APPENDIX K:
SUSTAINABILITY CRITERIA

RENEWABLE FUELS ROADMAP AND
SUSTAINABLE BIOMASS FEEDSTOCK SUPPLY FOR NEW YORK
Final Report

Submitted to
PACE ENERGY AND CLIMATE CENTER
White Plains, NY
Zywia Wojnar, Project Manager

on behalf of
THE NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY
Albany, NY
Judy Jarnefeld, Senior Project Manager

and Co-Sponsors
NEW YORK STATE DEPARTMENT OF AGRICULTURE AND MARKETS
and
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Submitted by
Timothy A. Volk
Roadmap Sustainability Task Team Leader
State University of New York,
College of Environmental Science and Forestry (SUNY-ESF)

Contract # 10994
NYSERDA Report 10-05
January 2010

Contributors to this Report

(Task team members, Alphabetical order)

Colin Beier, Ph. D.
Research Associate
Forest Ecology and Management
Adirondack Ecological Center & Huntington Wildlife Forest, SUNY ESF
Syracuse, NY

Thomas Buchholz, Ph.D.
Postdoctoral Research Associate
Department of Forest and Natural Resources Management, SUNY ESF
Syracuse, NY

Jesse Caputo
Research Assistant
Department of Forest and Natural Resources Management, SUNY ESF
Syracuse, NY

Philip Castellano, M.Sc.
Senior Research Support Specialist
Department of Forest and Natural Resources Management, SUNY ESF
Syracuse, NY

Rene Germain, Ph.D.
Associate Professor Sustainable Forestry Systems and Forest Management
Department of Forest and Natural Resources Management, SUNY ESF
Syracuse, NY

Michael Kelleher
Director of Renewable Energy Systems
SUNY ESF
Syracuse, NY

Valerie Luzadis, Ph.D.
Associate Professor Natural Resources Policy & Values, Department of Forest and Natural Resources Management, SUNY ESF,
Syracuse, NY

Robert W. Malmsheimer, Ph.D.
Associate Professor of Forest Policy and Law
SUNY-ESF
Syracuse, NY

Timothy Volk, Ph.D.
Senior Research Associate
Short Rotation Forestry
Department of Forest and Natural Resources Management, SUNY ESF
Syracuse, NY

ABSTRACT

Sustainability is both a process of knowledge production and norm creation. The final decision regarding which sustainability criteria should be used, how they should be weighted, and what qualifies a biofuel system as sustainable according to a given criterion, remains largely with the general public and policy makers while the task to measure those criteria relies on experts and scientific knowledge. This section of the Roadmap sought input from biofuel stakeholders across New York on the use of sustainability criteria under New York conditions. A set of internationally-recognized biofuel sustainability criteria was rated by participants on the applicability of each criterion under New York conditions. Furthermore, regulatory frameworks were reviewed and state-wide datasets identified for their current applicability and coverage of these biofuel sustainability criteria. An exemplary case study on the impact of biofuels on selected criteria is demonstrated. Recommendations on how to proceed with the development of a holistic biofuel sustainability assessment framework for New York include the establishment of a central monitoring agency to track performance of criteria.

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1 RATIONALE

Introducing biofuels into a region is a complex challenge because the five main components of the biofuels industry: (1) Feedstock Production, (2) Feedstock Transportation, (3) Biorefinery (Fuel Processing), (4) Fuel Marketing, Blending and Distribution, and (5) Fuel Combustion. Each of these components, in turn, is influenced simultaneously by social, economic and ecological factors. Understanding these factors, their interdependency and their integration is essential to achieving sustainability. For example, case studies performed in England and Wales show that individuals in local communities may strongly value the environmental benefits of renewable fuels, but the same community may also simultaneously express strong opposition to renewable fuel production in their area for various reasons (Upreti 2004, or Sovacool 2009 for a similar discussion in the U.S. on opposition to renewables). Thus, any efforts in planning a biofuels industry must seriously consider the full spectrum of social, economic and environmental values of stakeholder communities, because failure of just one factor can lead to the failure of attempts to develop and introduce bioenergy systems (Upham and Shackley 2007, Upreti 2004). However, identifying what is sustainable is an unsolved issue that does not only involve agreement on certain criteria but also agreement on how to measure and enforce them.

To measure sustainability of such complex systems, frameworks can be used that identify criteria and measure them through indicators. In addition to the inherent complexity in these systems due to various interconnected components, such sustainability assessments face further implementation barriers that are some of the most researched and pressing issues of our times:

- Sustainability is a dynamic, indefinite and contested concept even amongst experts (Buchholz et al. 2009) because it is based on the normative values of the stakeholders affected by the system (Costanza and Patten 1995, Mog 2004). For instance, some people value the social, economic, and ecological factors of sustainability equally, while others support the view of a nested sustainability, stressing that sustainability can only be achieved when its social and economic factors do not violate ecological limits (the biophysical view of sustainability, Gowdy 1999); Sustainability is not only considered to be a knowledge-producing process but also a norm-creating course of action (see also Rametsteiner et al 2009). Therefore, iterative development between these two parts of knowledge production and norm creation is necessary to accommodate changes that occur in one of these two processes and in turn influences the other process. In addition to assessing biophysical aspects of a biofuels system, sustainability as a social value requires the consideration of broader economic and social values and often requires trade-offs between different criteria and indicators associated with sustainability (Buchholz et al. 2007) as lists of potential criteria can be long and conflicting (see e.g. Lattimore et al. 2009 for a list of bioenergy relevant forest criteria);Sustainability assessment frameworks need to be responsive to *spatial and temporal scales* as well as to distinctive regions and criteria used. Frameworks may need to be adapted or their order of importance might be changed when assessments address different scales or regions; and

- Sustainability is laden with *scientific uncertainties* of two origins: Part of the current uncertainties can be traced to 'reducable ignorance' that can be overcome by research. Uncertainties also exist due to the system's complexity and unpredictable dynamics that are impossible to overcome completely ('irreducable ignorance'; Faber et al. 1996).

Subsequently, the challenge is to develop agreement on the concept of (biofuels) sustainability so that planning and decision making can progress while balancing three tensions: (1) maintaining scientific credibility, (2) assuring practical saliency and effectiveness, and (3) legitimizing the process to multiple participants (Joyce 2003). In other words, in order to operationalize sustainability assessments of bioenergy systems, it is crucial to identify critical criteria, keep their numbers at a manageable and low level, and remain responsive to the values expressed by stakeholders at the local level.

1.1 GOALS AND OBJECTIVES

Based on the approach to sustainability outlined above, the goal of this task was to use a systems approach and stakeholder involvement to assess available and emerging sustainability criteria, to define barriers to tracking and verifying sustainability of biofuels systems, and to advance an understanding of how New York biofuels would meet proposed sustainability criteria.

To serve these goals, the following objectives were chosen:

- Review literature on existing approaches to assessing biofuels sustainability;
- Create a list of potential biofuel sustainability criteria applicable for New York State;
- Identify and contact potential stakeholders for New York to assess criteria; and
- Gather necessary data to measure sustainability indicators across New York and demonstrate criteria use in a case study.

2 PARTICIPATORY IDENTIFICATION OF BIOENERGY-RELEVANT SUSTAINABILITY CRITERIA IN NEW YORK

2.1 SIGNIFICANCE OF STAKEHOLDER INVOLVEMENT IN SUSTAINABILITY ASSESSMENTS AND LITERATURE REVIEW

The most effective way to get broad support for the development and deployment of biofuels (i.e., bring it to implementation and make it truly sustainable) is through participation of stakeholders involved and affected by each of the components of a biofuel system (Buchholz et al. 2007). To contribute to the ongoing debate about biofuel sustainability in New York, we surveyed and analyzed New York stakeholders on bioenergy sustainability criteria that are currently under discussion to identify the criteria that are viewed as most practical and important. The methodology to develop such a tool has been tested on a global scale for bioenergy systems by SUNY-ESF (Buchholz et al. 2009). The goal was to identify areas of agreement and uncertainty among stakeholders on what to

include and how to organize the assessment of sustainability for bioenergy with a manageable list of criteria. Based on this participatory and systems-oriented sustainability framework, the development of a Renewable Fuels Roadmap for New York and its later support, implementation, and success will be greatly enhanced. Similar survey efforts are being pursued on national levels (e.g. Wellisch [2008] performed an expert survey focusing on Canada), but to date, none have measured and analyzed consensus at a New York level.

Developing sustainability criteria frameworks is one mechanism for conducting criteria-based assessments and is currently driven by international and national efforts related to a rapidly expanding global biomass trade (e.g. Junginger et al. 2008). Two such efforts include the Roundtable on Sustainable Biofuels (RSB) (RSB 2008) and Lausanne and the Cramer Commission (2007). These initiatives are often driven by an effort to reduce carbon emissions from the transport sector while also acknowledging other dimensions of biofuel sustainability besides the carbon aspect (e.g. Farell and Sperling 2007a&2007b for California, European Commission 2009, Yacobucci 2008 for the US, or Fehrenbach et al. 2008 for Germany). Several agencies and organizations are in the process of developing criteria and indicators for biofuels on a national scale (e.g., Biomass Research and Development Board [BRDI] 2008a for governmental organizations, Council on Sustainable Biomass Production [CSBP] 2009 for the private and nonprofit sector, Sustainable Biodiesel Alliance [SBA] for biodiesel) or for generic use across the globe (e.g. Biomass Technology Group 2009). Other efforts focus on the identification of drivers and research needs to advance sustainable use of resources (e.g., BRDI 2008b) or summarize scientific findings on the impacts and implications of bioenergy use for policy makers (German Advisory Council on Global Change 2009). However, approaches and even perceived needs of action vary: while many states and organizations have started to develop guidelines for biomass harvest in forests; for example, the Forest Stewardship Council (FSC) sees little need to produce specific bioenergy guidelines for use of biomass from FSC-certified forests because the overall sustainability measures and thresholds have to be met no matter what product is derived from forests (Dodge, personal communication).

Activities to spur the sustainable use of biomass for energy in the Northeast and New York are developing in a similar pace. Based on the implementation of the Renewable Portfolio Standard (RPS), Antares Group (2006) developed a practitioner's biomass use guidebook for New York. Efforts are driven by replacing fossil liquid fuel use in the Northeast (e.g., Coleman et al. 2008), which is widely used not only in the transport but also in the heating sector (NYSERDA 2008). New York State has already started to look specifically at the production and implication of liquid biofuel use (e.g. NYSERDA 2007, NYSERDA and Pace University 2008), and the Renewable Energy Task Force (RETF) established for New York has further pushed a coordinated development of renewables in the state (e.g. RETF NY 2008). Roadmaps similar to the solar roadmap for New York (Solar Initiative of NY 2007) are expected for other renewable sources of energy as well. Another driver for renewables in the Northeast is the recently implemented greenhouse gas cap through the Regional Greenhouse Gas Initiative (RGGI). While the New York State Energy Plan describes the planned steps to advance sustainable energy production in New York, it fails to define what sustainability means in this specific context.

Although there has been a great deal of discussion about sustainability through these efforts and other forums (for an overview see e.g., van Dam et al. 2008 or Vis et al. 2008), there are only a few examples of certified bioenergy production using criteria and indicator approaches, which have been hypothesized or put in practice (e.g., Smeets et al. 2008). This is because no clear consensus amongst bioenergy experts and other stakeholders has emerged on which criteria are critical and which framework should become standard practice. This lack of agreement on sustainability for bioenergy systems is not only prevalent when dealing with global biomass trade. Consensus on which sustainability criteria are relevant, practical, reliable, and important is also low for bioenergy applications in smaller scales (e.g. McCormick and Kåberger 2007). While some specific criteria can be quantified and measured using tools such as life cycle analysis (LCA) for carbon cycles of liquid biofuels (e.g. Wang 1999), other sustainability criteria (e.g. , local participation) cannot be measured by such tools. The measurement of these criteria is often hotly debated while even their significance is disputed amongst experts. But more importantly, a holistic sustainability assessment framework for bioenergy systems that would help prioritize those individual sustainability criteria in relation to each other is lacking at both the international and local scales. Current efforts to assess sustainability based on the social–economic–ecological concept are still somewhat ad hoc in their approach to identify the criteria we need in each of these three factors.

2.2 METHODS

2.2.1 Study Population and Implementation

The study population was comprised of current and potential bioenergy stakeholders from across the state with an interest and/or expertise in New York and with a specific attention to range of experience in regions, types of bioenergy systems, scale of operations, and professions. Stakeholders were identified through word-of-mouth, conference participation lists, participation in the state-wide workshops, membership in relevant organizations and listservs, and they also included the Roadmap team as well as its advisory board. Participants received a survey and explanatory cover letter in February to March 2009 and a maximum of two follow up emails spaced two weeks apart to encourage participation.

2.2.2 Survey Design

Respondent demographics. Stakeholders were asked to provide information about their professional background, geographical association, level of involvement and knowledge in bioenergy, and – for active stakeholders – the scale of bioenergy projects with which they are familiar. This information was used to assess if there were differences of opinion between groups of stakeholders based on these characteristics.

