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TASK 43

BIOMASS FEEDSTOCKS FOR ENERGY MARKETS

Final Proposal for Task Prolongation for the new triennium 2016-2018

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Prepared by:
Ioannis Dimitriou, candidate Task Leader 2016-2018
in collaboration with current Task Leaders, National Team Leaders, and associated experts

Task Prolongation Summary Sheet

Task Title: Biomass Feedstocks for Energy Markets

Task Leader
Ioannis Dimitriou, Swedish University of Agricultural Sciences, Sweden.
PO Box 7043, SE-756 51, UPPSALA, Visiting address: Ullsväg 16
Email: ioannis.dimitriou@slu.se; Phone: +46 18-672553, Mobile: +46 70 -247 45 83

WP Leaders
Göran Berndes (WP1)
Mark Brown (WP2)
Hans Langeveld (WP3)
Tat Smith (WP3)

Endorsement by ExCo Member of participating country
Country: Sweden, ExCo Member: Åsa Forsum, Signature:

Objective
The Task will address issues critical to mobilizing sustainable bioenergy supply chains, including all aspects of feedstock production, its markets and environmental, social and economic impacts. The objective is to promote sound bioenergy development that is driven by well-informed decisions by land owners, businesses, governments and others. This will be achieved by collecting, analysing, and sharing technical and non-technical information related to biomass feedstock supply and providing relevant actors with timely and topical analyses, syntheses and information.

Work scope
The Task has a global scope and includes commercial, near-commercial and promising feedstock production systems in agriculture and forestry. The primary focus is on land use and land management of biomass production systems. The work program builds upon the work done in the 2013-2015 triennium where the Task has established several activities that address key questions of high relevance to the land use and energy sectors. The Task will seek new opportunities for collaboration with other Tasks as well as organizations outside IEA Bioenergy. The Task will also interact with other research networks and programmes that have workplans in the same areas.

Work Programme
- Studies integrating several disciplines will be conducted to analyze trade-offs, compatibility and synergies between food, fibre and energy production systems and the bio-economy.
- The Work Programme is organized in three WPs that are each organized in a set of Task Activities. Research priorities include Landscape management and design for bioenergy and the bio-economy (WP1); Developing effective supply chains for sustainable bioenergy deployment (WP2); Governance of bioenergy supply chains (WP3).
- Task workshops and meetings inclusive of the different WPs and international events will be arranged to address key questions for the Task.
- The Task intends to participate in three strategic inter-Task projects that has been proposed for the coming 2016-2018 triennium.

- The Task intends to continue collaboration with organisations that has taken place during the current triennium and will seek new collaboration where appropriate.

Deliverables
The Task will produce and provide timely and policy-relevant information to targeted audiences, arrange Task-specific events, contribute to important workshops and conferences, and engage in processes that are identified as important in shaping the conditions for biomass feedstock production. Scientific publications, policy-relevant reviews, case studies and science and technology briefs on a variety of topics will be published and presented throughout the triennium.

Management and annual budget
The Task leader will together with the WP Leaders to manage work of the Task. Budget, time lines and participant responsibilities will be clearly defined. A Steering Committee, consisting of the Task Leader, WP Leaders and the National Team Leaders (NTLs), will be responsible for reviewing progress and making overall priorities. Each NTL will form a national team of experts that supports the NTL in making national contributions to the collaboration. Other associated experts will also be involved.

The annual cost per participating country is proposed to be set to US$ 15 000. The Task budget is based on 12 participants, with 10% of country contributions set-aside to the strategic fund managed by ExCo. An expected positive balance from 2015 has been reserved for Task participation in inter-Task projects and a larger workshop planned for 2016.

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Task 43 - Biomass Feedstocks for Energy Markets

Background

One important basis for the 2013-2015-work plan in Task 43 was the recognition that ***biomass production in agriculture and forestry will have to increase tremendously*** in order to provide feedstock for a bioenergy sector of a size reported by studies that model global energy system pathways towards meeting existing energy and climate targets. It was further recognized that organic post-consumer waste and residues and by-products from the agricultural and forest industries can make important contributions but will not suffice to meet these anticipated levels of longer-term biomass demand. Dedicated biomass production systems for energy will be needed.

It was noted in the prolongation proposal for 2013-2015 that polarized views on impacts, benefits and priorities for bioenergy-food-fibre-environment values seemed to gradually give way to more nuanced and holistic considerations, and it was expected that this development would make it easier to move beyond polarized debates to address the bigger, more pertinent question about how the increasing demands for food, fibre *and* bioenergy can be met in the future. Task 43 consequently established as a central part of its work to ***investigate and communicate how dedicated biomass production systems can be expanded and how needed amounts of biomass for energy can be sustainably produced***.

The Task formulated plans for activities to promote sound bioenergy development driven by well-informed decisions in business, governments and elsewhere. Many Task activities supported the inter-Task project "Mobilising sustainable bioenergy supply chains" that focussed on feedstocks and supply chains with considerable global potential. Central to this work has been an effort to create competitive business cases that are efficient along the entire supply chain and to promote a holistic perspective on bioenergy and land use encompassing all three dimensions of sustainable systems. Work plans were established to address a number of critical questions:

- how to overcome technical, economic and policy barriers to mobilisation of existing and new biomass resources;
- how to mitigate negative impacts and avoid irreversible degradation of ecosystems and essential resources such as soil, water and biodiversity;
- how to integrate new bioenergy feedstock production systems into agricultural and forestry landscapes in ways that promotes environmental, social and economic sustainability of the overall agricultural and forestry production; and,
- how to develop governance models that provide sound operating conditions for the agriculture and forestry sectors, and also properly address concerns about various risks associated with bioenergy.

Regrettably, the expectations about more favourable conditions for rational deployment of sustainable bioenergy systems have not yet been met. During the 2013-2015 period, there

was continuous animated scientific, societal and political discussion concerning potential impacts of bioenergy on sustainable development. Opponents have continuously raised concerns over multiple risks, e.g., potential disruption to food security, raw material markets and rural livelihoods, greenhouse gas (GHG) emissions and ecological impacts associated with land use change (LUC), and displacement of small-scale farmers. Proponents on the other hand have pointed at opportunities for new land use options and benefits such as employment creation, climate change mitigation, and reduced dependency on fossil fuels. There are diverging views on how bioenergy systems should be evaluated relative to specific objectives, on the appropriateness of baseline assumptions, and on the effectiveness of the plethora of regulations in guiding bioenergy development towards better fulfilment of the objectives.

Policy makers are faced with striking the proper balance between energy security, social and economic development, and environmental quality goals. This is a challenge fraught with uncertainties and the risks embedded in these uncertainties can be large. Ambitions in the bioenergy area have been reformulated and governance of bioenergy has increasingly focused attention on risks as opposed to mitigation opportunities. Experience of some supporting instruments to boost bioenergy that were not designed so as to respond to changing conditions (e.g., biofuel mandates) has also resulted in policymakers looking for more dynamic instruments.

The promotion of sustainable land use and management through regulations, best practice guidelines and principles of adaptive landscape management has partly become overshadowed by emerging sustainability standards and certification systems. Emerging regulations of agriculture and forestry – as defined via sustainability requirements on bioenergy – do not necessarily harmonize with established principles and practice of sustainable management to meet the demand from multiple markets. This is partly due to application of international sustainability requirements that cannot easily be made operational across national borders, due to incompatible policies, concepts, definitions, and conditions.

