J Ind Microbiol Biotechnol (2011) 38:371–374
DOI 10.1007/s10295-010-0858-7

SHORT COMMUNICATION

Tools and methodologies to support more sustainable biofuel feedstock production

Christine Dragisic · Erica Ashkenazi · Lucio Bede · Miroslav Honzák · Tim Killeen · Adriano Paglia · Bambi Semroc · Conrad Savy

Received: 30 June 2010 / Accepted: 19 August 2010 / Published online: 29 September 2010

Abstract Increasingly, government regulations, voluntary standards, and company guidelines require that biofuel production complies with sustainability criteria. For some stakeholders, however, compliance with these criteria may seem complex, costly, or unfeasible. What exiting tools, then, might facilitate compliance with a variety of biofuel-related sustainability criteria? This paper presents four existing tools and methodologies that can help stakeholders assess (and mitigate) potential risks associated with feedstock production, and can thus facilitate compliance with requirements under different requirement systems. These include the Integrated Biodiversity Assessment Tool (IBAT), the ARtificial Intelligence for Ecosystem Services (ARIES) tool, the Responsible Cultivation Areas (RCA) methodology, and the related Biofuels + Forest Carbon (*Biofuel + FC*) methodology.

Keywords Biofuels · Landscape · Tools · Methodologies · Sustainability

Introduction

Biofuel production and use has the potential to generate notable benefits, among them rural income generation, diversification of energy sources, and increased export income. If done well, feedstock production can form part of a rural economy that generates economic value while protecting the provision of ecosystem services such as carbon sequestration and water quality and flow, maintaining local food security, and respecting community rights. If best practices are not followed, however, increasing biofuel feedstock production could be associated with negative impacts such as a net increase in greenhouse gas emissions, clearing or degradation of natural habitats, lost capacity for ecosystem service provision, reduced food security, or loss of land rights and local livelihood options [8].

Recognizing the need to ensure that biofuel production follows recognized best practices, and thus achieves its potential benefits, a number of systems containing sustainability criteria have been put into place. Some, such as the European Union's Renewable Energy Directive and the United States' Renewable Fuels Standard, are mandatory government regulations applicable to all biofuels produced within (or imported into) the relevant country or region. Other standards are voluntary, with actors along the supply chain choosing to adhere to the relevant set of principles and criteria. These include the Roundtable on Sustainable Palm Oil, the Roundtable on Sustainable Biofuels, the Round Table on Responsible Soy, the Better Sugarcane Initiative, and the Forest Stewardship Council, among others. Finally, many companies—whether feedstock producers, blenders, end users, or another profile—have chosen to adopt their own policies and guidelines on sustainability.

Complying with the panoply of sustainability criteria can be confusing, complex, and costly. However, a number of existing tools and methodologies are available to help perform the necessary evaluations and support sound decision-making, in line with the types of sustainability criteria noted above. Four of these are outlined below.

This article is based on a presentation at the 32nd Symposium on Biotechnology for Fuels and Chemicals.

C. Dragisic (✉) · E. Ashkenazi · L. Bede · M. Honzák · T. Killeen · A. Paglia · B. Semroc · C. Savy
Conservation International,
2011 Crystal Dr. Ste 500, Arlington, VA 22202, USA
e-mail: cdragisic@conservation.org

Results and discussion

Stakeholders seeking to assess project development options, evaluate potential suppliers, or comply with certification criteria on biodiversity and ecosystem services may find two existing tools especially useful.

The Integrated Biodiversity Assessment Tool (IBAT) [13, 14] is an online tool that integrates spatial and tabular information on major global compilations of conservation data such as the World Protected Areas Database [15], International Union for Conservation of Nature (IUCN) Red List of Threatened Species [7] and emerging spatial databases of globally significant sites mapped by national partners according to IUCN best practice guidelines for gap analysis [10]. As such, it serves as a critical first step to support decision-making by making this information easily accessible to diverse practitioners and facilitating the assessment of biodiversity risk at a site level. IBAT also highlights data. These fine-scale data sets are drawn from national and regional sources (e.g., governments, NGOs, and academic institutions) on globally threatened species, protected areas, and other sites that align with critical habitat criteria used by a number of major development banks (e.g., [5, 6]). IBAT was developed by a consortium including BirdLife International, Conservation International (CI), the IUCN, and the World Conservation Monitoring Centre (UNEP-WCMC), in close consultation with leaders in the private and public sector. IBAT guides users in identifying critical issues around globally significant national priorities and so informs development of responsible strategies for proposed or existing biofuel production landscapes that may intersect with or be situated adjacent to sites that are globally important for biodiversity. The on-line version of the tool was officially released in October 2008 and has been adopted by several large multinational corporations and multilateral development banks for internal project review. In just one example, IBAT users discovered a RAMSAR wetland located in close proximity to a proposed project (J. van de Staaij, pers. comm.). Based on the information identified through IBAT, developers were able to take the wetland into account during project design and propose appropriate risk mitigation strategies. Having consolidated information easily available improved the project design and management strategy, and minimized risk to the wetland. Because IBAT is applied by both private sector stakeholders and multilateral development banks, it improves the alignment between public and private sector environmental safeguards and facilitates the practical implementation of those safeguards at the project level. IBAT is available at http://www.ibatforbusiness.org.