Criteria identification and rating. Through a literature review and an internal review of criteria within the Roadmap team, we identified 36 sustainability criteria that are regularly discussed in the context of bioenergy (see Appendix K-A). Sources included Cramer et al. (2006), van Dam et al. (2006), Fritsche et al. (2006), Jürgens and Best (2005), Lewandowski and Faaji (2006), Modi et al. (2006), Reijnders (2006), Five Winds International (2006), Smeets et al. (2005), contributions of the RSB (2007 and 2008) Lausanne, the Sustainability Upreti (2004), and the

World Energy Council (1999). The criteria that were identified were grouped into the broad categories of social (15 criteria), economic (5 criteria) and environmental (16 criteria). Stakeholders were asked to rate each of these 36 sustainability criteria on their importance, while the Roadmap team members and other biofuels experts were also asked to rank criteria on their practicality. This subset of the complete sample labeled 'biofuels experts' was used based on the assumption that this selective group was deeply involved in biofuels development in New York and had the expertise to rank criteria on their practicality. The following definitions were used:

- **Importance:** How important is the criterion for assessing the sustainability of the bioenergy system? Is it critical, i.e., is it according to your opinion mandatory to include it in a sustainability assessment of bioenergy systems?

- **Practicality:** Are there existing scales and/or measurement units? Are there measurable threshold values? How easily can data be obtained? Is measuring the indicator cost, time and/or resource effective?

The focus of this survey was to understand the issues most important to the specific stakeholder within his/her context when considering the sustainability of biofuels in New York State – that is, the whole production cycle for biofuels including biomass production and transportation, conversion technology, distribution and final consumption of the fuel, and overall project design.

The attributes' importance and practicality were rated by stakeholders using the same six-point scale. Stakeholders were also given the opportunity to comment or add missing criteria and rate them in a special section of the survey. Because the question on practicality demands advanced knowledge of bioenergy systems, questions on practicality of the criteria were only posed to the Roadmap team members, advisory board, invitees to the visioning meeting, as well as other experts.

2.2.3 Survey Analysis

Results were analyzed using the statistical analysis software SPSS 16.0 and Microsoft Excel software. If stakeholders chose 'no opinion' for one item, the case was eliminated. As a means to compare rating between criteria but within attributes, an average rating was calculated for each criterion and attribute. Ratings were counted as 'Not important/practical at all' = 1 to 'Very important/practical' = 6 and the resulting mean was taken as the average rating. The overall average rating for each attribute was calculated as well.

The homogeneity of stakeholders' ratings for each criterion was assessed using the standard deviation of counts within the response ratings as a 'consensus rating'. A high standard deviation indicates an uneven distribution of ratings across the scale with a tendency towards one rating. A low standard deviation indicates a more even distribution of ratings across the scale and therefore low consensus. Using the standard deviation as consensus rating was possible as there was no occurrence where criteria were rated on both extremes, but little in the medium scale. See also Buchholz et al. (2009) for an application of this method.

2.3 RESULTS

2.3.1 Contacted/Selection of Stakeholders and Response Rates

The survey yielded 396 valid entries. A high turnout was observed (70 returns out of a sample of 129) in the category of experts that included Roadmap team members, the advisory board, invitees to the vision workshop, as well as other experts. The 11 workshops organized throughout New York yielded 194 responses, and an additional 39 responses (from 139 invitations sent out) came from other selected individual stakeholders or organization representatives. Organization representatives included (but were not restricted to) the New York Woodowners Association, Nature Conservancy New York, New York State Association of Conservation Commissions, New York Land Trusts, New York State Department of Environmental Conservation (NYSDEC), the Natural Resources Defense Council (NRDC), New York Farm Bureau, the New York State Department of Transportation (NYSDOT), and the Sierra Club, as well as the New York Agricultural Extension Service. Additional invitations to participate in the survey were sent to the listservs of selected Program Work Teams (PWTs) that gather stakeholders on specific agricultural topics and are organized by the Cornell Cooperative Extension Program. This effort received 105 responses. Participating PWT listservs included Renewable Energy and Energy Conservation (90 email addresses), Watershed-Based Management of Water Resources (130 email addresses), Dairy Program, Managing Wastes: Composting and Land Application, Integrated Field Crop, Soil, and Pest Management, Integrated Nutrient Management, Agricultural Marketing and Agribusiness Management, Agricultural Community Economic Development, Agroforestry and Private Woodland Management, Community-Based Biodiversity and Habitat Conservation, Community Economic Renewal, Community Forestry, Environmental Health Risks in Agricultural Communities, Family & Community Food Decision Making, Integrated Pest Management, as well as the listservs of the Cornell Cooperative Extension staff executive directors (56 email addresses), and New York Association of Natural Resource Extension Professionals (20 email addresses).

2.3.2 Background of Stakeholders

Figures K-1 through K-9 describe the background of survey respondents. Note that not all figures in the graphs sum up to the total of 396 responses, as not all questions were filled out by every respondent. Most respondents were in the age range of 41 to 60 years, reflecting mostly stakeholders in senior positions to whose attention this survey was brought. All regions of New York were represented with a focus along a line from the Catskills/Hudson Valley, Capital District, to Central and Western New York with a heavy focus on rural residents. Respondents had a fairly even distribution in their primary area of interest ranging from personal livelihood (e.g., farmer) to policy, as well as technological aspects (e.g., project development or conversion technology expertise) and environmental conservation. Those stakeholders with a primary interest in technological aspects focused mainly on feedstock production, but also represented voices from the conversion technology as well as biofuel finance and the distribution side. Approximately half of the stakeholders considered themselves as having a high level of knowledge on biofuels. The biofuels expertise of the survey participants was also revealed through the fact that one-third was already actively involved in biofuel development, with another third having interest in getting

involved in the near future. Those active stakeholders were working mainly on a local or state level with a majority from a background in academia, feedstock production, and industry. Further analysis revealed that 208 stakeholders participated in the survey as representatives of an organization while 182 stakeholders did not represent any organization.

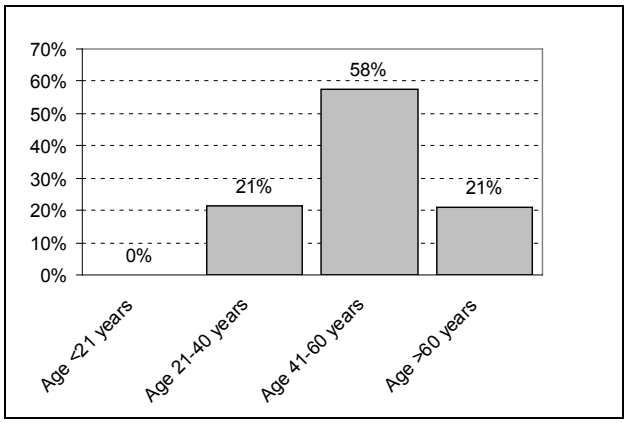

Figure K-1. Age distribution of stakeholders. N=182

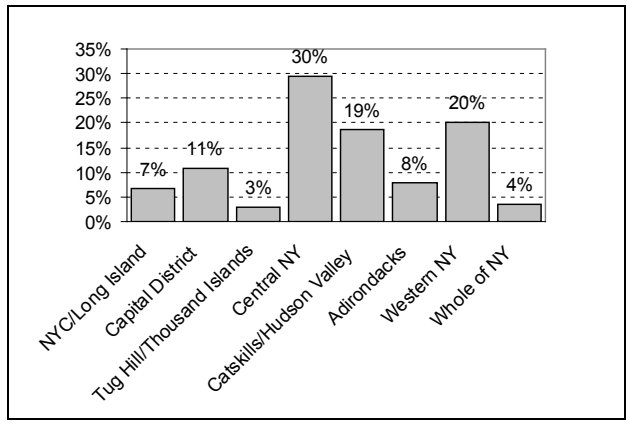

Figure K-2. Regional association of stakeholders. N=392

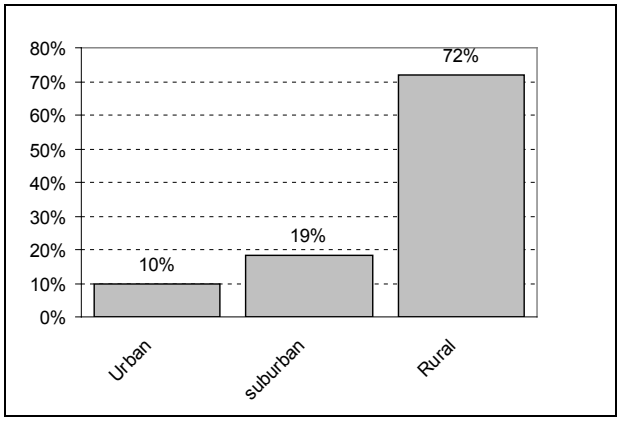

Figure K-3. Stakeholders' affiliation with an urban, suburban, or rural background. N=389

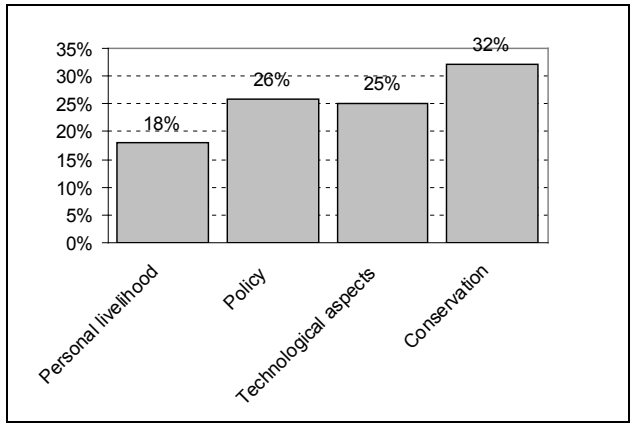

Figure K-4. Primary area of interest of all stakeholders. N=396

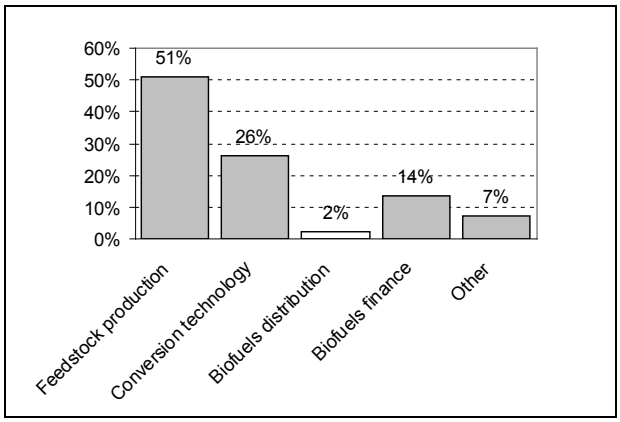

Figure K-5. More specific primary area of interest of those stakeholders who categorized themselves as being interested in 'technical aspects'. N=96

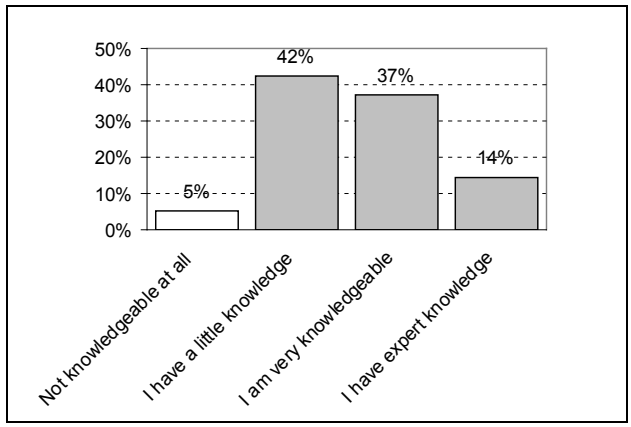

Figure K-6. Self assessed level of knowledge of stakeholders. N=389

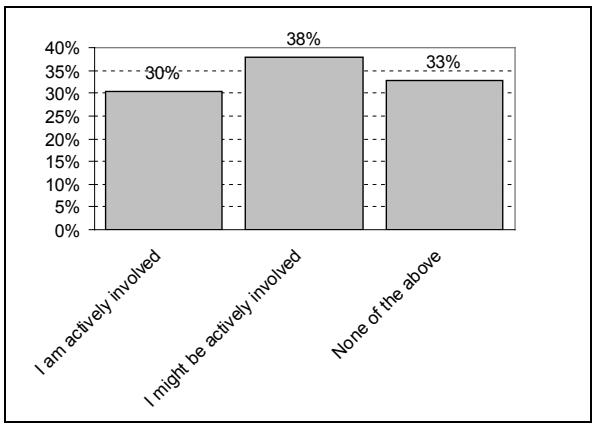

Figure K-7. Level of involvement of stakeholders. N=396

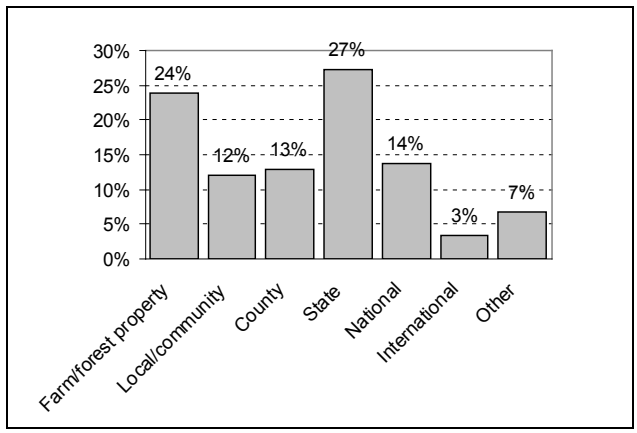

Figure K-8. Scale of operation of stakeholders that categorized themselves as being actively involved in biofuels development. N=117

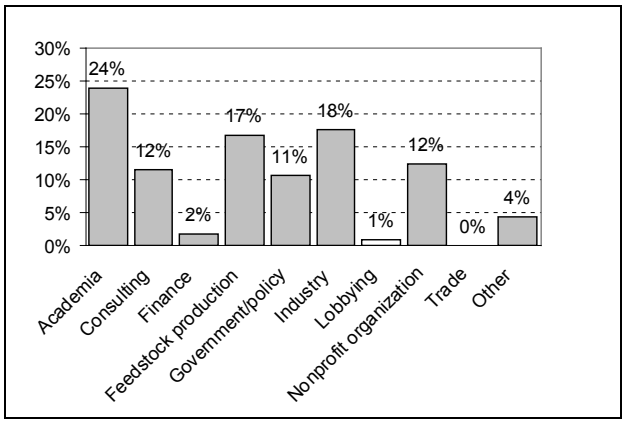

Figure K-9. Segments of profession of stakeholders that categorized themselves as being actively involved in biofuels development. N=113

2.3.3 Criteria Rating

Table K-1 shows the average rating for each criterion on the two attributes 'practicality' and 'importance' as rated by 374-394 stakeholders for the complete sample and a subset of 58-61 Roadmap experts, respectively. For criteria names and explanations see Appendix K-A. Further analysis was based on these average ratings and in particular on the top third highest ranked criteria in the importance category.