In some cases regulations and incentive structures appear to have been informed by paradigms and analytical frameworks that serve policymakers' needs for quantification (e.g., LCA and carbon accounting) and rely less on advice from the agriculture and forestry disciplines that likely have better knowledge and experience in land use and land management issues - including the motivations of land owners and other stakeholders influencing land use. One example of this is the idea to exclude biofuels produced from “roundwood”, which reflects the need for easy-to-communicate policy responses in a situation where certain analytical frameworks and simplistic messages dominate the debate, rather than science-based understanding of how actors involved with forest bioenergy production in particular, and the forest sector in general, respond to this type of regulation. Policy development may in this regard have been influenced by an unfortunate disciplinary asymmetry in the science-policy interaction.

Thanks to the broad objectives – to promote sound bioenergy development that is driven by well-informed decisions in business, governments and elsewhere – and the flexible work plan, it has been possible for Task 43 to engage in the evolving debate and to contribute research results, data, and information drawing on the agriculture and forestry expertise in the Task. For example, Task 43 has together with Task 38 and Task 40 arranged and contributed to several events and publications with the aim of supporting well-informed decisions in business, governments and elsewhere. It is our expectation that the 2016-2018-triennium will

also see animated debates and over-simplified messages. The Task aims to continuously offer science-based information and alternative perspectives to balance polarized assertions (negative and positive) about bioenergy systems, in general, and feedstock production in agriculture and forestry, in particular.

Task objective and work scope

The overarching objective of Task 43 is to support sound bioenergy development that is driven by well-informed decisions in the forestry, agriculture and energy sectors as well as in investment institutions, government agencies and elsewhere. It will address critical issues regarding deployment of sustainable biomass and bioenergy supply chains, including social, economic and environmental outcomes of feedstock production and supply.

The Task 43 National Team Leaders (NTLs) and associated experts identified three critical elements necessary to achieve the overarching objectives, which are organized in three inter-connected WPs. Each WP has specific objectives that are described in the following Work Programme. The three WPs are:

- WP1: Landscape management and design for bioenergy and the bio-economy
- WP2: Developing effective supply chains for sustainable bioenergy deployment
- WP3: Governing land use and bioenergy supply chains

The proposed Task is a prolongation of the present Task 43. Considerable efforts will be put into further identifying and developing strategies to overcome the critical barriers identified in the inter-Task Strategic Project "Mobilising sustainable bioenergy supply chains", with focus being on "ways forward". It will have a global scope and include commercial, near-commercial and promising systems in forestry and agriculture, including dedicated feedstock production systems as well as systems providing residues and organic waste, which will be addressed at global, national and local scales. It encompasses all aspects of land based bioenergy supply chains.

In this context, The Task will focus on relevant social, economic and environmental aspects, including synergies and trade-offs in situations where there are conflicting objectives. The Task intend to collaborate with other Tasks and organizations (e.g. UNEP, GBEP, JRC, EEA) to achieve the overall Task objective and the specific objectives within the Work Programme.

Work Programme

The work programme presented below is the result of a collaborative activity initiated in October 2014 and engaging all current Task 43 NTLs and associated experts to jointly produce a work plan that reflects the priorities and planned activities in presently participating countries in the coming years.

The three WPs represent the main elements to achieve the general Task objectives. Specific focus areas and associated work and activities have been outlined within each WP. Topics addressed are critical for deployment of sustainable biomass supply chains and many are relevant for more than one WP as examplified in Figure 1. The Task also expect to engage in other activities addressing possible emerging issues, i.e., concerns and developments that

were not foreseen when preparing this prolongation proposal. A more detailed description for each of the different WPs with the specific aims, methodology and activities is presented below, with specific deliverables, time line (Gantt chart) and estimated budgets in subsequent sections. Towards the end of the document, the planned Task workshops and inter-Task cooperation are also presented.

The Task will arrange several events each year with one major workshop per year forming the backbone in the Work Programme. These annual workshops will provide ample room for presentations and discussion of results obtained. Other experts will be invited to take part in open calls for contributions. Steering Committee and work meetings will provide opportunity for coordination of on-going work between WPs, and planning of the further work for the Task overall. Publications will be produced to further disseminate workshop contributions. Also other outreach methods will be used, including webinars and twitter.

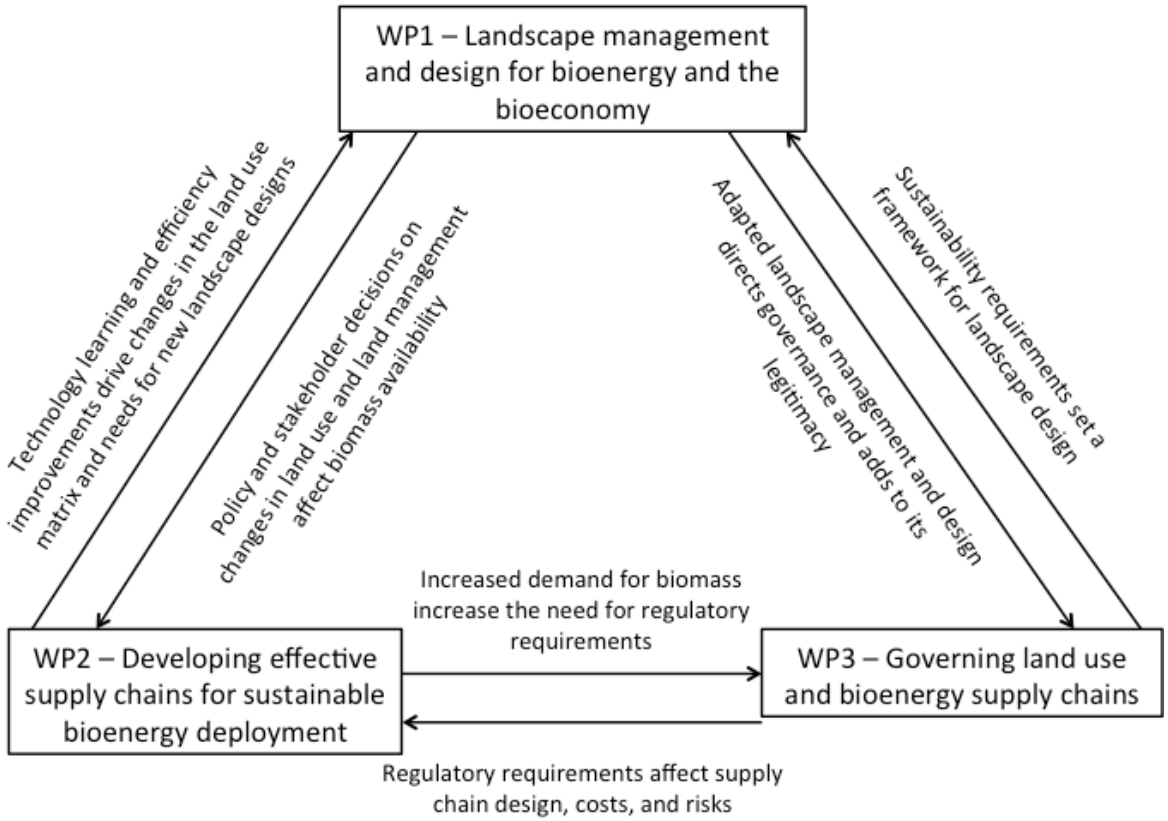

Figure 1. Interconnections between the three WPs in the proposed Task 43 Work Programme

WP1 - Landscape management and design for bioenergy and the bio-economy

Bioenergy implementation requires strategies for efficient use of biomass from sustainably managed landscapes. Formulating such strategies requires knowledge in how landscape management and land use decisions affect biodiversity and the capacity of ecosystems to provide biomass and other ecosystem services. In human-influenced landscapes, analyses need to consider both historical and current land use since today's landscape is shaped by

past practices. Biodiversity preservation may require mimicking natural ecosystems as well as historic land use features in current landscapes.

WP1 aims at supporting landscape management and design for bioenergy and the bio-economy, by expanding the knowledge base required for sustainable expansion of biomass production systems that also contribute positively to biodiversity and the generation of other ecosystem services.