ARtificial Intelligence for Ecosystem Services (ARIES) is a Web-accessible analytical tool that assesses the provision, use, and flow of ecosystem services on a user-identified landscape, using a range of technologies, such as probabilistic Bayesian models, machine learning, and pattern recognition. This allows users to evaluate and compare alternative policy and land-use scenarios in terms of their impact on the provision, flow, and beneficiaries of ecosystem services such as carbon storage and water supply. Its use of sophisticated statistical models provides a framework for tracking uncertainty and multiple-scaled information in a fully transparent way. The system is under development by a consortium of academic institutions and non-governmental organizations including CI, Earth Economics, and the University of Vermont. A beta version of the tool has been on-line since March 2010, and is available at http://www.ARIESonline.org.

Among the many methodologies and models available for land-use planning, two are especially relevant to companies seeking to promote best practices in sustainable feedstock production. Both have been designed to be practical and easily applied by any interested company or actor with relevant expertise, thus facilitating the adoption of best practices in land-use decisions for feedstock production throughout the biofuels industry.

The Responsible Cultivation Areas (RCA) methodology [4] allows for the identification of sites suitable for feedstock cultivation without significant negative impacts on High Conservation Values (HCV), carbon stocks, land rights, or the displacement of food production or other productive activities. Feedstocks produced on these sites using best practices would allow for the full range of benefits biofuel production and use can provide, without the potential negative direct and indirect impacts associated with some feedstock production. The RCA methodology is designed to be practical for efficient application, combining two desktop assessments, based on the best available existing information, with field work to generate any missing data and groundtruth the results of the desktop assessment. It is universally applicable, relevant to any feedstock in any region. It is also non-proprietary; any actor can apply the methodology for project development, evaluation, or land-use planning. The RCA methodology was developed by a consortium led by Ecofys in collaboration with CI and the World Wide Fund for Nature (WWF), and has been pilot-tested under diverse conditions in both Brazil and Indonesia with the participation of relevant actors in the biofuel supply chain. The pilot test in the state of Pará, Brazil, [2] led by CI, showed the methodology to be effective in identifying suitable areas for oil palm production, and which had a low risk of provoking displacement or causing negative social or environmental impacts. A local oil palm company confirmed that the methodology was appropriate for operations, and could be easily adopted. Pilots in São Paulo state in Brazil [3] and West Kalimantan in Indonesia [1, 11, 12] (the latter led by WWF) showed similarly promising results. The RCA methodology has proven to provide a practical framework for decision-makers in the public and private sectors, because it ensures sustainability in the economic, environmental, and social dimensions of feedstock production.

The *Biofuels + Forest Carbon* (*Biofuel + FC*) policy model [9] links the cultivation of biofuels with forest conservation, capitalizing on carbon markets to help subsidize feedstock production on "degraded" or "underutilized" lands, such as RCAs. By channeling feedstock production to these areas while at the same time providing incentives for forest conservation or restoration, the Biofuel + FC model helps stabilize the forest frontier while providing options for rural economic growth. The model includes two different strategies, depending on the characteristics of the local context. In areas where there is substantial standing forest, the model proposes a ratio of 4:1 forest conservation to biofuel cultivation, linked to proposals for reducing emissions from deforestation and forest degradation (*REDD + Biofuel*) on the voluntary carbon market.[1] In areas where most forest has been cleared, the model stipulates a ratio of 9:1 biofuel cultivation to reforestation on degraded landscape (*RDL + Biofuel*), linked to the afforestation/reforestation component of the Clean Development Mechanism or to the voluntary carbon market. Both biofuel production options would be limited to the cultivation of woody perennial biofuel species on low biomass landscapes in order to maximize the carbon benefits of the proposed policy model. Models that have been run for five different countries show the opportunity to generate significant levels of biofuel production while reducing emissions and increasing forest conservation far above business as usual scenarios. The Biofuel + FC policy model would leverage forest carbon with biofuel markets, which would reduce greenhouse gas emissions and conserve biodiversity, as well as improve human welfare in developing countries, a win–win–win strategy for sustainable development.