Differences in Importance Rankings Between Social, Economic, and Environmental Criteria. The 36 criteria included in the survey were in a ratio of about 3:1:3 (social, economic, environmental), indicating a strong emphasis on social and environmental issues in the literature and current sustainability assessment efforts. However, the stakeholders' aggregated rating of the top 10 criteria with the highest importance values presented a ratio of 3:1:6 (social, economic, environmental) deviating from the original ratio and focusing more on the environmental criteria.

The suggestion that social criteria are perceived as less important or not seen as a New York-specific problem is further supported by the fact that seven out of the 10 criteria with the lowest average rating in importance are classified as social (see Table K-1). It is also noteworthy that even *Employment generation* (no. 16), a criterion that can be categorized as social or economic criterion, was positioned in the low third for the complete sample in terms of importance. This could be an indicator that employment is seen as an important issue, but the connection to sustainability not seen as a strong argument. Another surprising observation was that the criterion *Macroeconomic sustainability* (no.18), which could indicate if a bioenergy system can be run profitably in absence of subsidies, was ranked in the bottom third for importance. This notion could be interpreted as a general agreement that government support is going to be required and accepted, especially in the near term, to develop bioenergy systems to the point that they can be profitable on a macroeconomic level. It could suggest as well that environmental issues are seen as more important in relation to sustainability than macroeconomics and that support for more environmentally friendly sources of energy should be developed even if they are more costly. However, it also has to be pointed out that – although each criterion had an extensive explanation attached to it specifying its meaning in the context of the survey – there was still room for interpretation by respondents, which could explain some variation.

Table K-1. Average ratings of criteria for all attributes, ranked by the importance rating. For criteria names and explanations see Appendix K-A. A high average rating indicates a more practical or important criterion.

CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	IMPORTANCE RATING	PRACTICALITY RATING
23	Natural resource efficiency	Environmental	5.34	4.62
31	Soil protection	Environmental	5.32	4.59
33	Water management	Environmental	5.29	4.68
14	Support for research and development	Social	5.25	4.90
22	Energy balance	Environmental	5.25	4.95
2	Food security	Social	5.21	4.25
34	Waste management	Environmental	5.19	4.85
4	Participation	Social	5.18	4.31
36	Potentially hazardous atmospheric emissions other than greenhouse gases	Environmental	5.16	4.70
20	Economic stability	Economic	5.16	4.32
11	Property rights and rights of use	Social	5.10	3.86
12	Planning	Social	5.10	4.90
1	Compliance with laws	Social	5.08	4.73
35	Greenhouse gas balance	Environmental	5.08	4.53
17	Microeconomic sustainability	Economic	5.06	4.72
25	Ecosystems protection	Environmental	5.05	4.44
13	Monitoring and criteria performance	Social	5.02	4.17
21	Adaption capacity to environmental hazards and climate change	Environmental	5.00	4.38
8	Working conditions of workers	Social	4.99	4.64
32	Land use change	Environmental	4.97	3.86
19	Economic development	Economic	4.97	4.50
27	Crop diversity	Environmental	4.91	4.28
26	Ecosystems connectivity	Environmental	4.90	4.05
30	Use of chemicals, pest control, and fertilizer	Environmental	4.87	4.54
28	Exotic species applications	Environmental	4.83	4.11
7	Respect for human rights	Social	4.80	3.73
24	Species protection	Environmental	4.77	4.31
10	Standard of living	Social	4.75	4.14
16	Employment generation	Economic	4.74	4.60
3	Land availability for human activities other than food production	Social	4.61	4.12
18	Macroeconomic sustainability	Economic	4.58	3.75
15	Local nuisances	Social	4.54	4.30
29	Use of genetically modified organisms	Environmental	4.51	3.90
6	Social cohesion	Social	4.49	3.28
9	Respecting minorities	Social	4.35	4.05
5	Cultural acceptability	Social	4.30	3.28
Overall average rating			**4.94**	**4.32**
Stakeholders			**374-394**	**58-61**

High Ranking Criteria. The top ten most important criteria across the complete sample of stakeholders included *Natural resource efficiency, Soil protection, Water management, Support for research and development, Energy balance, Food security, Waste management, Participation, Potentially hazardous atmospheric emissions other than greenhouse gases,* and *Economic stability*. These ten criteria were ranked highest in importance which indicates a certain priority against other criteria, but there was no breaking point occurring at any point in the criterion ranking (see Table K-2). In the remainder we focus on these top ten criteria to support our argumentation but it needs to be stressed that the ranks in importance are fairly continuous.

Further examination of importance ratings by groups (Table K-2) revealed that 25 of the 36 criteria were rated in the top ten by at least one group. All subgroups had at least four criteria in common with the top ten of the complete sample. The five criteria *Natural resource efficiency, Energy balance, Support for research and development, Water management, Potentially hazardous atmospheric emissions other than greenhouse gases,* were in the top ten ranking of most subgroups (18 out of 20). However, only one criterion was contained in all top ten for all groups (*Natural resource efficiency*) suggesting a heterogeneous mix of opinions on importance of criteria. The subgroups whose top ten lists diverged the most from the complete sample (and having only four criteria in common with the complete sample) were stakeholders from New York City/Long Island and biofuel stakeholders working on a national and/or international level.

It is also interesting to note that the criterion *Participation* made it to the top ten of the complete sample but occurred in none of the top ten lists for any of the subgroups. *Employment generation*, a criterion often used in the connection with biofuels, was only contained in the top ten list of industry[1] representatives.

Stakeholders from the Catskills, Capital District, western New York, and the Adirondacks shared nine criteria in their top ten rankings for the most important criteria. Stakeholders from New York City and the Adirondacks differed the most in their ranking, having only five criteria in common in their top ten rankings. Analyzing the complete sample by the respondent's professional backgrounds revealed the existence of two clusters in terms of how stakeholders ranked the importance of criteria. Stakeholders whose focus was on conservation and policy ranked the same eight criteria in their top ten while stakeholders with a background in academia, feedstock production, and industry/lobbying/finance/project development had at least seven criteria in common in their ranking of the ten most important criteria. The difference in criteria ranking could not be generalized as they were of social, economic, and environmental nature. Both clusters diverged considerably from each other in this ranking with the subgroups 'conservation' and 'industry/lobbying/finance/project development' differing the most (only four criteria in the top ten list in common), suggesting that there are some distinct differences of opinion about criteria between these groups. Similarly, stakeholders involved on different scales (local/county, state, and national/international) shared six or less of their respective top ten criteria. These differences indicate that people's professional background and spatial scale had an impact on the stakeholders' opinion of sustainability. This emphasizes that a single set of criteria may not be applicable to all bioenergy systems and that accurate assessments

of sustainability may require the use of approaches that are flexible to account for these differences. At the same time, splitting all respondents by their association with a rural or urban/suburban background revealed very few differences with both groups sharing eight criteria in their top ten ranking; which could be an indication that there is not a distinctive rift between sustainability values between urban/suburban residents and rural residents.

[1] Including lobbying, financing, and project development.

Table K-2. Top third criteria according to average rating for importance for the complete sample and subgroups. Only criteria occurring in one of the groups in the top third are listed. Numbers of stakeholders vary within each group as stakeholders rating with 'No opinion' were not included.

			KNOW-LEDGE[a]		REGION								URBAN/ RURAL		PROFESSIONAL INTEREST/BACKGROUND					SCALE		
CRIT.NO.	N / CRIT. NAME	COMPLETE SAMPLE	LOW	HIGH	NYC/LONG ISLAND	CAPITAL DISTRICT	TUG HILL/ TH. ISLANDS	CENTRAL	CATSKILLS/ HUDSON VAL.	ADIRONDACKS	WESTERN	WHOLE OF NY STATE	URBAN/ SUBURBAN	RURAL	FEEDSTOCK PRODUCTION	POLICY	CONSERVATION	ACADEMIA	INDUSTRY ETC.[b]	LOCAL/ COUNTY	STATE	NATIONAL & INT'L
	N	374-394	169 - 185	196 - 201	23-26	38-41	10-11	107 - 115	68-73	25-31	73-78	13-14	106 - 110	260 - 275	42-48	95-101	115 - 124	25-27	34-36	48-56	29-32	18-20
1	Compliance with laws			X	X	X	X		X		X	X	X	X		X					X	X
2	Food security	X	X	X		X	X	X	X	X	X		X	X		X	X			X		X
4	Participation	X																				
7	Respect for human rights						X															
8	Worker conditions							X														X
12	Planning		X			X	X	X	X	X				X		X	X			X		
13	Monitoring and criteria performance		X		X	X									X			X				X
14	Support for research and development	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	Employment generation																		X			
17	Microeconomic sustainability			X				X			X			X	X				X	X		X
19	Economic development							X												X	X	X
20	Economic stability	X																X	X			
21	Adaption capacity to environmental hazards and climate change				X							X			X				X		X	
22	Energy balance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

[a]) Self-assessed level of knowledge on biofuels.
[b]) Biofuel industry, lobbying, finance, project development.

Table K-2, continued.

CRIT.NO.	CRIT. NAME / N	COMPLETE SAMPLE	KNOW-LEDGE[a]		REGION								URBAN/ RURAL		PROFESSIONAL INTEREST/BACKGROUND					SCALE		
			LOW	HIGH	NYC/LONG ISLAND	CAPITAL DISTRICT	TUG HILL/ TH. ISLANDS	CENTRAL	CATSKILLS/ HUDSON VAL.	ADIRONDACKS	WESTERN	WHOLE OF NY STATE	URBAN/ SUBURBAN	RURAL	FEEDSTOCK PRODUCTION	POLICY	CONSERVATION	ACADEMIA	INDUSTRY ETC.[b]	LOCAL/ COUNTY	STATE	NATIONAL & INT'L
	N	374-394	169-185	196-201	23-26	38-41	10-11	107-115	68-73	25-31	73-78	13-14	106-110	260-275	42-48	95-101	115-124	25-27	34-36	48-56	29-32	18-20
23	Natural resource efficiency	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
24	Species protection				X							X										
25	Ecosystems protection		X		X							X	X				X				X	X
26	Ecosystems connectivity																X					
27	Crop diversity									X					X							
28	Exotic species applications																	X				
30	Use of chemicals, pest control, and fertilizer																					
31	Soil protection	X																X	X			
33	Water management	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	
34	Waste management	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X		
35	Greenhouse gas balance (GHG)			X	X				X	X	X	X	X		X	X		X	X		X	X
36	Potentially hazardous atmospheric emissions other than GHG	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	

[a]) Self-assessed level of knowledge on biofuels
[b]) Biofuel industry, lobbying, finance, project development

Low Ranking Criteria. Thirteen criteria were not included in the top ten criteria list for any of the subgroups outlined in Table K-2 (*Land availability for human activities other than food production, Cultural acceptability, Social cohesion, Respecting minorities, Standard of living, Property rights and rights of use, Local nuisances, Macroeconomic sustainability, Use of genetically modified organisms*, *Use of chemicals, pest control, and fertilizer*, and *Land use change*). This observation might suggest they could be dropped from future New York sustainability criteria lists. However, even these relatively low ranking criteria still had aggregated average rankings of 4.3 or more (see Figure K-10): these criteria were ranked in the upper half of the importance scale. An indication that the criteria that ranked low in the aggregated score still need to be considered to some extent is also given in Figure K-10, which shows the relationship between average criteria ratings and the level of consensus for each criterion. There was a very strong linear relationship for importance (R^2=0.96) and the consensus on the rating amongst stakeholders[2]. This observation carries an important implication: low ranking criteria might be rated low because they are heavily disputed.

