solution/recommendation

- Subsidize diverse biofuels research and development approaches in many sectors; and encourage innovation and competition in the marketplace to find the best solutions regarding projects targeting greenhouse-gas emissions (GSI 2010).
- "Incentivize research and development of new biofuels technologies that need less land and other resources, avoid social and environmental harms, and reduce greenhouse gas emissions" (Nuffield Council on Bioethics 2011).

VIII. IMPACTS ON RELATED SOCIOECONOMIC CONDITIONS

Biofuels have the potential to reduce poverty, strengthen economies, and create jobs and income in developing countries.

COP decisions and Targets: Decision IX/2, paragraph 2; decision X/37 paragraphs 2, 3, 4, 5, 7 (a), and 9. Related to Aichi Biodiversity Targets 2, 14 and 18.

Tools and approaches available to address issue

- EU Renewable Energy Directive has incorporated a commitment to monitoring human rights.
- Nuffield Council on Bioethics 2011. Biofuels: ethical issues. Principle 1: Human Rights.

- UN-Energy Bioenergy Decision Support Tool (Module 6: People and Processes) (*submitted by UNEP-WCMC*).
- The RSB incorporates social and rural development and human rights into their standard.
- GBEP's indicators for sustainable bioenergy include: price and supply of a national food basket; access to land, water and other natural resources; labour conditions; rural and social development; access to energy; and human health and safety.

Gaps

- Investment in biofuels in developing countries, including international investment, often does not allow for full and effective participation and local communities or adequately consider implications for local people.
- Information gap on monitoring and reporting of implications for indigenous and local communities.
- Local communities lack knowledge and legal experience to negotiate favourable terms and hold companies accountable.

Proposed solution/recommendation

- Set up compulsory regulations/certification ensuring that all biofuels produced/imported meet human rights standards (similar to RSB and GBEP's voluntary standards) (Nuffield Council on Bioethics 2011; Gilbert 2011).
- "Set up monitoring systems so that sanctions can quickly be put in place if human rights abuses are detected." (Nuffield Council on Bioethics 2011).
- Encourage widespread and enforceable corporate social responsibility, better practice among investor companies and improved government oversight (Gilbert 2011).
- Encourage more financial support and incentives for smallholder biofuel schemes (Gilbert 2011).