The work takes a landscape level approach to deployment of biomass production for bioenergy and integration of this objective with ownership and societal objectives for existing land use and associated systems. The framework shown in Figure 2 is an example of approaches to multi-stakeholder landscape management and design that will be explored in this WP. The focus is on major land-based biomass production systems for bioenergy and other bio-based products, including (i) cropping systems such as willow and poplar short rotation coppice, poplar and oil mallee tree plantations, and grasses (e.g., reed canary grass, switchgrass, Miscanthus); (ii) agriculture by-products such as stover, straw and dung; and (iii) forest biomass including whole trees, logging residues and other by-flows associated with forest management operations. Other biomass production systems, which are currently not common but have shown potential for wider implementation, may also be considered.The work will be conducted in close interaction with WP2 and WP3 in order to enhance and leverage existing and planned multi-disciplinary research activities.

The WP activities address the below overarching questions, which are relevant for both agricultural and forestry systems and reflect that agriculture and forestry activities often co-exist and shape the landscape together.

- Which are the most suitable areas for production and/or extraction of various biomass feedstocks?
- How can biomass feedstock production systems be located, designed and managed to increase resource use efficiency, avoid/mitigate negative and promote positive environmental, economic, and social effects?
- How can outcomes be optimised to meet the goals of individual stakeholders and society as a whole, including environmental, economic, and social goals?
- How can analysis and assessment inform participatory processes engaging land owners, policy makers, and other stakeholders in further developing and re-defining goals and plans for landscape management and designs?

Specific projects and case studies with Task involvement provide an important basis for the work in this WP (See Appendix A). Data will be gathered across scales and sustainability dimensions. This includes available datasets from commercial and research operations for selected feedstocks or landscapes. The consequences of different feedstock-related alternatives will be quantified, analysed and evaluated with regard to effects on stakeholder economy, management systems, social conditions, and various ecosystem services. Data from experimental plots and/or modelling will be used to assess the potential of bioenergy feedstock production systems, which are currently not common.

The analysed feedstock systems and landscapes will be compared with each other and with relevant reference systems, e.g., cultivation of conventional food/feed crops and forest management to produce saw timber and pulpwood. It is expected that the feedstock alternatives, their location in the landscape, and the needed management systems will vary in

how they perform relative to different stakeholder objectives (e.g., biomass yields, economy, nutrient use efficiency, energy efficiency, water quality, soil quality, biodiversity and GHG balances). Comparison with stakeholders' preferences, existing guidelines and regulations will help clarify benefits and trade-offs related to choices and alternatives.

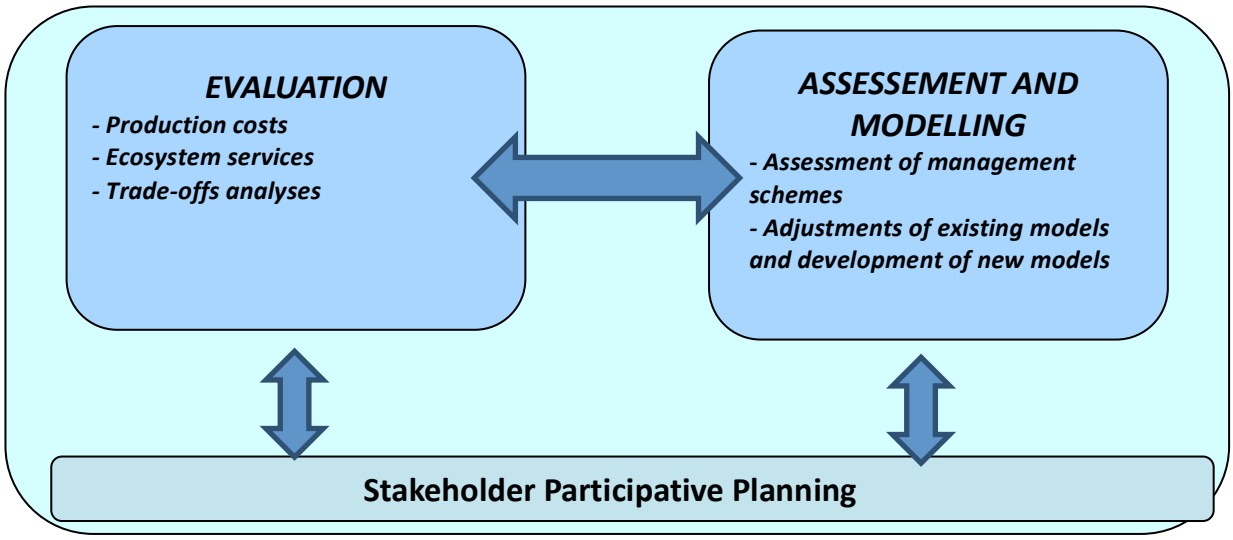

Figure 2. General methodological framework for landscape management and design for bioenergy and the bio-economy. In the first step, production costs and influence on ecosystem services and value need to be assessed and potential synergies and trade-offs analysed. In a second step, different management alternatives to optimise outcomes relative to multiple stakeholder goals are assessed based on quantified effects of these alternatives on yields, economy, social conditions, and ecosystem services. The results are presented and discussed at stakeholder meetings held at different stages in the process.

WP2 – Developing effective supply chains for sustainable bioenergy deployment

Achieving deployment of competitive biomass supply chains requires the effective application of technology and systems to provide improved integration, increased efficiency and reduced supply chain costs. The technologies and systems need to be properly planned, managed and deployed to deliver the varying qualities and characteristics required for efficient conversion to a range of different bioenergy and other bio-products. This requires good understanding of the roles of actors along supply chains and their capabilities to address economic, environmental and social risks related to the competitive deployment of bioenergy systems.

The aim of this WP is to identify opportunities, strategies and practices for improved supply chains and supply chain technology to support large-scale bioenergy deployment.

WP2 will synthesize and advance state-of-the-art knowledge on biomass supply chains to increase understanding, development and deployment of effective, efficient and sustainable biomass production, harvest, and delivery options. The roles of technologies and of logistics and other management aspects will be analysed in varying regulatory and policy contexts. Particular attention will be given to integration and interaction between biomass supply chains and the operating and regulatory environment in which they are set, and how that

impacts the efficient, sustainable production and use of the biomass resource. The WP is organized around four main activities:

Activity 2.1: Biomass resource assessment and system mapping
This activity will develop on-the-ground operational supply chain knowledge, including environmental and techno-economic aspects that can support modelling to estimate implementation potentials. It is important to consider resource type, availability and costs; genetic and management options for improving quality and productivity; the interface between biomass characteristics and the various requirements of biomass conversion technologies; and influence of bioproducts produced along with bioenergy. This Activity will explore how supply chains would need to be adapted to variations in biomass characteristics and seasonality so as to meet different and potentially variable demands, for example through the development of biomass terminals/depots. Ensuring the range of biomass qualities and characteristics that will be required for efficient energy production will require close collaboration with both conversion technology and crosscutting Tasks.

Activity 2.2: Technology learning and systems mapping
Learning curves can describe how biomass procurement cost evolves as production and experience increase. Improved efficiency is an outcome of technology innovation resulting in improved understanding and systematic planning and management of biomass sourcing and supply. This Activity will seek to better understand how technology learning applies to bioenergy supply chains and to identify effective strategies to transfer technology learning from existing efficient supply chains to new supply chains, including niche applications in emerging bioenergy markets. Technology-explicit investigations will be made to understand how the respective technology and supply chains can effectively respond to changing conditions and requirements. Moreover, this Activity intends to map and analyse supply chains for varying regulative and policy context conditions, to understand the impact of certain policy scenarios on supply chain efficiencies. The results will usefully inform ongoing policy and regulation evolution.