Conclusions

To fully harness the potential benefits of biofuel production and avoid the negative effects, sustainability criteria are being proposed by regulators, standards organizations, and companies. Tools such as IBAT and ARIES can help actors assess compliance with these criteria, incorporating potential risks and impacts into project development and management, as well as sourcing and investment decisions. The RCA methodology, as well as the *Biofuel + FC* policy model, can be effective in identifying the most appropriate areas for feedstock production while safeguarding forests and other natural ecosystems and protecting the rights of local communities. Applying these existing tools, methodologies, and models is an effective and efficient way not only to comply with sustainability criteria but to move beyond basic requirements and demonstrate leadership on sustainability issues within the biofuels industry. Producing biofuels while conserving ecosystems, ecosystem services, biodiversity, and community rights is indeed a scenario where everyone wins.

[1] The REDD market is currently entirely voluntary, though this may change in the future.

References

1. Budiman A, Smit H (2010). Identification of responsible cultivation areas in West Kalimantan Indonesia—Phase I: Preliminary assessment. A report prepared by WWW with support by Ecofys
2. Conservation International (2010a) Identification of responsible cultivation areas in Pará Brazil—pilot report. A report prepared by CI with support from Ecofys
3. Conservation International (2010b) Identification of responsible cultivation areas in São Paolo Brazil—pilot report. A report prepared by CI with support from Ecofys
4. Dehue B, Meyer S, van de Staaij J (2010) Responsible cultivation areas: identification and certification of feedstock production with a low risk of indirect effects. Ecofys
5. IDB (2007) Implementation Guidelines for the Environment and safeguards compliance policy. Sustainable development department sector strategy and policy papers series. Inter-American Development Bank, Washington, DC
6. IFC (2006) Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management. International Finance Corporation's Performance Standards on Social & Environmental Sustainability. International Finance Corporation, Washington, DC
7. IUCN (2010) 2010 IUCN red list of threatened species. IUCN Species Survival Commission, Gland, Switzerland. Web: http://www.iucnredlist.org
8. Hennenberg KJ, Dragisic C, Haye S, Hewson J, Semroc B, Savy C (2009) The power of bioenergy-related standards to protect biodiversity. Conserv Biol 24(2):412–423
9. Killeen TJ, Schroth G, Turner W, Harvey CA, Steininger MK, Dragisic C, Mittermeier RA (2010) Stabilizing the agricultural frontier: leveraging REDD with biofuels for sustainable development. Biomass & Bioenergy (Elsevier). Special Issue dedicated to the International IEA Bioenergy Task Force # 38 on Biofuels and land-use change
10. Langhammer PF, Bakarr MI, Bennun LA, Brooks TM, Clay RP, Darwall W, De Silva N, Edgar GJ, Eken G, Fishpool LDC, Fonseca GAB da, Foster MN, Knox DH, Matiku P, Radford EA, Rodrigues ASL, Salaman P, Sechrest W and Tordoff AW (2007). Identification and gap analysis of key biodiversity areas: targets for comprehensive protected area systems. Best Practice Protected Areas Guidelines Series No. 15. IUCN, Gland, Switzerland
11. Smit H, Budiman A, Yaya A (2010). Identification of responsible cultivation areas in West Kalimantan Indonesia—Phase II: Desk-based analysis. A report prepared by WWW with support by Ecofys
12. Smit H, Budiman A, Yaya A (2010). Identification of responsible cultivation areas in West Kalimantan Indonesia—Phase III: Field verification. A report prepared by WWW with support by Ecofys

13. The Economist 2008. Where the wild things are. The Economist, 4 Oct 2008
14. UNEP (2010) Where on earth is biodiversity? UNEP press release, August 2010. UNEP, Nairobi, Kenya
15. WDPA Consortium (2010) World Database on Protected Areas (WDPA). World Conservation Union (IUCN) and UNEP-World Conservation Monitoring Centre (UNEP-WCMC), Switzerland and UK