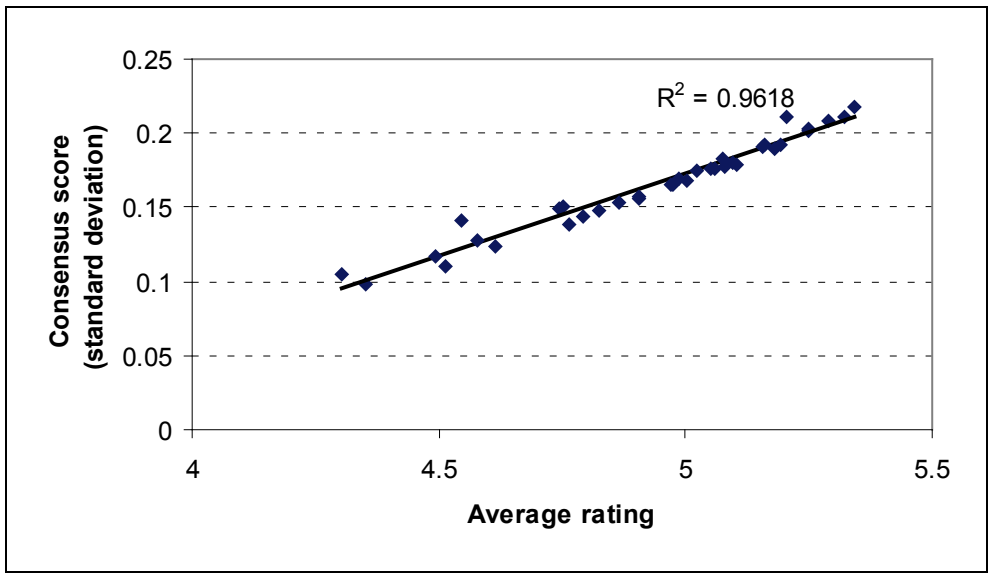

Figure K-10. Correlation between average ratings in importance and consensus scores for individual criteria. High average ratings indicate a tendency of stakeholders to rate a given criterion as high in importance. High consensus scores indicate that a given criterion was scored similarly by all stakeholders.

[2] A high standard deviation indicates an uneven distribution of ratings across the scale with a tendency towards one rating. A low standard deviation indicates a more even distribution of ratings across the scale and therefore low consensus. Using the standard deviation as consensus rating was possible as there was no occurrence where criteria were rated on both extremes but little in the medium scale. Hence, low standard deviations signal low consensus in this specific analysis. See also Buchholz et al. 2009 for methodological implications.

Practicality Ratings of Criteria. The current status of our research suggests that most of the criteria ranked as the top ten most important criteria by the complete sample are perceived as being fairly practical[3] to measure and enforce by the Roadmap's expert group with the exceptions of the criteria *Food security, Participation,* and *Economic stability*, indicating the need for more research on making these three criteria more measurable and applicable.

While these three criteria are of a social and economic nature, the environmental criteria seem to be perceived as more practical at this point. One example for a criterion ranked fairly high in importance, but low in practicality, is the criterion *Property rights and rights of use* (position 11), which ranked in the low third in terms of practicality.

3 THE SEARCH FOR CRITERIA METRICS: EXISTING REGULATORY FRAMEWORKS AND DATASETS FOR SUSTAINABILITY CRITERIA

In this chapter we discuss the discrepancy between the perceived importance of criteria (as measured through the New York biofuels stakeholder survey) and the ability to actually measure these criteria and make them applicable to New York policy makers and practitioners. As revealed in the New York biofuels stakeholder survey, the criteria *Participation, Monitoring of criteria performance, Food security,* and especially *Property rights and rights of use* were ranked fairly high in importance but low in practicality; subsequently, a certain focus is given to these criteria. At the same time, the survey revealed that the importance score for all criteria was relatively high.

There are already existing regulatory frameworks for both public and private land that monitor some of the criteria against certain indicators and thresholds. Policy tools include mandatory federal, regional, state, or local regulations as well as voluntary frameworks such as certification bodies or guidelines on best management practices. Table K-3 gives an overview of how existing regulations cover the list of criteria used in the New York biofuels stakeholder survey. It becomes apparent that many criteria are already covered to a certain extent by mandatory regulation frameworks spanning from the federal to the local level. We argue that these criteria, which are already covered by mandatory regulations, should be of second priority concerning the advancement of biofuel sustainability efforts as monitoring mechanisms are already in place and tested.

There also exist a variety of voluntary regulatory frameworks in various stages of implementation and scale of operation. We want to focus here on frameworks that include all aspects of sustainability, i.e. social, economic, and environmental criteria. While the Cramer framework and the RSB are the most prominent examples of bioenergy sustainability frameworks being established on an international level, they are still in a more or less advanced development stage. The Roundtable on Sustainable Palm Oil Production (RSPO) has certified pilot production schemes since late 2008. On a national scale, the SBA is developing an assessment framework as well as the CSBP, which has recently released a draft version of sustainability standards and plans to publish a preliminary standard in early 2010 and a final standard in 2012. This CSBP standard is tailored to U.S. conditions, refers closely to RSB

[3] Lead questions to define practicality (see also section 2.2.2): Are there existing scales and/or measurement units? Are there measurable threshold values? How easily can data be obtained? Is measuring the indicator cost, time and/or resource effective?

standard development, and is most likely to gain relevance in the United States. Therefore, we focused on this standard as an example for voluntary regulations in our analysis in Table K-3 since we only wanted to refer to standards that are proven or close to realization, i.e., have developed criteria and indicator frameworks ready for implementation. We also analyzed voluntary sustainability frameworks focusing on forestry as these are the standards that have a proven track-record in sustainability certifications. Existing voluntary forestry sustainability frameworks in the United States include the FSC, the Panel for the Endorsement of Forest Certification (PEFC), the Sustainable Forestry Initiative (SFI) and the American Tree Farm System (ATFS). We focused on the FSC and SFI criteria framework in this analysis as an example due to their significance among voluntary frameworks. The other forestry-focused sustainability assessment frameworks are similar in their depth and breadth.

Looking at the social criteria, it becomes apparent that a variety of mandatory, especially state, regulations already exist. Nevertheless, we identified few existing regulations on the social criteria *Respect for human rights, Property rights and rights of use, Standard of living,* and *Food security*. There are no regulations on *Compliance with laws* and *Monitoring of criteria performance,* which go hand in hand and have to a certain extent both mandatory and regulatory frameworks in place. *Food security* is partially addressed by the New York Agriculture and Markets Law on the protection and acquisition of farm lands, and *Participation* finds an implementation approach through obligatory public hearings present in many local codes.

Looking at the economic criteria, we could not identify mandatory regulations, probably due to the fact that projects that do not fulfill economic sustainability would not materialize anyway, because these could be seen as self-regulating criteria. The fact that the other economic criteria apart from *Microeconomic sustainability* seem not to be addressed by mandatory regulations could be explained by the general philosophy of a predominantly free market approach in New York. For the environmental criteria, a variety of especially state-level regulations exist. The criteria *Water management* and *Potentially hazardous atmospheric emissions other than greenhouse gases* seem to be especially well covered by mandatory regulations. Underserved environmental criteria under this matrix in Table K-3 seem to be *Land use change* and *Energy balance* and the *Use of genetically modified organisms* that are only partly addressed in voluntary frameworks.

The last column of Table K-3 shows a collection of statewide datasets available for criteria in New York. The focus of this effort was to retrieve statewide datasets and does not include other datasets on other (e.g., local) scales, which might offer an additional valuable knowledge base. There is an abundance of datasets available for some criteria such as *Land availability for other human activities than food production* (with a focus on recreation) and many environmental criteria such as *Species* and *Ecosystems protection,* and especially *Water management*. At the same time, there is a lack of datasets, particularly on many of the social criteria.

Table K-3. Existing regulatory frameworks for potential biofuel sustainability criteria. Many mandatory regulation citations come from "Guide for Siting Small-Scale Biomass Projects in New York State" by T. Bourgeois, Pace Energy and Climate Center, June 2009 draft and the "Inventory of Existing Relevant State and Federal Policies" (Appendix N of the Roadmap). Citations on the voluntary regulations focus on the FSC and the CSBP as examples of a proven framework (FSC) and a framework close to implementation with indicators in place (CSBP). For criteria descriptions see Appendix K-A.

			REGULATIONS AND INCENTIVES			EXISTING NY STATEWIDE DATASETS
CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	FEDERAL	REGIONAL, STATE, AND LOCAL	VOLUNTARY	
1	Compliance with laws	Social criterion Process criterion	Court System	Court System	CSBP; FSC, SFI, etc.	New York State Department of State (NYSDOS) Local Laws [1]
2	Food security	Social criterion Condition criterion		NYCRR 370 Article 25-AA of NYS Agriculture & Markets Law, Sections 303, 304, 305 Protection and acquisition of farm lands		1997 Ag Census[2] National Land Cover Database (NLCD) 2001 [3] County-level Ag districts & markets [4]
3	Land availability for other human activities than food production	Social criterion Condition criterion	Forest Legacy (conservation easements), Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), Wildlife Habitat Incentives Program (WHIP), etc. Federal Lands Policy and Management Act	Local zoning codes		NLCD 2001[3] NYSDEC State Lands Layers NYSDEC campgrounds [5] Multi-use trails and roads [6] NYS Public Lands [7] Scenic areas of Statewide Significance [8]
4	Participation	Social criterion Process criterion		Local zoning codes requiring public hearings	FSC, SFI, etc.	
5	Cultural acceptability	Social criterion Process criterion	Native American Graves Protection and Repatriation Act	Cultural, historic, and archaeological res. consultations etc. 6NYCRR Part 617 SEQR	FSC, SFI, etc.	

Table K-3, continued.

			Regulations and incentives			Existing NY statewide datasets
Crit. no.	Criterion name	Nature of criterion	Federal	Regional, state, and local	Voluntary	
6	Social cohesion	Social criterion Process criterion	Fed. Equal Employment Opportunity (EEO) Laws	NY Minimum Wage Act	FSC, SFI, etc.	
7	Respect for human rights	Social criterion Process criterion				
8	Working conditions of workers	Social criterion Process criterion	EEO Laws	NY Minimum Wage Act	CSBP FSC, SFI, etc.	
9	Respecting minorities	Social criterion Process criterion	Native American Graves Protection and Repatriation Act		FSC, SFI, etc.	
10	Standard of living	Social criterion Condition criterion				Census blocks [9]
11	Property rights and rights of use	Social criterion Process criterion	Court system		NYS Conservation Easements (Areas of Environmental Concern -AEC) CRP FSC, SFI, etc.	NYS Conservation Easements (AEC)
12	Planning	Social criterion Process criterion	National Environmental Policy Act (NEPA) National Forest Management Act		CSBP NYS Agricultural Nonpoint Source Abatement & Control Grant Program FSC, SFI, etc.	
13	Monitoring of criteria performance	Social criterion Process criterion	Lookback provisions in Energy Independence and Security Act of 2007 (EISA) (Sec 2003/2004)		CSBP FSC, SFI, etc.	

Table K-3, continued.

			Regulations and incentives			Existing NY statewide datasets
Crit. no.	Criterion name	Nature of criterion	Federal	Regional, state, and local	Voluntary	
14	Support for research and development	Social criterion Process criterion	Various tax credits for biofuel production, provision, and use Import Duty for Fuel Ethanol Renewable Fuel Standard Program	Various tax credits for biofuel production, provision, and use	CSBP	
15	Local nuisances	Social criterion		Local zoning codes; NYS Transport. Code		Scenic areas of Statewide Significance [8]
16	Employment generation	Economic criterion Process criterion			FSC, SFI, etc.	
17	Microeconomic sustainability	Economic criterion Process and condition criterion			FSC, SFI, etc.	
18	Macroeconomic sustainability	Economic criterion Process and condition criterion	Lookback provisions in EISA (Secs 203/204)			
19	Economic development	Economic criterion Process criterion				Census blocks [9] Transportation infrastructure [10] Bulk Storage Facilities (petroleum, oil, chemicals) [11] NYS Empire Zone Boundaries [12] Railroads [13]
20	Economic stability	Economic & process criterion				

Table K-3, continued.

			Regulations and incentives			Existing NY statewide datasets
Crit. no.	Criterion name	Nature of criterion	Federal	Regional, state, and local	Voluntary	
21	Adaptation capacity to environmental hazards and climate change	Environmental criterion Process criterion			FSC, SFI, etc.	Feedstock data from P. Woodbury (NY Renewable Fuels Roadmap 2009 data) National Commodity Crop Index data 1992 Land Use U.S. Geological Survey (USGS) 1:250K [14] NLCD 2001 [3]
22	Energy balance	Environmental criterion Condition criterion		NYS Energy Code		Feedstock data from P. Woodbury (NY Renewable Fuels Roadmap 2009 data)
23	Natural resource efficiency	Environmental criterion Condition criterion	U.S. Department of Transportation(USDOT) Fuel Economy Standards for Model Year 2011 Vehicles	Various fuel efficiency regulations for vehicles	CSBP	Water quality classification [15] 1997 Ag Census [2] 1992 Land Use USGS 1:250K [14] Feedstock data from P. Woodbury (NY Renewable Fuels Roadmap 2009 data) National Commodity Crop Index data
24	Species protection	Environmental criterion Condition criterion	Endangered Species Act	Wildlife and habitat consultation/permit under Part of 6NYCRR Part 617 SEQR	CSBP FSC, SFI, etc.	Bird concentration areas [16] Amphibian distributions[3] Significant coastal habitats [17] NYSDEC Bird Conservation areas [18] NYS Gap Analysis Program (NYSGAP) datasets (AEC) National Wetlands Inventory (NWI) – U.S. Fish & Wildlife Service [19]

Table K-3, continued.