Activity 2.3: Integration of natural resources and energy systems
Bioenergy systems may be combined with other renewable energy systems to provide reliable energy supplies. Intermittent energy technologies such as wind and solar PV require balancing of electricity supply, and bioenergy can be an effective alternative that in some locations may be more attractive than other alternatives such as hydro, fossil fuels with/without CCS, and nuclear. This activity will explore the supply chains required to integrate bioenergy into hybrid systems providing balancing power. Moreover, potential interfaces between biomass sectors and other natural resource sectors will be explored in order to identify and analyse opportunities for GHG emissions mitigation; to increase biomass use in industrial processes and to use marginal, cleared or reclaimed areas for biomass feedstock production within the context of effective landscape management and policies. This activity will be linked to collaboration with Task 38.

Activity 2.4: Integration of biomass supply chains with existing forest and agricultural supply chains.
Biomass harvest for bioenergy is often done as a separate operation to biomass harvest for the production conventional forest and agricultural products, and may use different technology and supply chains. This segregation can be viable while demand for residual biomasses fluctuates greatly between years and may not be utilized. With demand for biomass expected to increase as the bio-economy develops, increased integration of biomass-to-energy chains

with traditional forest and agricultural supply chains may deliver reduction in costs, energy use, etc. Such integration could require sophisticated planning and logistics including terminals for separation of products to serve the needs of many different bio-based industries, including the existing forest, agriculture and energy industries as well as emerging bio-refining and biochemical industries. The development of such planning/logistic systems for biomass supply chains may create opportunities for integration across industry supply chains that improve the opportunity to recover biomass from other sources like manufacturing and waste industries. This level of supply chain integration will require the development and adaptation of novel systems and technology allowing equipment to effectively deal with different forest, agriculture and biomass products. The activity will examine the efficiencies and costs of planning/logistics systems for a variety of feedstocks and conversion configurations

WP3 - Governing land use and bioenergy supply chains

Decision makers and stakeholders are looking for options which may increase biomass production for bioenergy and the bio-economy while also enhancing other ecosystem services, or at least avoiding or mitigating negative impacts on ecosystem capacity to provide such services. Addressing GHG balances and climate effects of land use, land-use change and forestry (LULUCF) is one key concern. At the same time climate change affects landscape management and biomass production by altering production conditions and possibly by increasing the frequency of severe ecosystem perturbations (e.g., storms, insect infestations, fire). Management activities associated with prevention, mitigation and recovery give rise to opportunities and challenges for bioenergy. Ecosystem disturbance, climate change adaptation and related management are rarely addressed in governance of bioenergy supply chains.

In this environment, public and private regulations are being developed that challenge private and public actors to identify and make a number of trade-offs among environmental, social, economic and cultural benefits and impacts.

WP3 aims to identify how public or private regulatory systems governing land use and bioenergy supply chains can be improved in terms of abilities to monitor, assess and promote achievement of economic, social, and environmental goals while considering the perspectives of land owners, biomass users, and society as a whole. WP3 will examine the interactions among governance, bioenergy supply chain deployment and climate change.

Regulatory systems are understood broadly to include a range of systems from international conventions and law, to national, regional and local policies, programs, legislation at all levels, and further on to certification and standards compliance, best management practices and business policies. WP3 takes a starting point in previous and on-going work within Task 43 and other Tasks, including field research, modelling, reviews, syntheses of scientific knowledge, assessments of existing and emerging governance systems, and surveys to determine the views and experiences of different stakeholder groups with sustainability governance. Workshops will be arranged to foster broad interdisciplinary collaboration with colleagues, other Tasks and organizations that conduct research and in other ways contribute development of these topics. The sustainability framework for this collaborative research is comprehensive and considers social, economic and environmental values. The work intends to inform development of governance from local to international levels.

Activity 3.1: Governance to support sustainability goals at multiple scales

This Activity will provide science-based information to inform policy decisions and collaborative efforts on developing governance systems for integrated landscape management associated with bioenergy systems. Sustainability criteria in agriculture and forestry are relatively well established and seem to be converging, for example in systems that address sustainable forest management, bio-liquids (due to the EU Renewable Energy Directive), and solid biofuels (e.g., resulting from collaboration among European energy producers). However, some systems are still in their initial phase of development, and integration to address the landscape level is poor. WP3 will examine how governance may support or hinder such integration, including effectiveness and efficiency in identifying benefits and making tradeoffs among economic, social and environmental issues when making choices about locations, types of feedstock, transport, refining and distribution of bioenergy products and services.

Activity 3.2: Effectiveness and efficiency of sustainability governance

Several studies exist which benchmark sustainability requirements of different governance initiatives, but fewer studies address effectiveness and efficiency of these systems relative to sustainability goals. The activity will examine procedural rules, auditing, and other sanctions and control measures (Fig. 3), data availability and quality, costs, benefits, and effectiveness in achieving economic, social, and environmental goals on-the-ground. The work will explore how approaches to stakeholder involvement may be related to results including public acceptance and effectiveness on-the-ground. The role of governance in selected bioenergy success stories will be analysed. Part of the work in this Activity will contribute to the inter-Task projects 'Measuring, governing and implementing sustainable bioenergy' and 'Bioenergy success stories', and collaboration with social scientists will be further developed.

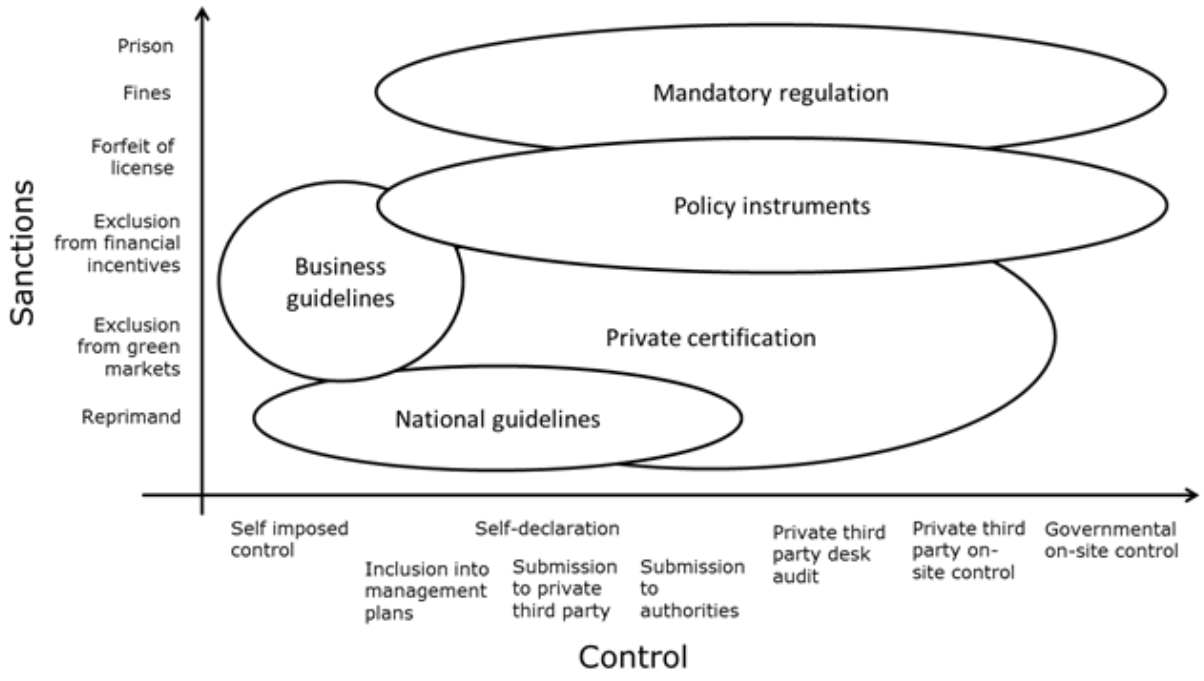

Figure 3. 'The Enforcement Space' as defined by the combination of the applied types of control measures and sanctions.

