

Approaches to creating trust in sustainability of bioenergy through effective governance

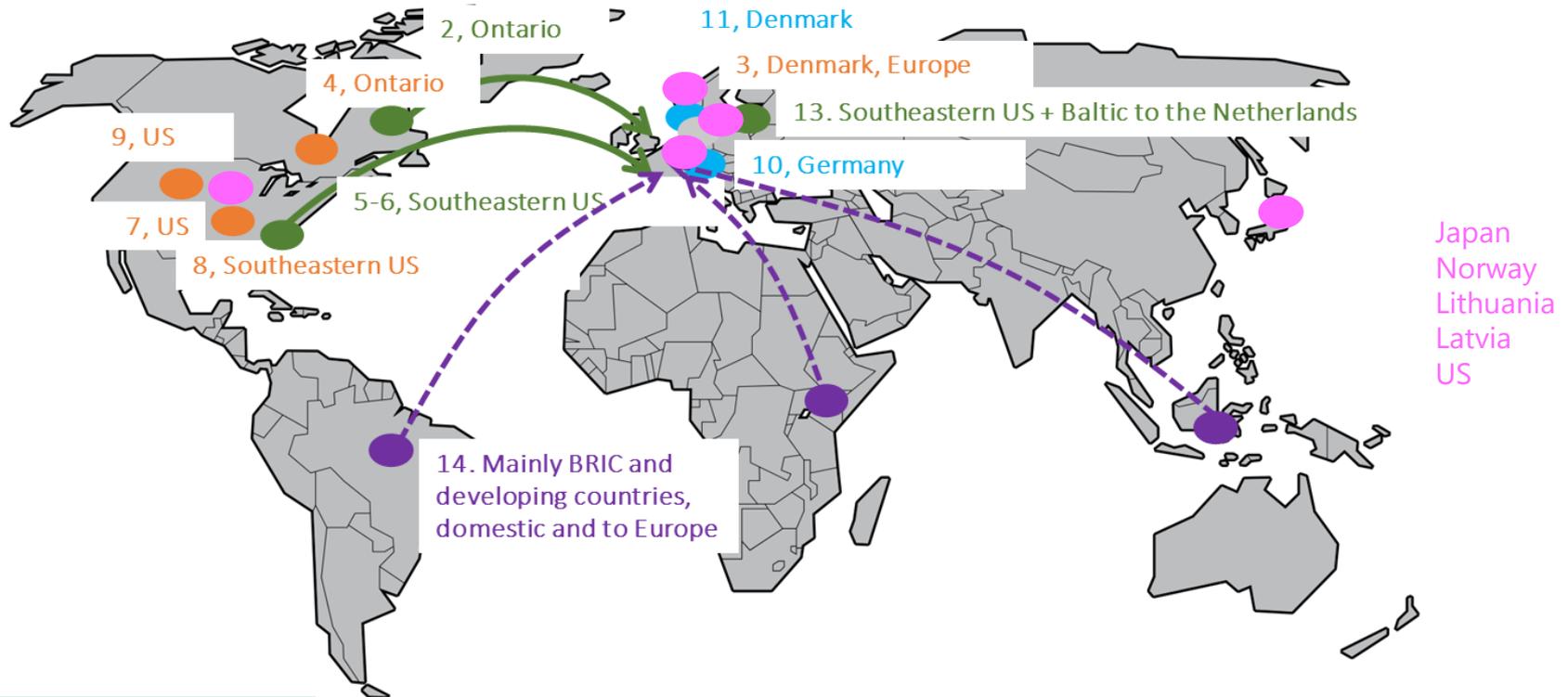
Results from collaboration within IEA Bioenergy and other research networks



Collaboration

- **IEA Bioenergy inter-Task project** on “Measuring, governing and gaining support for sustainable bioenergy supply chains”
- **IEA Bioenergy Task 43** “Biomass feedstock for Energy Markets”
- **SNS-NKJ network** activity “Effect of bioenergy production from forests and agriculture on ecosystem services in the Nordic and Baltic landscapes”
- **CAR-ES III network** “Centre of Advanced Research on Environmental Services from Nordic Forest Ecosystems”
- **Conference** in Copenhagen, 17-19 April 2018 “Governing sustainability of bioenergy, biomaterial and bioproduct supply chains from forest and agricultural landscapes”

Case studies under the IEA Bioenergy inter-Task project: **“Measuring, governing and gaining support for sustainable bioenergy supply chains”**



Some studies to be submitted for publication in Thematic series of 'Energy, Sustainability, and Society' (ESSO)

- Forest biomass
- Agricultural biomass
- Biogas
- Complementary Task 43 study on regional approaches to governance/Jinke van Dam and Rocio Diaz-Chavez
- National or global studies