			REGULATIONS AND INCENTIVES			EXISTING NY STATEWIDE DATASETS
CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	FEDERAL	REGIONAL, STATE, AND LOCAL	VOLUNTARY	
25	Ecosystems protection	Environmental criterion Condition criterion		Wildlife and habitat consult./permit under Part of 6NYCRR Part 617 SEQR State Permits from (Article 24) U.S. Army Corps of Engineers (USACE) (Section 408) work in State or Federal designated wetlands	CSBP FSC, SFI, etc.	Bird concentration areas [16] Water quality classification [15] Amphibian distributions [3] Significant coastal habitats [17] NYSDEC Bird Conservation areas [18] U.S. Environmental Protection Agency (USEPA) Ecoregions [20] National Wetlands Inventory (NWI) – U.S. Fish & Wildlife Service [19]
26	Ecosystems connectivity	Environmental criterion Condition criterion		Wildlife and habitat consultation/permit under Part of 6NYCRR Part 617 SEQR	CSBP FSC, SFI, etc.	NLCD 2001 [3] USEPA Ecoregions [20] NWI - US Fish & Wildlife Service [19]
27	Crop diversity	Environmental criterion Process and condition criterion		Wildlife and habitat consult./permit under Part of 6NYCRR Part 617 SEQR	CSBP FSC, SFI, etc.	1997 Ag Census [2] National Commodity Crop Index data STATSGO soils [21]
28	Exotic species applications	Environmental criterion Process and condition criterion	Executive Order 13112 National Invasive Species Council	New York Consolidated Laws Article 9, 11, 14	CSBP FSC, SFI, etc.	Invasive plants: Purple Loosestrife (Lhythrum salicaria) [22] Invasive plants: Leafy Spurge (Euphorbia esula) [23] Adirondack Park Invasive Plant Program (APIPP) data (AEC)
29	Use of genetically modified organisms	Environmental criterion Process and condition criterion			FSC, SFI, etc.	Bird concentration areas [16] Amphibian distributions [3] NYSGAP datasets (AEC) NLCD 2001 [3]

Table K-3, continued.

			Regulations and incentives			Existing NY statewide datasets
Crit. no.	Criterion name	Nature of criterion	Federal	Regional, state, and local	Voluntary	
30	Use of chemicals, pest control, and fertilizer	Environmental criterion Process criterion		Pesticide Reporting Law (PRL)	CSBP FSC, SFI, etc.	Environmental remediation sites (NYSDEC) [24]
31	Soil protection	Environmental criterion Process & condition criterion	CRP	Coastal Zone Management Act	CSBP FSC, SFI, etc.	STATSGO soils [21]
32	Land use change	Environmental criterion Process criterion	Forest Legacy		CSBP FSC, SFI, etc. Conservation easements	1992 Land Use USGS 1:250K [14] NLCD 2001 [3] 1992-2001 NLCD - Land Cover Change [25] Historical Land Cover (1970s) [26] Statewide Digital Orthoimagery (1m resolution color) [27] Stream restoration needs, Great Lakes WS[28] NYS aquifers [28] Wastewater treatment facilities [29] Hydrologic unit code (HUC), USGS [30] Water quality classification[15] Sole source aquifers [31] Water Inventory/Priority List NYS [32] NWI – U.S. Fish & Wildlife Service [39] Dams in NYS [33] Toxic Releases Inventory [34] State Pollution Discharge Elimination System [15]
33	Water management	Environmental criterion Process and condition criterion	Clean Waters Act Section 319	SPDES Permit for stormwater and wastewater discharges (Division of Water Parts 700-750; Local sewer ordinance)	CSBP NYS Best Management Practices (BMP) Field Guide for Water Quality FSC, SFI, etc.	
34	Waste management	Environmental & Process and condition criterion	Resource Conservation and Recovery Act	Solid Waste Master Plan; Solid Waste Permit/Part 360	CSBP FSC, SFI, etc.	

Table K-3, continued.

			REGULATIONS AND INCENTIVES			EXISTING NY STATEWIDE DATASETS
CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	FEDERAL	REGIONAL, STATE, AND LOCAL	VOLUNTARY	
35	Greenhouse gas balance	Environmental criterion Process and condition criterion	Greenhouse Gas 'Screens' in the Renewable Fuel Standard (RFS) (60% better than fossil for cellulosic)	RGGI	CSBP	NWI – U.S. Fish & Wildlife Service [19]
36	Potentially hazardous atmospheric emissions other than greenhouse gases	Environmental criterion Process criterion	Clean Air Act Air Pollution Control Program	Air Emissions Permit under Part 200/201 of State Regulations County Health Codes; Fire Codes	Clean Agriculture USA (targeting agricultural diesel emissions)	Non-attainment air quality areas [35]

Weblinks to datasets listed in Table K-3:

1 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=325]

2 [http://cugir.mannlib.cornell.edu/updatebasket?action=download&ids=7313]

3 [http://cugir.mannlib.cornell.edu/updatebasket?action=download&ids=7321]

4 [http://cugir.mannlib.cornell.edu/datatheme.jsp?id=2]

5 [http://www.dec.ny.gov/maps/campgroundslink.kmz]

6[https://www.nysgis.state.ny.us/secured/coop/fileserver/?DSID=903&file=nytrail.zip]

7 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=931]

8[http://www.nysgis.state.ny.us/gisdata/fileserver/?DSID=321&file=scenic_areas.zip]

9 [ftp://nyoglatlas.org/data/Adirondack_Park/Cultural/]

10 [http://cugir.mannlib.cornell.edu/updatebasket?action=download&ids=1643]

11 [http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=4]

12 [http://www.nysgis.state.ny.us/gisdata/fileserver/?DSID=895&file=empirezone.zip]

13 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=37]

14 [http://cugir.mannlib.cornell.edu/datatheme.jsp?id=41]

15 [ftp://nyoglatlas.org/data/Statewide/Enviro_Quality/]

16[ftp://nyoglatlas.org/data/Great_Lakes/Lake_Ontario/LOCI_ENE/Data/Critical_Habitat/ CoastalHabitat/Birds/]

17 [ftp://nyoglatlas.org/data/Statewide/Habitat/]

18 [ftp://nyoglatlas.org/data/Statewide/Wildlife/Birds/]

19 [http://www.fws.gov/wetlands/data/#36]

20 [ftp://nyoglatlas.org/data/Statewide/vector/]

21 [ftp://nyoglatlas.org/data/Statewide/Soils/]

22 [http://cugir.mannlib.cornell.edu/updatebasket?action=download&ids=7325]

23 [http://cugir.mannlib.cornell.edu/updatebasket?action=download&ids=7324]

24 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1097]

25 [http://www.mrlc.gov/multizone_map2.php?xxxxx=nyplus]

26 [http://edc.usgs.gov/products/landcover/lulc.html]

27 [http://www.nysgis.state.ny.us/gateway/mg/napp_download.htm]

28[ftp://nyoglatlas.org/data/Great_Lakes/Lake_Ontario/LOCI_ENE/Data/Hydrology/streams/ Erosion_potential/]

29[ftp://nyoglatlas.org/data/Great_Lakes/Lake_Ontario/LOCI_ENE/Data/Hazards/WWTP/]

30 [ftp://nyoglatlas.org/data/Lake_Champlain/lcbp_hu8/]

31 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1125]

32 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1117]

33 [http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1130]

34[ftp://nyoglatlas.org/data/Great_Lakes/Lake_Ontario/LOCI_ENE/Data/Hazards/Ny_tri/]

35 [ftp://nyoglatlas.org/data/Statewide/Health/]

3.1 UNDERSTANDING WHAT TO MEASURE IN SUSTAINABILITY ASSESSMENTS: THE SIGNIFICANCE OF *CONDITION* AND *PROCESS* CRITERIA

In many sustainability assessments using a Criteria and Indicator approach, there is a tendency to use criteria that describe a current condition and help measuring the current performance of a system against threshold values or verifying compliance with yes/no answers. These condition criteria often are designed to help a system achieve a certain goal in a given time. An example for such a condition criterion is the criterion *Standard of living* defined in the Roadmap sustainability survey as "Public service support in areas producing bioenergy, e.g. education, health, access to energy". A certain standard can be numerically set and the system's performance easily measured against this standard, implying conformance or non-conformance with a given definition on sustainability. These condition criteria also tend to be tested fairly independently from other criteria in the sustainability assessment set and can be criticized as loose and static as they relate little to each other (e.g. Mendoza and Prabhu 2005). While they might help to achieve certain goals, there is criticism that they do not acknowledge in full the process-oriented concept of sustainability where understanding and measurement of sustainability constantly changes and depends on evolving knowledge production and norm-creation (e.g. Rametsteiner et al. 2009). Also, thresholds and goals can change over time due to changes in, for example, scientific breakthroughs or societal perceptions. Sustainability is therefore not seen as a goal that can be reached but as a societal process.

Against these condition criteria stand those criteria that aim to measure the activities and speed of a trend or process and to determine if it is leading in a desired direction. Using such process criteria in a sustainability assessment follows the understanding of sustainability and sustainable development as an evolving process and defining sustainability as "the capacity to create, test, and maintain adaptive capability" (Holling 2001). In other words, systems are sustainable when they possess, now and in the future, the necessary infrastructure and material wealth to make adaptations. *Development* in this case is the process of creating, testing and maintaining opportunity (Holling 2001). An example for a process criterion is *Participation*, which in itself might be difficult to be comprehended in its contribution to sustainability. However, having an active participation in a process will most likely ensure continuous scrutiny of a (biofuels) system by the broader public against contemporary knowledge and norms and therefore increase the likelihood of broad support, continued development and realization of, in this case, biofuel production and consumption. Such process criteria often have the potential to serve as linkages across disciplines, compartments, etc., emphasizing the interlinkages between different parts of the (biofuel) system. Process-oriented criteria therefore tend to a lesser extent to be a loose-knit list of largely unrelated criteria and have the potential to come closer in tracking sustainability of a dynamic system consisting of interacting elements. On the downside, thresholds and goals can be intricate to define for such process criteria, which can make these criteria more difficult to understand, measure, and communicate to lay persons.

Of the 36 criteria discussed in this Roadmap, 10 criteria of the survey list are condition criteria, 17 are process criteria, and nine feature characteristics of both criteria (see Table K-3). In other words, these nine criteria have the ability to monitor both condition as well as process development of sustainability of biofuels in New York. Efforts

are strong on the process side (17 criteria exist), which seems to be justified when considering sustainability in the first case as a process towards a desired future (see also section 1 and 5).

3.2 CURRENTLY UNDER-SERVED CRITERIA

Analysis of Table K-3 suggests increasing efforts for the development of indicators and/or regulations of the criteria *Participation, Monitoring of criteria performance, Food security, Property rights and rights of use* r*espect for human rights, Standard of living, Land use change, Energy balance* and the *Use of genetically modified organisms*. The first four criteria were also identified by experts as ranking low in practicality while also being identified by stakeholders as being of high importance. Voluntary frameworks such as the FSC and CSBP can assist in these efforts and provide implementation frameworks to monitor the criteria mentioned above. However, both frameworks have limitations, as they certify only feedstock operations but do not look into larger life-cycle assessments, including the conversion and consumption of biofuels in society at large. These larger life-cycle assessments, which include elements of both sustainability and energy efficiency, can be covered by state laws such as vehicle fuel efficiency standards (under the criterion *Natural resource efficiency* in Table K-3).

4 GEOSPATIAL ASSESSMENT OF BIOFUEL SUSTAINABILITY CRITERIA

The measurement and monitoring of sustainability criteria is an essential (but infrequently addressed) part of the process of designing, developing and managing renewable energy production systems. Following the steps of defining and evaluating a group of social, economic and environmental sustainability criteria (chapter 2), these factors need to be implemented in the context of local, regional and statewide decision-making. In other words, additional work with place-specific knowledge and institutions is typically needed to make these criteria useful for 'on-the-ground' applications. To achieve this local relevance and applicability, the use of geographic information systems (GIS) has become invaluable.

For this portion of the Roadmap study, we have demonstrated the construction of a preliminary GIS for assessment of six of the biofuel sustainability criteria identified for New York State (chapter 2), for the case study of Tupper Lake, NY, in the Adirondack region (Figure K-11). The Tupper Lake case study was selected because of previous research conducted to evaluate the biomass feedstock availability in a 25-mile radius surrounding the community; in addition to abundant woody biomass in the locale, a currently vacant industrial site and manufacturing facility has been considered for possible renovation for biomass energy production. The preliminary GIS presented here has built upon that initial feedstock research by incorporating over twenty additional geodata sources of high quality and, in most cases, of local or regional origin. These data include a range of environmental, ecological, economic, and social factors related to the area. Many of these datasets are publicly available statewide for New York, and others may be acquired through request to the authors or via New York GIS clearinghouses.

Using an inventory of available GIS data, the definitions of the sustainability criteria, and our expert knowledge, we selected six criteria for which at least four relevant GIS datasets existed. The criteria, GIS datasets, and sources used are provided in Table K-4. All GIS datasets were clipped (for vector data – points, lines and polygons) or

masked (for raster or gridded data) for the 25-mile radius surrounding Tupper Lake. For each criterion, a separate GIS was created that included the four most important datasets, as depicted in the maps in Figure K-11. Several of the criteria, including those not depicted in this example, have greater than four datasets that may be applicable, but are very difficult to visualize if added to the maps. In other words, the maps in Figure K-11 do not show all available information, because this would become very difficult to interpret; instead, the maps depict the four highest quality and most relevant data sources available for each of the selected criteria.