Activity 3.3: Governance to guide management of forests and other ecosystems affected by disturbances.

Management of forests and other ecosystems affected by disturbances (e.g., large scale wildfires, storm fellings, pest outbreaks, droughts) often involve biomass harvest, burning or both; one example is salvage logging. Also climate change adaptation and measures to prevent/reduce risk or intensity of future disturbances can include opportunities for biomass extraction, e.g., silviculture measures in forests to reduce fire risk and severity. This activity will address governance issues related to such management, including criteria and indicators that might be developed. Addressing this question is considered increasingly important as climate change might increase the frequency of ecosystem disturbances.

Activity 3.4: Advancement and assessment of governance addressing LUC impacts.

The work aims to support an improved knowledge basis for developing governance addressing LUC impacts and to identify opportunities to expand bioenergy within the context of current land use in the agriculture and forestry sectors. Existing policies and regulations for mitigation or prevention of unwanted (direct and indirect) LUC will be assessed, including promotion of so-called 'low indirect impact' biofuels (e.g., biomass plantations on degraded lands and promotion of sustainable land use intensification to "make room" for bioenergy cropping), or of other bioenergy feedstocks with low risk of causing unwanted LUC. Finally, the linkage between specific policy instruments and resource availability will be analysed, including policies serving near term GHG targets and cascading concepts that limit bioenergy feedstock resources to materials that have served other functions before being used for energy.

Activity 3.5: GHG balances and climate effects of LULUCF activities associated with biomass and bioenergy systems.

This activity will address methodologies for quantification of GHG balances and climate effects (e.g., albedo) associated with LULUCF. Existing methodologies used in, e.g., legislation and certification will be assessed and quantification methodologies for bioenergy (including hybrid systems) and other end-uses compared. Options for harmonizing input and output data and methods to define reference cases will be investigated. GHG balances and other climate effects of bioenergy feedstock production will be compared with those for land uses and management for other objectives such as food production and nature preservation.

Activity 3.6: Other topics that relates to governance of land use and bioenergy

Task 43 intends to contribute to a number of additional topics related to governance of land use and bioenergy, for example:

- Development and update of *best practice guidelines* for bioenergy feedstock production, and local and global bioenergy supply chains, to suggest how cost-effective metrics can be developed and applied to measure outcomes of interest.
- Facilitation of efficient *communication and information exchange* among different actors in the bioenergy supply chain, to support a positive role of governance in the sustainable deployment of bioenergy rather than unintentionally counteracting such goals.
- Deployment of tools that effectively enable *visualization of outcomes of complex assessments* that can for example be accessed via the web.

Emerging issues

Given that Task 43 works within a dynamic area undergoing rapid change, it is essential to have a significant degree of flexibility and capacity to respond constructively to unforeseen developments. Experience from the current triennium provides good arguments for developing a flexible work plan in the next triennium: several publications as well as workshops and seminars that have been arranged during the current triennium (several in collaboration with other Tasks) were not planned in the beginning of the triennium but were initiated in response to developments taking place within areas where Task 43 has expertise. This flexibility and ability to mobilise capacity to respond promptly to arising demands has helped the Task to establish a position in relation to important processes and to influence the conditions for bioenergy feedstock production.

We expect that emerging activities will be readily incorporated within the previously listed WPs in order to allow a more structured formation of the work, but focus will be formulated over time so as to reflect emerging science and the bioenergy agendas in the countries participating in the Task, as well as international developments. It is anticipated that many of these will be inter-WP activities, aiming to proactively identify areas where science-based deliverables can be useful to inform policy, action, and bioenergy market development.

Ad hoc groups will be established within the Task that will be able to respond promptly to demands from ExCo or other key international organisations. The ad hoc groups can also provide expert scientific and technical review of relevant reports and proposals, as appropriate. To achieve this, regular coordination using on-line meetings will take place where Task participants can share information of recent developments and agree on appropriate Task actions. The Task Steering Committee will make decisions in regular and ad hoc meetings on priorities for allocation of T43 funding to such upcoming activities.

Deliverables

As shown in the Gantt chart in Annex 3, deliverables D1-D6 include Task business meetings, workshops, workshop reports, and reporting to ExCo. All three WPs contribute to these deliverables. Deliverables D7-D19 are topics for publications and other dissemination associated with specific WPs. Each deliverable can consist of one or several items (e.g., Task report and special issue collecting multiple contributions to a workshop). The deliverables list does not include all deliverables that are associated with inter-Task projects, nor all publications intended for scientific journals and conferences.

WP1

- D7. State-of-the-art in sustainable landscape management and design
- D8. Atlas of attractive systems for bioenergy feedstock production in sustainably managed landscapes
- D9. Application of landscape management and design approach to assess and promote sustainability of established and promising bioenergy systems

WP2

- D10. EU-RED influence on international biomass supply chains.
- D11. Challenges and benefits of supply chain integration across agriculture and forestry.

- D12. Learning from the best supply chains and making them better.
- D13. The role of supply chains in financing bioenergy.
- D14. Systems for improved supply chain performance and flexibility.
- D15. Efficient woody biomass supply within multi-forest product supply chains.

WP3

- D16. Governance to support sustainability goals at multiple scales.
- D17. Effectiveness and efficiency of sustainability governance
- D18. Governance to guide management of forests and other ecosystems affected by disturbances.
- D19. Governance addressing direct and indirect LUC impacts.
- D20. Quantification of GHG balances and climate effects of LULUCF activities associated with biomass and bioenergy systems

Task management and meetings

The Task Leader has the overall responsibility for budget and coordination of activities and deliverables in the Work Programme presented above. The WP leaders will support the Task Leader and will be well-informed about all Task activities to ensure robustness and coherence. WP Leaders will manage WP budgets and coordinate WP activities and associated deliverables.

Task Activity Teams will develop more detailed work plans and will organize and carry out the work. Collaboration with other networks and activities (i.e., national research projects) will be pursued when beneficial for achieving the final objectives. Teams will also be formed to contribute in inter-Task projects, with one individual appointed responsible for coordination with the Task Leader and WP leaders.

The Task Leader and WP Leaders will together with the NTLs constitute the Steering Committee that will approve plans and budgets associated with events as well as WP budgets and work plans proposed by Task Activity Teams. They will also review progress, and accounts and budgets at all levels at business meetings and in more frequent online conference calls.

The Task will arrange annual Task 43 workshops and a number of focused and/or collaborative workshops. Two business meetings per year and regular phone/skype/webinar meetings will be organized to facilitate coordination of Task activities and information exchange concerning relevant developments in science, markets and policy.

The annual Task 43 workshops will feature a specific national or regional context that concretely exemplifies the opportunities and barriers experienced in specific landscapes with specific supply chains and actors involved. The workshops will solicit invited and volunteer papers leading to Task reports and peer- reviewed journal publications. Besides making room for presentations relating to the specific context, the annual Task workshops will provide opportunity for Task participants to present and discuss work taking place within the WPs, which is critical for coordination between WPs and planning of the further work. The Task also plans to co-organise events as part of executing research projects associated with a certain Task activity. These events may not always gather all Task NTLs but primarily those that are involved in the specific activity.

Table 1. Overview of planned Task events. Additional meetings will be arranged in association with inter-Task projects.