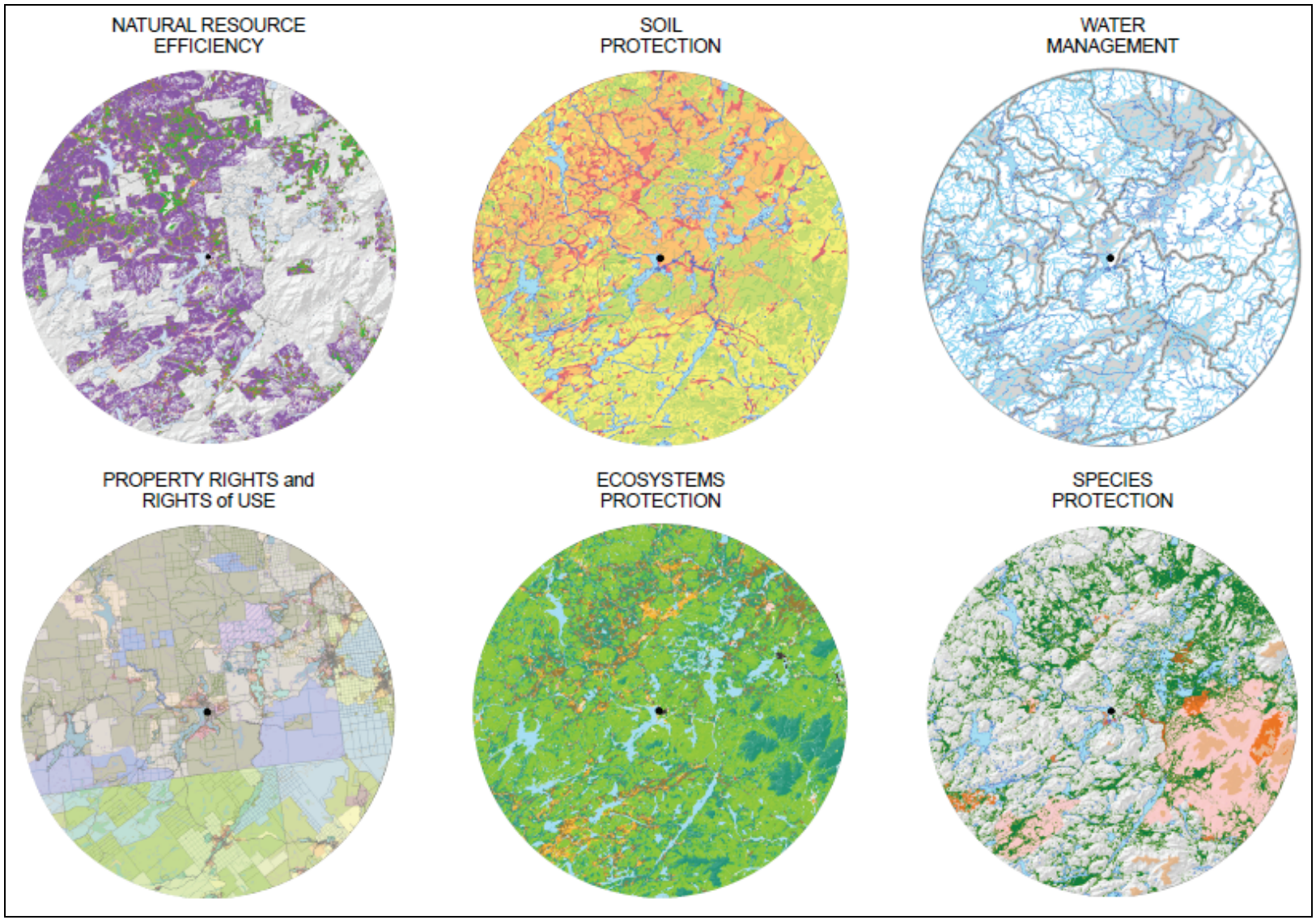

Figure K-11: Examples of GIS-based assessment of six biofuel sustainability criteria for a 25-mile radius surrounding Tupper Lake, NY. Each image depicts multiple data sets (selected from those available statewide) that may be used to evaluate the criteria (detailed information on data used is provided in the text and Table K-3). Further GIS analysis may be conducted to merge individual assessments into a composite sustainability assessment for the study area.

Table K-4: Indicator data and data sources used for Figure K-11.

CRITERIA	DEFINITION	INDICATOR DATA	SOURCE
Natural Resource Efficiency	Efficient use of resources at all stages of the system	Forest Cover & Type / Agricultural Land	NLCD 2001 (USGS)
		Aboveground Biomass USDA	Forest Inventory & Analysis (FIA)
		Forest Growth & Mortality Rates	FIA
		USDA NYS DEC Conservation Easements	NYSDEC
Soil Protection	Impacts on soil fertility like changes in nutrient cycling, rooting depth, organic matter, water holding capacity, erosion, and carbon storage	Soil Type	SSIRGO (USGS) / Adirondack Park Agency (APA)
		Erodability	APA / USGS
		Drainage Class	APA / USGS
		Wetlands, Lakes, Streams and Watersheds	APA / USGS (HUC)
Water Management	Surface and groundwater impacts, riparian buffers, irrigation and cooling cycles and waste water management	Wetlands	APA / EPA / USGS (NWI)
		Lakes & Streams	APA / USGS (HUC)
		Aquifers & Drinking Water Reservoirs	APA / EPA / USGS
		Watersheds & Sub-Drainages	USGS (HUC)
Property Rights and Rights of Use	Land and resource tenure, dependencies on foreign sources (e.g. financial investments, knowledge) fair and equal division of proceeds, customary rights, freedom to choose best use for land	Tax Parcels	APA / NYS Office of Real Property Services
		NY State Land (Forest Preserve)	APA
		APA Land Use Regulations	APA
		NYS DEC Conservation Easements	NYSDEC Dept. of Environmental Conservation
Ecosystems Protection	Safeguarding protected, threatened, representative, or other valuable ecosystems (e.g. forests)	Land Cover	NLCD 2001 (USGS)
		Ecological Land Units	NY Natural Heritage Program
		Lakes & Streams	APA / USGS
		Exemplary Natural Communities	NY Natural Heritage Program
Species Protection	Protection of rare, threatened, or endangered species	Important Bird & Endangered Species Habitats	NY Natural Heritage Program / WCS
		Exemplary Natural Communities	NY Natural Heritage Program
		Potential Winter Habitat Yards for Deer	SUNY ESF - Adirondack Ecological Center
		Wetlands	APA / EPA / USGS (NWI)

The next step in this methodology involves an analysis that integrates, or synthesizes, these multiple datasets for each criterion and provides an overall (aggregate) criteria score for the study area. An advantage to GIS-based assessment – building upon the work described above – is that the sustainability criteria can be mapped across a landscape so that variation in criteria within and across regions can be understood and monitored. Such a modeling and analysis effort is not a trivial exercise, and because its outputs may be used directly in decision-support and planning, it is imperative to apply scientifically sound methods that reduce the influence of data error and the source of uncertainty in the analysis. For example, weighting schemes are often used to aggregate multiple data sources into a single index, yet there are numerous available and widely used weighting schemes that may be chosen. A number of spatial overlay techniques in GIS are also applicable. In each case, the techniques used may have strong (and often diverse) effects on the outputs and their reliability for a range of applications, including planning and policy-making. For these reasons, we have not conducted this type of analysis for the New York biofuel sustainability criteria, but have constructed the necessary GIS platform to easily proceed in this direction.

5 CONCLUSIONS AND IMPLICATIONS FOR POLICY MAKERS

5.1 UNDERSTANDING SUSTAINABILITY AS A SCIENTIFIC AND SOCIAL PROCESS

Sustainability is an idea that is widely discussed as being important by diverse groups of people. However, there is a lack of agreement on what is meant by sustainability. Much of this controversy occurs because sustainability is based on many worldviews rooted in human values. There is broad agreement that sustainability should include environmental, social and economic components, but there is often disagreement on how these components should be weighted. Also, the multiple perspectives encompassed in the concept of sustainability are subject to frequent changes across time and space. Moreover, the assessment of many of these aspects is subject to scientific uncertainties. Finally, there is often disagreement about knowing when a system is sustainable. One way to measure sustainability is to assess whether a future system will generate more benefits and have fewer negative impacts that its predecessor. This process focus requires that a cyclical and ongoing system of monitoring, assessment and modifications is implemented and maintained so that trends can be detected.

Discussing the complete life-cycle for a system like biofuels is complicated as it consists of different components such as feedstock production, conversion technology, fuel distribution, and end use with each component engaging different groups with diverse worldviews and values. For instance, while feedstock producers know a lot about their component, they are generally less concerned with and knowledgeable about issues related to conversion technology. In order to address the issue of sustainability within the life-cycle of a New York biofuels industry, this broad array of views needs to be understood and orchestrated. The focus of this portion of the Roadmap was to (i) identify, through a survey, the components of sustainability that are important to New York biofuels stakeholders, (ii) determine what level of agreement there is among stakeholders on these components, (iii) assess which of these components currently are being addressed through federal, state or local laws and regulations, and (iv) analyze that issues identified as being important by New Yorkers related to sustainability can realistically be assessed.

One of the most common approaches to conducting a sustainability assessment is to choose criteria that reflect these values and identify indicators, which can measure those criteria with the latest scientific knowledge. This Criteria and Indicator approach has been developed and applied in forestry for over 15 years through organizations such as the FSC or the SFI. Experts around the world are in the process of developing similar sustainability assessment frameworks for bioenergy. The CSBP is a prominent US-relevant example of an effort to develop a criterion-based certification system for biomass production. Such frameworks developed globally can be summarized in 36 criteria proposed to adequately assess the sustainability of biofuel systems. However, there is little consensus among experts on how important they are or how they should be applied in different contexts. Therefore, in order to develop a sustainable biofuels industry in New York, it is critical to understand what issues are important to New York stakeholders as a first step. The selection and significance of these criteria can vary depending on an individual's values, geographical region, and attributes on a spatial scale. For example, one easily-recognized sustainability criterion is food security, which is often called "Food versus Fuel." With the current state of our knowledge, there is no single metric that can be applied to determine whether a given piece of land would be best used for food or fuel production, or, as is often the case, some combination of the two. Thus, efforts in planning a biofuels industry must seek input and consider the values of local stakeholders to assist in creating sustainability norms.

5.2 NEW YORK BIOFUELS SUSTAINABILITY SURVEY

Approximately 400 New York stakeholders, including 70 experts, were surveyed on their opinions regarding the relative importance of 36 internationally recognized sustainability criteria for a New York biofuels industry. These criteria address the entire biofuel system including feedstock production, conversion technology, and energy distribution, and incorporate a range of environmental, economic and cultural aspects of biofuel sustainability. All New York regions were represented among the survey respondents, but the majority of respondents (281) identified themselves as rural residents. Participants were asked to rate criteria on their importance. In addition, experts were asked to rate the practicality (or feasibility) of each criterion for measurement and monitoring with existing knowledge, tools and regulatory frameworks.

5.2.1 Ranking of Sustainability Criteria Among Groups in New York

Overall, survey results indicated that all of the 36 sustainability criteria are important to the broad range of stakeholder respondents. The average importance rating for each of the 36 criteria was equal to or greater than 4.3 on a scale from 1-6 with 6 being 'very important'. The criteria with the highest importance scores included *Natural Resource Efficiency, Soil Protection, Water Management, Support for Research and Development, Energy Balance,* and *Food Security* (Figure K-12). However, each criterion received a score of '6' (highest importance) from at least 74 respondents. In other words, all the lowest rated criteria were heavily disputed, i.e., many respondents scored these criteria low, while a minority of respondents scored them very high. These disputed criteria included *Cultural Acceptability, Respecting Minorities, Social Cohesion, Use of Genetically Modified Organisms,* and *Local Nuisances*. Results suggest that all 36 criteria should be included in a biofuels sustainability framework for New York State.

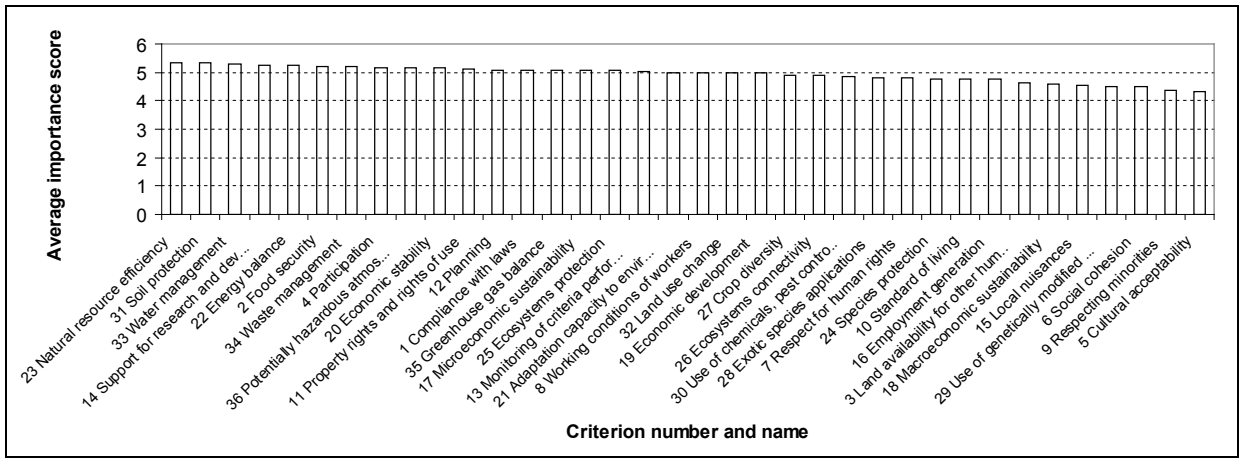

Figure K-12. Ranking of criteria according to the average importance score across the sample of New York biofuels stakeholders.