Suggested date	Potential content of event	Parties involved and planned location
Q1 - 2016	- Task 43 kick-off meeting	T43. Location: Sweden or Belgium
April 2016	- Annual workshop and field tour focused on landscape designs and innovations supporting deployment of a sustainable bio-economy - Task business meeting	T43, T83, Oak Ridge National Lab, Argonne, NREL, INL. Location: SE USA
Q3/Q4 - 2016	- Workshop/event at conference - Task business meeting	Tbd
Q1/Q2 - 2017	- Workshop/event at conference - Task business meeting	Tbd
Nov 2017	- Annual workshop and field tour - Task business meeting	T43, Bioenergy Australia. Location: East Australia
Q1/Q2 - 2018	- Annual workshop and field tour - Task business meeting	T43, BioFuelNet/Canadian Council of Forest Ministers and the Canadian Institute of Forestry (tbd). Location: Canada*
Q4 - 2018	- Workshop/event at conference - Task business meeting	In conjunction with the IEA Bioenergy Conference 2018

* The location of the first Task 43 meeting in 2018 depends on where the IEA Bioenergy Conference 2018 will be located. If this conference will be placed in Canada, then the first Task 43 in 2018 will likely be placed elsewhere.

Collaboration with other Tasks

Collaboration with other Tasks will occur through engagement in inter-Task projects and also associated with specific WP activities and joint workshops addressing issues of importance for several Tasks.

Presently, three draft proposals for inter-Task projects have been circulated where Task 43 is involved:

- Fuel pretreatment of biomass residues in the supply chain for thermal conversion. Coordinators: Jaap Koppejan and Marcel Cremers, Task 32
- Bioenergy success stories. Coordinator: Uwe Fritsche, Task 40
- Measuring, governing and implementing sustainable bioenergy. Coordinator: Martin Junginger, Task 40

In addition to these inter-Task projects, the Task has confirmed an intention to collaborate with other Tasks on the following topics:

- Forest-based bioenergy systems: carbon dynamics and GHG fluxes in forest biomass and soils, and forest products (Task 38 andTask 40)
- Improving methodologies for assessing GHG emissions from LULUCF (Task 38 and Task 40)
- Integrated landscape management for bioenergy and the bio-economy - joint study tour in SE US, April 2016 (Task 38)
- GHG balances of hybrid systems with bioenergy (Task 38)
- Matching feedstock quality with conversion technology requirements (Task 39)

Collaboration with other organizations, networks and industry

Building on the work in the current triennium, the Task will seek to continue effective and productive collaboration with organisations working in areas relevant for the Task. These organizations often have an informative role in relation to governments, industry, users, and other parties that play a role in the development for feedstock supply systems and their markets. The Task will also seek collaboration with new organizations as appropriate, with present and intended future collaborations being tentatively listed below.

- Global Bioenergy Partnership (GBEP) Activity Group 6 “Bioenergy and Water”
- Other implementing agreements within IEA
- United Nations Environment Programme (UNEP)
- Food and Agriculture Organization (FAO)
- The UN Sustainable Energy for All Initiative
- IRENA

This list does not include universities and research institutes that Task 43 will be associated with as Task participants engage in various networks and research programmes. Task 43 NTLs have identified existing and planned research networks and programmes that have work plans in the same areas as Task 43 and where collaboration consequently can result in synergy benefits including stronger outreach. The identified research networks and programmes are listed in Annex 1. The list will be updated when useful, and serve as a basis for developing collaboration throughout the triennium.

Communication and outreach

The aim of the Task 43 dissemination strategy is to ensure that the knowledge and information produced by the Task is effectively communicated to relevant target groups, including policy makers and policy advisors, industry in all relevant sectors, and the general public. The planning of the deliverables as outlined in the work plan and meeting schedule – including identification of target groups – will take place in dialogue with the collaborating other Tasks and organizations, as appropriate, and with the ExCo. The intention is to align the Task dissemination strategy with the new strategy developed by the ExCo communications group.

The Task also has high ambitions concerning scientific publishing and communication with the scientific community. Special Issue publications, individual scientific papers, and conference presentations will be high priority. The build-up of scientific dissemination

channels that started during this triennium will continue in the next triennium. The two journals *WIREs - Energy & Environment* and *Biofuels, Bioproducts & Biorefining* will, as in the present triennium, be important outlets for the Task. Alternative fast-track routes for scientific publications, such as on-line journals, will be investigated as a complement to the conventional approach of publishing articles in traditional print journals.

Budget

The annual cost per participating country is proposed to be set to US$ 15 000. The Task budget is based on 12 participating countries, with 10% of country contributions set-aside to the strategic fund managed by ExCo. An expected positive balance for 2015 has been reserved for Task participation in inter-Task projects. 40 000 US$ that was reserved for a workshop planned to take place in October/November 2015, is withheld from the Task budget with the intention to cover costs for arranging the workshop in 2016 instead.

A fixed sum is allocated to cover travel expenses associated with Task management. If the Task Leader will not be able to participate in an ExCo meeting, part of this sum can be used to cover travel and accommodation costs for a replacement person from the Task. Funding from alternative sources will be sought to cover Task management costs.

Budget allocated to WP activities concerns costs for work time of individuals contributing to activities in the respective WPs. There is also a budget for addressing emerging issues, as described in the Work Programme.

The budget for workshops, seminars and other meetings includes costs for venue, equipment and consumables not covered by fees, and travel and accommodation costs for selected invited participants. Included is also production of supporting material before the event.

Costs for publication includes production and dissemination of Task publications including outcome publications from workshops, special issues in peer-review journals, Task reports and policy briefs. When appropriate, Task publications will be printed and distributed to relevant parties. However, most publications will be distributed electronically to keep down costs.

Category	Budget 2016	Budget 2017	Budget 2018
In	**(US$)**	**(US$)**	**(US$)**
Contributions of Member Countries	180000	180000	180000
Contribution to Strategic Funds and TC	-18000	-18000	-18000
Positive balance from previous year	60000	46000	24000
Total in (budget)	**222000**	**208000**	**186000**
Out			
Task Management	**12000**	**12000**	**12000**
Travel and Subsistence	12000	12000	12000
WP Activities	**88000**	**96000**	**86000**
WP1	25000	25000	25000
WP2	28000	36000	26000
WP3	30000	30000	30000

Emerging issues	5000	5000	5000
Other costs	**76000**	**76000**	**87000**
Workshops, seminars and other meetings	33000	33000	40000
Task contribution to Inter-Task projects	20000	20000	20000
Publications	11000	11000	15000
Task secretary, web management, outreach	12000	12000	12000
Total out	**176000**	**184000**	**185000**
Balance	**46000**	**24000**	**1000**

Contact information of the Task management

Operating Agent

Name: Åsa Forsum
Organization: Swedish Energy Agency

Task Leader

Name: Ioannis Dimitriou
Organisation: Swedish University of Agricultural Sciences
Address: Ullsväg 16, PO Box 7043, SE-756 51, Uppsala, Sweden
E-mail: ioannis.dimitriou@slu.se, Phone: +46 (0) 18 67 25 53, Fax: +46 (0) 18 67 28 90

WP Leaders

Name: Göran Berndes
Organisation: Department of Energy and Environment, Chalmers University of Technology
Address:, SE-412 96 Göteborg, Sweden
E-mail: goran.berndes@chalmers.se, Phone: +46 (0)31 772 3148, Fax: +46 (0)31 772 3150

Name: Mark Brown
Organisation: University of the Sunshine Coast
Address: 90 Sippy Downs Drive, Sippy Downs QLD 4556, Australia
E-mail: mbrown2@usc.edu.au, Phone: +61 7 5459 4483

Name: Hans Langeveld
Organisation: Bioenergy Research
Address:
E-mail: hans@biomassresearch.eu, Phone: +31 6 52 05 85 37

Name: Tat Smith
Organisation: University of Toronto
Address: 33 Willcocks Street, Toronto, ON M5S 3B3 Canada
E-mail: tat.smith@utoronto.ca, Phone: +1-416-978-4638, Fax: +1-416-978-3834

Annex 1: Existing and planned research networks and programmes relevant for Task 43

- The Strategic Working Group of the European Commission on Bioeconomy plans a project that covers the EU region. The current situation in member states, concerning certification for multiple outlet, will be assessed and challenges will be addressed. In particular, the problem that certification systems associated with different products are not well harmonized will be addressed. Contact person in Task 43 is the present Dutch NTL Jan van den Esch, who is also chair of the Strategic Working Group. The Danish representative in the Working Group, Lasse Juul-Olsen at the Danish Ministry of Agriculture, is contributing the development of the project and Aarhus University has been engaged in the project.

- BioFuelNet Canada is a strategic research network funded by the Natural Science and Engineering Research Council of Canada that brings together the Canadian biofuels research community to address the challenges impeding the growth of an advanced biofuels industry. BioFuelNet includes multi-disciplinary experts from academia, government and industry. It is working to develop and apply novel and innovative science, engineering and socio-economic strategies that will enhance development and market penetration of biofuels. One of the BiofuelNet research topics aims to bridge field-based knowledge of forestry and agricultural feedstock characteristics with conversion technologies. BiofuelNet proponents include members of both Task43 (E. Thiffault) and Task39 (J. Saddler, W. Mabee) ; it therefore represents opportunities for intertask collaboration on how to improve quantification, characterization (physical, chemical, thermal), sorting and conditioning of biomass feedstocks to enhance the efficiency of conversion technologies.

- The Canadian Council of Forest Ministers (CCFM) and the Canadian Institute of Forestry (CIF) related to bioenergy events across Canada tailored to each region's priorities for sustainable bioenergy deployment. The program would be custom designed by planning committees set up for each region and combine elements of (1) regional bioenergy development priorities featuring regional experts in market development, policy, forest management, harvesting and logistics, etc. and (2) national and international hot topics featuring colleagues from Canada and around the world and focusing on topics that are critical to international trade such as EU and Asian ambitions for bioenergy market development, sustainability standards and role of certification schemes in facilitating market development (e.g. specific focus on implementation of the newly released Sustainable Biomass Partnership (SBP) standards) and implications for Canadian market position, GHG balance standards, etc.; and include elements of the 2016-18 triennium Work Programme for Task 43 and other IEA Bioenergy Tasks that have regional and international relevance to the planning committee. Contact person in Task 43 is Tat Smith, T43-CA.

- CAR-ES (Centre of Advanced Research on Environmental Services from Nordic Forest Ecosystems) is an open network that brings together Nordic and Baltic forest researchers with the aim to provide scientific knowledge on the impacts of forest management, including forest bioenergy harvesting and biomass production on major environmental services to support informed decision making in the forestry sector. The main environmental services addressed are: Carbon sequestration, Water quality, Biodiversity, Soil quality. The first CAR-ES was running through period 2006-2010, and the current working period for CAR-ES II is 2011-2015. A prolongation proposal will be submitted for the period 2016-2020. Contact person in Task 43 is Inge Stupak, T43-DK, who is also coordinator of the CAR-ES network

in the present period. The network is arranging a larger conference on forest ecosystem services, 3-5 November 2015, in Copenhagen.

- The proposed ERA-NET project Opti Ligno has as aim to promote the expansion of lignocellulosic crop systems that provide biomass for energy along with other benefits. The project intends to identify the most suitable areas for cultivation of lignocellulosic energy crops and expected positive and negative effects in such identified areas (e.g. in terms of soil and water quality, and biodiversity). The project will further investigate how lignocellulosic crop systems can be located and managed to increase resource use efficiency, avoid/mitigate negative effects and promote positive effects. A participatory process will be established involving policy makers and other stakeholders (society, land owners etc) where project results and insights provide a basis for the development of strategic plans for lignocellulosic crop deployment at national level that achieve optimal outcome considering affected stakeholders, environment and associated ecosystem services. Contact persons in Task 43 are Ioannis Dimitriou and Göran Berndes, both T43-SE.

- SRCplus is an Intelligent Energy for Europe Programme supported by the European Commission that has as an overall goal to support and speed-up the development of local supply chains of Short Rotation Woody Crops by implementing various capacity building measures and regional mobilization actions for the key actors in local supply chains. The project consortium includes 10 European countries and its results and development are of special interest to Task 43 since the proejct objectives comprise marketing and implementing of biomass feedstock systems that currently only exist in very small scale in the referred countries, but do exist in other countries with recorded success. Ioannis Dimitriou, T43-SE, is a project partner in this project responsible for transmitting obtained knowledge from Sweden, where such biomass feedstock systems already exist in large-scale and are successfully implemented, to other countries in an infantry stage.

- The Nordic Forest Research (SNS) network entitled "Developing Forest Energy Governance in Northern Europe" has received funding to strengthen the collaboration in forest energy governance in Northern Europe including several countries and institutions involved in Task 43 activities. This network will offer possibilities to exchange experience between the different countries and identify bottlenecks for broader implementation of forest bioenergy feedstock systems sourcing from legislation, economy, social and culture differences between the countries involved (including countries that have broadly adapted such systems such as Sweden and Finland, and countries such as Estonia, Latvia, Norway etc with great potential but still with more limited adaptation. Ioannis Dimitriou, T43-SE, is partner in this network together with a number of participants from Task 43 involved institutions.

- Another SNS network entitled "Effects of bioenergy production from forests and agriculture on ecosystem services in Nordic and Baltic landscapes" aims to share knowledge and experiences concerning the effect of more intensive management for biomass and bioenergy production from forests and agriculture on ecosystem services in Nordic and Baltic landscapes. Questions to be addressed include: Do the same challenges with respect to ecosystem services exist in all Nordic and Baltic countries and across sectors? How can forestry and agriculture be driven to optimize provisioning of ecosystem services at a landscape level? What trade-offs may be necessary, and will these be the same in all countries? What are the effects of differences in governance between countries? Contacts for Task 43 are Inge Stupak, T43-DK, and Göran Berndes, T43-SE.

- USDA-FS, Oak Ridge National Laboratory and other National Labs and their collaborating organizations plan several activities in the coming years that address topics that are central for Task 43 and collaboration plans are discussed. Coordinating contacts are USA T43 NTL Marilyn Buford, USDA-FS, and Kristen Johnson, US Department of Energy, Bioenergy Technologies Office, who leads sustainability efforts in bioenergy for DOE and oversees the work at DOE Labs. Projects under development include "Bioenergy Sustainability: Assessing Progress" (Virginia Dale) that has as aim to establish how progress toward bioenergy sustainability can be assessed in a way that moves the industry towards a sustainable bioeconomy. The project builds from previously proposed sustainability indicators and analysis and focuses on (1) case studies to validate and further develop our approach (e.g., the use of woody residues for bioenergy in the southeastern US), (2) further development of the underlying theory - focusing on applying aggregation theory to bioenergy sustainability, and (3) visualization tools for better communication with stakeholders. Another project "Addressing Global Barriers to Growth of the US Bio-Economy" (Keith Kline) has as objectives to (1) address key barriers related to sustainability assessment methods, food security, land-use change, reference case and carbon measurement; (2) build international consensus around criteria, definitions and measurement methods; and (3) support more consistent assessment of bioenergy sustainability

- US NSF-Supported Research Collaboration Network on Bioenergy – A Research Roadmap is being developed for publication in 2016 and specifically seeks to generate collaboration and help identify funding or other support to improve sustainability assessments related to bioenergy developments in the Americas. David Shonard (Michigan Technological University) is contact.

-National Council for Air and Stream Improvement (NCASI) is an independent, non-profit research institute that focuses on environmental and sustainability topics relevant to forest management and the manufacture of forest products. NCASI undertakes scientific studies that will enhance the technical understanding of environmental and sustainability issues associated with forest management practices and the use of wood-derived materials to manufacture forest products. NCASI provides reliable data on environmental issues that pertain to forest products.