5.2.2 Consensus on Criteria Importance

Survey respondents were further categorized into subgroups based on several factors, including their stated level of knowledge about biofuels/renewable energy, area of residence in New York State, professional background, and scale of interest in biofuels (local, state, national). Among 18 of 20 subgroups, there was a set of criteria that were consistently ranked among the most important, including *Natural Resource Efficiency, Energy Balance, Support for Research and Development, Water Management,* and *Potentially Hazardous Atmospheric Emissions Other Than Greenhouse Gases*. Results also suggested significant differences in the criteria deemed important between stakeholders from a background in conservation or policy and those from a background in academia or project development and implementation. There was no significant discrepancy in the importance of sustainability criteria between urban, suburban and rural residents.

5.2.3 Practicality of Assessing Criteria

Results suggested that criteria with high importance ratings also had high practicality ratings, with the exception of *Participation, Monitoring of Criteria Performance, Food Security,* and most notably, *Property Rights and Rights of Use*. Although these criteria were ranked low in practicality, they are addressed to a certain extent by existing laws, regulations and/or guidelines for best management practices and therefore may not be of primary concern to advance biofuel sustainability assessments in New York. By contrast, several criteria rated low in terms of practicality – including *Respect for Human Rights, Standard of Living, Land Use Change,* and *Energy Balance* – lack an existing legal and/or regulatory framework in New York. Developing guidelines on how to assess these criteria may be a priority for evaluating the sustainability of biofuels in New York.

5.3 BIOFUEL SUSTAINABILITY FOR NEW YORK

Biomass systems can be sustainable only if they are able to perform effectively under changing conditions that are internal or external to the system, such as changing human needs or values, variations in climate, or shifts in the economy or policy and regulations. The resulting inherent complexity under which these systems need to perform

requires them to maintain a high resilience or adaptive capacity over time. Therefore, sustainability needs to be understood as an ever-changing process rather than a single specific goal that can be decided upon once and for all. Broad examples of strengthening adaptive capacity are increased diversity or access to information, which in turn increases the system's sustainability.

A liquid biofuel system includes feedstock production, conversion, and end use. The following suggested definition of sustainability is intended only for liquid biofuels that are produced in New York State:

> *Sustainable liquid biofuels are developed, grown and produced through a deliberate planning and monitoring process that draws on extensive knowledge and current scientific understanding to maximize a mixture of environmental, economic, and social benefits. This process engages stakeholders, considers diverse feedstocks and technologies, and incorporates adaptive mechanisms necessary to respond to environmental, economic, and societal changes. The result of this process is a reliable source of liquid fuel that is supported by a range of stakeholder values throughout time.*
>
> *Sustainable biomass production and its conversion to liquid fuels creates new job opportunities especially in rural areas, has a favorable energy balance, enhances New York's economy, maintains or improves desirable environmental conditions for future generations, contributes to resilient ecosystems that can adapt to changing external and internal forces, and can be produced in a sustained yield manner, i.e., no decrease in feedstock productivity is expected over time. Sustainable liquid biofuels use improves New York's overall soil, water and air quality, including greenhouse gas emissions, reduces dependence on outside sources of energy, and their consumption is tied into larger energy conservation and efficiency efforts that continuously improve end use technologies.*

5.3.1 The Need for a Comprehensive Framework to Assess Biofuel Sustainability on a New York State Scale

Survey results underscore the need to refine and prioritize criteria for biofuel sustainability in New York. The importance of a participatory process in continuing the development of a system for monitoring, assessing and improving a biofuels industry will be important to ensure the successful development of this industry. Once these criteria are identified, their application should be flexible and dynamic because the environmental, economic and cultural systems to which they apply are highly variable across New York and will inevitably change over time. The implementation of sub-regional assessment frameworks might be worth exploring in order to accommodate divergent views on sustainability across regions. The task of measuring and monitoring the sustainability criteria might be best enabled by a central and comprehensive inter-agency database to store baseline and monitoring data. Efforts could build on the Geodetic Control Viewer of NYSDOT or the NYSDEC Mapping Gateway. These steps should be followed by multi-stakeholder efforts to establish performance indices. Assessment frameworks should be periodically reviewed to make determinations whether a given biofuel system does or does not comply with agreed-upon sustainability standards. We suggest assigning an office to be responsible for collecting and keeping these data and periodic assessment of the sustainability of biofuels efforts statewide. We further propose a five- year cycle of

assessing the sustainability of New York biofuels and bioenergy; the 'Look back' provisions in Energy Independence and Security Act of 2007 Section 203/204 could serve as a model.

5.4 PRACTICAL STEPS TOWARDS SUSTAINABLE BIOFUEL PRODUCTION

In the absence of a comprehensive biofuels sustainability framework for New York, focusing on ecologically-sustainable practices of producing biofuel feedstock is a crucial first step towards sustainability. This entails the practical support of biofuel feedstock growers resulting in immediate effects. There is a need to further develop comprehensive and centrally stored guidelines for growing different feedstocks incorporating various environmental aspects.

Using forest-derived biomass as an example, alternative paths are conceivable to assist forest owners in sustainable biomass harvest practices: (i) Encouraging third party certification by one of the larger Sustainable Forest Management (SFM) initiatives such as FSC, SFI or the ATFS, or (ii) formally endorsing forest management plans containing exemplary practices suggested by state agencies. Such optional regulations are already in place targeting various aspects of SFM (*NYS Forestry Best Management Practices for Water Quality, EQIP (Environmental Quality Incentives Program) Forestry Initiative, Timber Harvesting Guidelines, Forest Tax Law Program*, etc.). Research is needed on how to make such recommended practices easily available to practitioners (e.g., on a central website). Also, guidelines specifically assisting in forest biomass extraction could be developed. A first step towards such guidelines is provided in Appendix E-E. *Forest Biomass Harvest Best Management Practices*.

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APPENDIX K-A

Sustainability Criteria Used in the Survey with Explanations and Categories.

Sources included [1] Cramer et al. (2006), [2] van Dam et al. (2006), [3] Fritsche et al. (2006), [4] Jürgens and Best (2005), [5] Lewandowski and Faaji (2006), [6] Modi et al. (2006), [7] Reijnders (2006), [8] Five Winds International (2006), [9] Smeets et al. (2005), [10] the Sustainable Bioenergy Wiki of the Roundtable on Sustainable Biofuels (RSB) Lausanne, [11] Upreti (2004), [12] the World Energy Council (1999), and [13] the CSBP and its global equivalent the Version 0 of the sustainability criteria used by the RSB. Depending on the source, criteria descriptions were streamlined in an effort to represent the same meaning across several sources and might therefore diverge from original wording.

CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	CRITERION EXPLANATION	SOURCES
1	Compliance with laws	Social criterion	Complying with all applicable laws and internal regulations such as certification principles, countering bribery	[4[[5] [10] [13]
2	Food security	Social criterion	Enough land locally available for food production	[1] [2] [3] [4] [5] [6] [9] [10] [13]
3	Land availability for other human activities than food production	Social criterion	Enough land locally available for housing, energy (e.g. firewood), recreation, and other resources	[10]
4	Participation	Social criterion	Inclusion of stakeholders in decision making	[1] [4] [5] [6] [10] [11]
5	Cultural acceptability	Social criterion	Consideration of spiritual values, handling of local knowledge	[1] [4] [8] [10] [11]
6	Social cohesion	Social criterion	Impacts on migration, wealth distribution, fair wages, intergenerational equity	[1] [2] [3] [5] [4] [8] [9] [10] [11]
7	Respect for human rights	Social criterion	Health services, liberty rights, security, education	[1] [2] [3] [4] [5] [6] [9] [10]
8	Working conditions of workers	Social criterion	Worker health, work hours, safety, liability regulations	[1] [2] [3] [4] [5] [8] [9] [10] [13]
9	Respecting minorities	Social criterion	Recognition of indigenous peoples' rights, gender issues	[1] [4] [5] [10]
10	Standard of living	Social criterion	Public service support in areas producing bioenergy, e.g. education, health, access to energy	[1] [4] [5] [8] [10] [11]
11	Property rights and rights of use	Social criterion	Land and resource tenure, dependencies on foreign sources (e.g. financial investments, knowledge) fair and equal division of proceeds, customary rights, freedom to choose best use for land	[1] [3] [5] [10] [13]
12	Planning	Social criterion	Stating clear objectives, a management plan is written, implemented, and updated as necessary	[5] [10] [13]

Appendix K-A, continued.

CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	CRITERION EXPLANATION	SOURCES
13	Monitoring of criteria performance	Social criterion	Monitoring systems in place for all criteria	[5] [10]
14	Support for research and development	Social criterion	Financial, technical, institutional support for advancing bioenergy knowledge	[13]
15	Local nuisances	Social criterion	Project related visual, noise, or odor impacts, road use and upkeep	[11] [10]
16	Employment generation	Economic criterion	Number jobs created, quality of jobs created	[4] [5] [8] [9] [10] [11] [12]
17	Microeconomic sustainability	Economic criterion	Cost-efficiency incl. startup costs, internal rate of return, net present value, payback period	[1] [4] [5] [8] [10] [12] [13]
18	Macroeconomic sustainability	Economic criterion	Trade balances, foreign investments, financial flows across project boundary, changes in overall productivity, 'economic development'	[2] [4] [5] [10]
19	Economic development	Economic criterion	Providing adequate marketing arrangements, material transport, assessment, implementation, financing, and management assistance	[2] [4] [5] [10] [13]
20	Economic stability	Economic criterion	Project lifetime, degree to which applied technology and operational aspects are proven, flexibility to changes in demand and supply, product diversification	[1] [5] [8] [10]
21	Adaptation capacity to environmental hazards and climate change	Environmental criterion	Diversification of feedstocks, available knowledge on site demand of feedstocks	[5] [10]
22	Energy balance	Environmental criterion	Conversion efficiencies, energy return on investment, energy return per hectare	[5] [10]
23	Natural resource efficiency	Environmental criterion	Efficient use of resources at all stages of the system	[4] [5] [7] [8] [10] [12]
24	Species protection	Environmental criterion	Protection of rare, threatened, or endangered species	[2] [3] [4] [5] [9] [10] [11]
25	Ecosystems protection	Environmental criterion	Safeguarding protected, threatened, representative, or other valuable ecosystems (e.g. forests)	[1] [2] [3] [4] [5] [8] [9] [10] [13]
26	Ecosystems connectivity	Environmental criterion	Preventing land fragmentation, e.g. presence of wildlife corridors etc.	[1] [2] [3] [4] [5] [8] [9] [10]

Appendix K-A, continued.

CRIT. NO.	CRITERION NAME	NATURE OF CRITERION	CRITERION EXPLANATION	SOURCES
27	Crop diversity	Environmental criterion	E.g. impacts and risks associated with monocultures such as its impacts on landscape and wildlife, and its susceptability to catastrophic failure	[4] [10]
28	Exotic species applications	Environmental criterion	Invasiveness, risks to other species and land uses	[5] [8] [10]
29	Use of genetically modified organisms	Environmental criterion	Compliance with law, risk to other land uses	[8] [10] [11]
30	Use of chemicals, pest control, and fertilizer	Environmental criterion	Insecticides, herbicides, chemicals in the conversion process, impacts on surrounding environment	[1] [4] [5] [9] [10]
31	Soil protection	Environmental criterion	Impacts on soil fertility such as changes in nutrient cycling, rooting depth, organic matter, water holding capacity, erosion, and carbon storage	[1] [2] [3] [4] [5] [6] [7] [9] [10] [13]
32	Land use change	Environmental criterion	Impacts of land conversion on greenhouse gas emissions and other natural processes that could eventually affect ecological balances	[3] [5] [6] [7] [8] [10] [11]
33	Water management	Environmental criterion	Surface and groundwater impacts, riparian buffers, irrigation and cooling cycles and waste water management	[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [13]
34	Waste management	Environmental criterion	Disposal of ashes, sewage, hazardous/contaminated solid and liquid material	[1] [4] [5] [8] [10] [11]
35	Greenhouse gas balance	Environmental criterion	GHG balance of system covering CO_2, CH_4, O_3, NO_2, H_2O	[2] [3] [4] [5] [6] [7] [8] [10] [13]
36	Potentially hazardous atmospheric emissions other than greenhouse gases	Environmental criterion	Emissions of SO_x, CO, NO_x, particulates, and other hazardous air pollutants	[1] [2] [5] [8] [10] [11] [13]

APPENDIX K-B

Sustainability criteria survey as distributed through the stakeholder workshops and other avenues. The cover letter and survey that were circulated are on the following pages.

ESF State University of New York
College of Environmental Science and Forestry

February 2nd 2009

Dear Madam/Sir,

As part of the development of the NY Renewable Fuels Roadmap we are investigating the sustainability of biofuels under NY conditions. The attached questionnaire is designed to help us to understand the issues most important to you when considering the sustainability of biofuels in New York State.