Annex 2: CV for Task Leader and WP Leaders

Ioannis Dimitriou. Senior Researcher and Associate Professor, Dept. of Crop Production Ecology, Swedish University of Agricultural Sciences, Sweden

Ioannis Dimitriou has conducted biomass-for-energy related research during the last 15 years. His general research activities are related to the implementation of short-rotation energy crops and their implications in system sustainability. He has been also working with using short-rotation energy crops as multifunctional systems for bioenergy but also for wastewater treatment and utilisation looking at the impact on the environment and on the surroundings. Ioannis has been involved in a range of national and international (both EU and other) biomass-related projects. He has served as the Vice-Chairman of FAO's International Poplar Commission (IPC) WP6 Environmental uses of poplar and willow, coordinator of the ERA-Net Bioenergy project Rating-SRC ("Reducing environmental impacts of Short Rotation Coppice (SRC) through evidence-based integrated decision support tools"), member of the Steering Board of the Swedish National Poplar Commission, chairman of the EU Network of SLU's Faculty of Natural Resources and Agriculture, and chairman of the Committee on Global Issues at SLU's Faculty of Natural Resources and Agricultural Sciences. He is currently coordinator of four national biomass projects linking bioenergy production and environmental impacts, and partner in the FP7 project Greenland "Gentle remediation of trace element contaminated land" and the IEE project SRCplus "Short Rotation Woody Crops (SRC) plantations for local supply chains and heat use, as well as a Management Committee member of the EU Cost Action FP1301 Eurocoppice "Innovative management and multifunctional utilization of traditional coppice forests".

Göran Berndes. Associate Professor, Division of Physical Resource Theory, Dept. of Energy and Environment, Chalmers University of Technology. Sweden

Göran Berndes conducts research that integrates land use and energy systems at scales ranging from local case studies to the global context. The research is in particular directed towards land use and bioenergy systems. Important aspects include: (i) the effectiveness of different ways to produce and use biomass for energy, using land use and energy system modeling, LCA analyses, and other methods; and (ii) the resource (e.g., land and water), environmental and socioeconomic implications of land use and bioenergy strategies for climate change mitigation. Göran is alternate Swedish representative in the ExCo and was Task Leader for Task 30 2007-2009 and for Task 43 2010-2015. He has coordinated numerous research projects and has served in several international expert groups and committees, including GBEP AG6 - Bioenergy and Water, where he is chair on behalf of IEA. He served as author for the IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation and for the Fifth Assessment Report (WG3). Göran is Associated with the Stockholm International Water Institute, Sweden, and the International Institute for Sustainability Analysis and Strategy, Germany.

Mark Brown. Professor or Forestry Operations, University of the Sunshine Coast (USC) Director - Australian Forest Operations Research alliance Director (AFORA), USC Director – Forest Industries Research Centre (FIRC) – USC. Australia

Mark Brown is a researcher manager with over 15 years' experience in forest industry applied research in Canada and Australia. His focus is on research implementation for impact across the entire forest product supply chain, with a particular emphasis on operational

efficiency and value recovery. As the director of FIRC and AFORA, Mark's experience in partnership building and research implementation is being applied with forestry collaborators nationally and internationally. Mark is on the editorial committee of the International Journal of Forest Engineering, an editorial board member of the Australian Journal of Forestry, an ISO-TC 248-sustainability criteria for bioenergy committee member, A non-executive board member of Bioenergy Australia, a strategic technical advisor for INFRES-improved European forest biomass supply chains; an EU-FP7 project, and represents Australia as national task leader on IEA Bioenergy Task 43.

Hans Langeveld. Director, Biomass Research, Netherlands

Hans Langeveld was trained as a tropical agronomist. He worked on land use modelling at the Free University in Amsterdam and on sustainable land use at Wageningen University and Research Centre before starting a private research and consulting company in 2008. His company, Biomass Research, is oriented towards the sustainable production of biomass for food, feed, biofuels and biobased products. Main focus is on data management, uncertainty analysis and benchmarking. Hans has over 25 years of experience in sustainable cropping systems, land use practices and renewable energy. He has plenty experience in the development and evaluation of bioenergy and biobased production chains. His main focus is on biomass availability, LUC, soil carbon dynamics and GHG emissions. Experience includes analysis of land use in Europe, Indonesia, China, Nigeria, Kenya, Ethiopia, Zimbabwe, Brazil and Honduras. Presently, he is engaged in developing smallscale bioenergy applications for oil palm residues in Colombia. Hans has extensive experience in data and systems analysis, trend analysis, project management and reporting. He has led a range of international projects and research initiatives and has given over 200 presentations in 18 countries. Hans co-authored many scientific papers as well as books on biofuel cropping systems, on farming systems and on the biobased economy.

Tat Smith. Professor and Dean Emeritus (Forestry) at the University of Toronto

Tat Smith has held the following positions since the early 1980s: Professor and Head of the Department of Forest Science at Texas A&M University from January 1999 to June 2005; Programme Manager for the New Zealand Forest Research Institute 1993 to 1998; and was a professor in the Department of Forest Resources, University of New Hampshire in Durham from 1983-92. Tat is Past President for the Canadian Institute of Forestry; serves as Associate Leader for IEA Bioenergy Task 43 "Biomass Feedstocks for Energy Markets" for the period 2010-15; and is a member of the Board and Secretary-Treasurer of the Sustainable Forestry Initiative (SFI).

Tat's major research contributions have been in the area of developing sustainable forest management systems (SFM) for bioenergy feedstock production: international efforts (e.g. IEA Bioenergy) to determine the environmental impacts of bioenergy production in plantation and natural forests, the utility of environmental certification systems defining SFM standards and criteria and indicators for developing reliable SFM practices, the impact of intensive harvesting on forest ecosystem nutrient cycling and site productivity, and soil carbon storage in forest ecosystems and the impacts of intensive forestry on carbon cycling in forests.

Annex 3: Time plan and deliverables

Deliverables		2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activities across all WPs													
D1	Task 43 kick-off meeting	D1											
D2	Task 43 annual workshops		D2:1						D2:2		D2:3		
D3	Workshop reporting and policy briefs		D3:1						D3:2		D3.3		
D4	Collaborative workshops with other Tasks and organisations (tbd)												
D5	Business meetings												
D6	Reporting to the ExCo		D6:1		D6:2		D6:3		D6:4		D6:5		D6:6
WP1 - Landscape management and design for bioenergy and the bioeconomy													
D7	State-of-the-art in sustainable landscape management and design						D7						
D8	Atlas of attractive systems for bioenergy feedstock production in sustainably managed landscapes								D8				
D9	Application of landscape management and design approach to assess and promote sustainability of established and promising bioenergy systems												D9
WP2 - Developing effective supply chains for sustainable bioenergy deployment													
D10	EU-RED influence on international biomass supply chains							D10					
D11	Challenges and benefits of supply chain integration across agriculture and forestry							D11					
D12	Learning from the best supply chains and making them better										D12		
D13	The role of supply chains in financing bioenergy										D13		
D14	Systems for improved supply chain performance and flexibility												D14
D15	Efficient woody biomass supply within multi-forest product supply chains												D15
WP3 - Governing land use and bioenergy supply chains													
D16	Governance to support sustainability goals at multiple scales						D16						
D17	Effectiveness and efficiency of sustainability governance								D17				
D18	Governance to guide management of forests and other ecosystems affected by disturbances												D18
D19	Governance addressing direct and indirect LUC impacts										D19		
D20	Quantification of GHG balances and climate effects of LULUCF activities associated with biomass and bioenergy systems										D20		