By biofuels we mean the whole production cycle for biofuels including biomass production and transportation, conversion technology, distribution and final consumption of the fuel, and overall project design.

You have been chosen for this survey based on your interest and/or expertise in NY biofuels. Your responses are essential to this effort. Completing this questionnaire should take you about 20 minutes.

Your input is extremely important to help us to understand the broader implications of biofuels in NY and the values we should be sure to maintain as we go forward. We would be very grateful if you could complete the enclosed survey and return it preferably during this session or by mail to Timothy Volk (see address below).

The information you provide will be kept confidential and never associated with your name. It will be analyzed with responses from other interested parties. The results will influence the NY Renewable Fuels Roadmap Project and will be made accessible to the public.

Thank you for your consideration. If you have questions, please do not hesitate to contact us by email (tsbuchho@syr.edu) or phone (315 470 6774). Thank you very much in advance for completing and returning the questionnaire.

Sincerely,

Timothy Volk, Ph.D.
Research Associate

Thomas Buchholz, Ph.D.
Research Scientist

Valerie A. Luzadis, Ph.D.
Associate Professor

Survey on Sustainability Values in New York

NEW YORK Renewable Fuels Roadmap 2009

ESF
State University of New York
College of Environmental Science and Forestry

PACE UNIVERSITY

Sponsored by:

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

NYSERDA

DEPARTMENT OF ENVIRONMENTAL CONSERVATION · NEW YORK STATE ·

New York State Department of Agriculture & Markets

Dear NY biofuels stakeholder,

Below you will find a list of criteria that are being discussed in relation to the sustainability of biofuels and bioenergy in various parts of the world. The selection of criteria to assess sustainability varies by region of the world, the scale of the effort – i.e. a local town bioenergy project versus national level goals – and the values of the people involved.

The focus of this survey is to identify the sustainability criteria that are the important to you. In the questionnaire, when we say "biofuels industry", we mean the production of the biomass feedstock, its conversion to a useful form of energy, and its distribution and use by consumers.

If you have any questions please send an email to Thomas Buchholz (tsbuchho@syr.edu) or call Timothy Volk (315 470 6774). Thank you for your time and consideration.

The Roadmap Sustainability Team

More about the Renewable Fuels Roadmap Project

Dependence on foreign petroleum, climate change, and the environmental impacts of fossil fuel consumption are issues of national concern. New York will face the challenge of transitioning to biofuels to help fuel its energy sector, which will largely be driven by external forces such as U.S. policy and international oil and agricultural commodity prices. At the same time, New York has an opportunity to use its significant agricultural and industrial capacity to develop conventional and advanced biofuels for sale in-state and elsewhere.

The Renewable Fuels Roadmap will serve as a strategic planning tool that will help decision makers shape the future of the biofuels industry in the State (including both production and consumption), as well as identify the resources, infrastructure, and policy incentives necessary to support such an industry. Through development of a set of analyses, workshops, documents, and policy guidance, the Roadmap processes' goal is to answer the most basic questions for New Yorkers and New York leaders:

- What resources does New York State have for a sustainable biofuels industry?
- What is the best use of these resources for New Yorkers?

ABOUT YOU

Please mark by checking the box next to the category that applies to you. **Choose only ONE answer per question**. If you feel several options apply to you, choose the one that you identify the most with. Leave blank if you don't know.

1. Which part of NY do you most associate with?

- ☐ NYC/ Long Island
- ☐ Catskills/Hudson Valley
- ☐ Capital District
- ☐ Adirondacks
- ☐ Tug Hill/Thousand Islands
- ☐ Western NY
- ☐ Central NY
- ☐ Whole of NY

2. Do you most associate with an **urban, suburban, or rural** environment?

- ☐ Urban
- ☐ Suburban
- ☐ Rural

3. What is your **primary area of interest** in biofuels?

- ☐ Personal livelihood
- ☐ Technological aspects (**please answer 3a**)
- ☐ Policy
- ☐ Conservation

3.a If your primary interest is in **technological aspects** of biofuels, what do you most associate with?

- ☐ Feedstock production
- ☐ Conversion technology
- ☐ Biofuels distribution
- ☐ Biofuels finance and project development
- ☐ Other (please specify):

4. How knowledgeable would you judge yourself to be in your primary area of interest (**Q3**)?

- ☐ Not knowledgeable at all
- ☐ I have a little knowledge
- ☐ I am very knowledgeable
- ☐ I have expert level knowledge

5. Do you represent yourself individually or is your participation on behalf of an organization?

- ☐ Myself
- ☐ Organization

6. Are you actively involved in biofuels development or production in NY?

- ☐ I am actively involved (**please answer 6a and 6b**)
- ☐ I might be actively involved in the future (**please answer 6a and 6b**)
- ☐ None of the above

6a. If you are **actively involved** with biofuels, please indicate at what **project scale** you are most often involved.

- ☐ Farm/Forest property
- ☐ Local/Community
- ☐ County
- ☐ State
- ☐ National
- ☐ International
- ☐ Other (please specify):

6b. If you are **actively involved** in biofuels professionally, what is your **segment of profession**?

- ☐ Academia
- ☐ Consulting
- ☐ Finance
- ☐ Feedstock production (farmer, forester, etc.)
- ☐ Government/Policy
- ☐ Industry
- ☐ Lobbying
- ☐ Nonprofit organization
- ☐ Trade
- ☐ Other (please specify):

Sustainability Criteria evaluation

Please indicate how important each of the following proposed criteria is for assessing the sustainability of developing a biofuels industry in New York State.

By **Importance** we mean:

- How important is the criterion for assessing the sustainability of biofuels in NY?
- How important is it to consider this criterion when looking for ways to sustain NY into the future?

Please mark choices by checking the boxes in the fields that apply according to your opinion. Criteria are printed in bold, the respective explanations are just an idea to what it refers to based on the literature.

CRITERION NAME		NOT IMPORTANT / PRACTICAL AT ALL 1	2	3	4	5	EXTREMELY IMPORTANT / PRACTICAL 6	NO OPINION
Social Criteria								
1. Compliance with laws: Complying with all applicable laws and internal regulations like certification principles, countering bribery	**Importance**	☐	☐	☐	☐	☐	☐	☐
2. Food security: Enough land locally available for food production	**Importance**	☐	☐	☐	☐	☐	☐	☐
3. Land availability for human activities other than food production: Enough land locally available for housing, energy (e.g. firewood), recreation, and other resources	**Importance**	☐	☐	☐	☐	☐	☐	☐
4. Participation: Inclusion of stakeholders in decision making	**Importance**	☐	☐	☐	☐	☐	☐	☐
5. Cultural acceptability: Consideration of spiritual values, handling of local knowledge	**Importance**	☐	☐	☐	☐	☐	☐	☐
6. Social cohesion: Impacts on migration , wealth distribution, fair wages, intergenerational equity	**Importance**	☐	☐	☐	☐	☐	☐	☐
7. Respect for human rights: Health services, liberty rights, security, education	**Importance**	☐	☐	☐	☐	☐	☐	☐
8. Working conditions of workers: Worker health, work hours, safety, liability regulations	**Importance**	☐	☐	☐	☐	☐	☐	☐
9. Respecting minorities: Recognition of indigenous peoples' rights, gender issues	**Importance**	☐	☐	☐	☐	☐	☐	☐

CRITERION NAME		NOT IMPORTANT / PRACTICAL AT ALL 1	2	3	4	5	EXTREMELY IMPORTANT / PRACTICAL 6	NO OPINION
10. Standard of living: Public service support in areas producing bioenergy, e.g. education, health, access to energy	**Importance**	☐	☐	☐	☐	☐	☐	☐
11. Property rights and rights of use: Land and resource tenure, dependencies on foreign sources (e.g. financial investments, knowledge) fair and equal division of proceeds, customary rights, freedom to choose best use for land	**Importance**	☐	☐	☐	☐	☐	☐	☐
12. Planning: Stating clear objectives, a management plan is written, implemented, and updated as necessary	**Importance**	☐	☐	☐	☐	☐	☐	☐
13. Monitoring of criteria performance: Monitoring systems in place for all criteria	**Importance**	☐	☐	☐	☐	☐	☐	☐
14. Support for research and development: Financial, technical, institutional support for advancing bioenergy knowledge	**Importance**	☐	☐	☐	☐	☐	☐	☐
15. Local nuisances: Project related visual, noise, or odor impacts, road use and upkeep	**Importance**	☐	☐	☐	☐	☐	☐	☐
Economic Criteria								
16. Employment generation: Number jobs created, quality of jobs created	**Importance**	☐	☐	☐	☐	☐	☐	☐
17. Microeconomic sustainability: Cost-efficiency incl. startup costs, internal rate of return, net present value, payback period	**Importance**	☐	☐	☐	☐	☐	☐	☐
18. Macroeconomic sustainability: Trade balances, foreign investments, financial flows across project boundary, changes in overall productivity, 'economic development'	**Importance**	☐	☐	☐	☐	☐	☐	☐
19. Economic development: Providing adequate marketing arrangements, material transport, assessment, implementation, financing, and management assistance	**Importance**	☐	☐	☐	☐	☐	☐	☐
20. Economic stability: Project lifetime, degree to which applied technology and operational aspects are proven, flexibility to changes in demand and supply, product diversification	**Importance**	☐	☐	☐	☐	☐	☐	☐

CRITERION NAME		NOT IMPORTANT / PRACTICAL AT ALL 1	2	3	4	5	EXTREMELY IMPORTANT / PRACTICAL 6	NO OPINION
Environmental Criteria								
21. Adaptation capacity to environmental hazards and climate change: Diversification of feedstocks, available knowledge on site demand of feedstocks	**Importance**	☐	☐	☐	☐	☐	☐	☐
22. Energy balance: Conversion efficiencies, energy return on investment, energy return per hectare	**Importance**	☐	☐	☐	☐	☐	☐	☐
23. Natural resource efficiency: Efficient use of resources at all stages of the system	**Importance**	☐	☐	☐	☐	☐	☐	☐
24. Species protection: Protection of rare, threatened, or endangered species	**Importance**	☐	☐	☐	☐	☐	☐	☐
25. Ecosystems protection: Safeguarding protected, threatened, representative, or other valuable ecosystems (e.g. forests)	**Importance**	☐	☐	☐	☐	☐	☐	☐
26. Ecosystems connectivity: Preventing land fragmentation, e.g. presence of wildlife corridors etc.	**Importance**	☐	☐	☐	☐	☐	☐	☐
27. Crop diversity: E.g. impacts and risks associated with monocultures like its impacts on landscape and wildlife, and its susceptibility to catastrophic failure, scale of monocultures	**Importance**	☐	☐	☐	☐	☐	☐	☐
28. Exotic species applications: Invasiveness, risks to other species and land uses	**Importance**	☐	☐	☐	☐	☐	☐	☐
29. Use of genetically modified organisms: Compliance with laws, risk to other land uses	**Importance**	☐	☐	☐	☐	☐	☐	☐
30. Use of chemicals, pest control, and fertilizer: Insecticides, herbicides, chemicals, in the conversion process, impacts on surrounding environment	**Importance**	☐	☐	☐	☐	☐	☐	☐

CRITERION NAME		NOT IMPORTANT / PRACTICAL AT ALL 1	2	3	4	5	EXTREMELY IMPORTANT / PRACTICAL 6	NO OPINION
31. Soil protection: Impacts on soil fertility like changes in nutrient cycling, rooting depth, organic matter, water holding capacity, erosion, and carbon storage	**Importance**	☐	☐	☐	☐	☐	☐	☐
32. Land use change: Impacts of land conversion on greenhouse gas emissions and other natural processes that could eventually affect ecological balances	**Importance**	☐	☐	☐	☐	☐	☐	☐
33. Water management: Surface and groundwater impacts, riparian buffers, irrigation and cooling cycles and waste water management	**Importance**	☐	☐	☐	☐	☐	☐	☐
34. Waste management: Disposal of ashes, sewage, hazardous/contaminated solid and liquid material	**Importance**	☐	☐	☐	☐	☐	☐	☐
35. Greenhouse gas balance: GHG balance of system covering CO_2, CH_4, O_3, NO_2, H_2O	**Importance**	☐	☐	☐	☐	☐	☐	☐
36. Potentially hazardous atmospheric emissions other than greenhouse gases: Emissions of SO_x, CO, NO_x, particulates, and other hazardous air pollutants	**Importance**	☐	☐	☐	☐	☐	☐	☐

Add missing criteria

If you missed any criteria, please describe and evaluate them below.

CRITERIA SUGGESTIONS:		NOT IMPORTANT / PRACTICAL AT ALL					EXTREMELY IMPORTANT / PRACTICAL	NO OPINION
CRITERION NAME		1	2	3	4	5	6	
	Importance	☐	☐	☐	☐	☐	☐	☐
	Importance	☐	☐	☐	☐	☐	☐	☐
	Importance	☐	☐	☐	☐	☐	☐	☐
	Importance	☐	☐	☐	☐	☐	☐	☐

Top five most important criteria

Please write down those **five** criteria which are the most important according to your opinion. **Indicate by using the number of the criteria from the list above.**

1. ___

2. ___

3. ___

4. ___

5. ___

General comments

Please provide any general comment to this survey here:

_____

_____

_____

_____

Thank you for your time!