No	Supply chain	Title	Key authors	Status
1	Conceptual	Trust and Legitimacy in Sustainability Governance of Bioenergy Supply Chains	Mansoor, Stupak, Smith	Manuscript in progress
2	Forestry, Ontario	Governance of sustainable forest management and bioenergy in Ontario, Canada	Cheung, Smith	Manuscript in progress
3	Agriculture DK, Europe	Sustainability governance of the bioeconomy – agricultural crops and residues in Denmark and Europe	Bentsen, Stupak	Manuscript in progress
4	Agriculture, Canada	Sustainability Governance of the Agriculture-based Bioeconomy in Canada	Lalonde, Wellisch	Manuscript in progress
5	Forestry, SE US	Assessing the Wood Sourcing Practices of the U.S. Industrial Wood Pellet Industry Supplying European Energy Demand	Kittler	Manuscript in progress
6	Forestry SE US	Parish ES, Dale VH, Kline KL (2017) Has pellet production affected SE US forests? World Biomass. DCM Productions, United Kingdom. Pages 38-42.		Published
7	Agriculture, US	Sustainability Governance of Biofuel and Bioeconomic Development: Complexity and Data Barriers	Gan	Manuscript in progress
8	Agriculture, US	Dale VH, Kline KL, Richard TL, Karlen DL, Belden WW. 2018. Bridging biofuel sustainability indicators and ecosystem services through stakeholder engagement. In a Special Issue on "Biofuels and Ecosystem Services" Biomass & Bioenergy 114: 143-156.		Published
9	Agriculture, US	Shyam K. Nair & L. Michael Griffel & Damon S. Hartley & Gabe S. McNunn & M. Ross Kunz. 2018. Investigating the Efficacy of Integrating Energy Crops into Non-Profitable Subfields in Iowa. BioEnergy Research, 11:623–637.		Published
10	Agriculture, US	Shyam K. Nair, L. Michael Griffel, Damon S. Hartley, Gabe S. McNunn, and M. Ross Kunz. Integration of Energy Crops into Corn and Soybean Subfields in Kansas to Increase Sustainable Biomass Production. Energy, Sustainability and Society.		In review
11	Agriculture, US	Shyam K. Nair et al. Improvements in Nutrient and Carbon Retention in Soils Through Energy Crop Integration into Agricultural Croplands.		Manuscript in progress
12	Biogas, Germany	Thrän D., Schaubach K., Majer, S. Horschig, T. Governance of Sustainability in the German biogas sector - Adaptive Management of the Renewable Energy Act between Agriculture and the Energy Sector. Energy, Sustainability and Society.		Manuscript submitted to ESSO
13	Biogas, Denmark	Al Seadi, T., Stupak, I., Smith, C. T. (2018). Governance of environmental sustainability of manure-based centralised biogas production in Denmark. Murphy, J.D. (Ed.) IEA Bioenergy Task 37, 2018: 7, 31 pp.		Published
14	Synthesis	Approaches to creating trust in sustainability of bioenergy through effective governance	Stupak, Smith	In progress

No	Supply chain	Title	First author	Status
15	Forestry, SE US + Baltic	Stupak, I. and C.T. Smith. 2018. Feasibility of verifying sustainable forest management principles for secondary feedstock to produce wood pellets for co-generation of electricity in the Netherlands. IEA Bioenergy Task 43 TR2018:01.		Published
16	Landscapes in different c.	Regional Governance Models: Novel multi-stakeholder approaches	Van Dam, Diaz-Chavez	Manuscript in progress
17	All Global	Postions, perceptions and visions of stakeholders on bioenergy sustainability	Thuy Mai-Moulin	Manuscript in progress
18	All, Norway	Bioenergy risk and risk management in the Nordic countries	Nicholas Clarke	Manuscript in progress
19	Agriculture, Lithuania	The sustainability of growing agricultural energy crops in changing climate perspective	Vita Tilvikiene	Manuscript in progress
20	All, Global	Gaps in sustainability tools and schemes for biobased products and stakeholders' preferences and expectations	Sergio Ugarte	Manuscript in progress
21	Forestry, Lithuania	The dynamics of different fuel use (natural gas, oil & biomass) in district heating of Lithuania	Lina Beniušienė	Manuscript in progress
22	Agriculture, US	Spatially-explicit modeling of biological productivity and economic attractiveness of short-rotation woody crops	John Stanturf	Manuscript in progress
23	Forestry, US	Show Me: Research and Demonstration Sites for Innovation	John Stanturf	Manuscript in progress
24	Agriculture, Canada	Multi-objective optimization modeling of bioenergy systems and landscape design	Nathaniel Newlands	Manuscript in progress
25	Forestry, Denmark	Analysis of the documentation used in the first reporting of energy companies to the Danish Industrial Agreement on Sustainability of wood pellets and wood chips	Søren Larsen	Manuscript in progress
26	Forestry, Japan	Incentives and Barriers for Deployment of Sustainable Forest Bioenergy in Japan	Yoko Kitigawa	Manuscript in progress
27	Forestry, Europe, US and Canada	The dynamics of different fuel use (natural gas, oil & biomass) in district heating of Lithuania	Brian Titus	Manuscript in progress
28	Forestry, Latvia	Wood ash recycling and acceptance from citizen side of that kind of circular biobased economy	Dagnija Lazdina	Manuscript in progress

Conference in Copenhagen, 17-19 April 2018

The screenshot shows the website for the 'Governing sustainability of bioenergy International Conference 2018'. The header includes the conference title and a decorative graphic of a classical bust. The main content area features a green banner with the conference title and dates, followed by a collage of images related to bioenergy (a wind turbine, a field, a forest, and a processing facility) with a 'Call for abstracts' overlay. Below this is a paragraph describing the conference's focus on bioenergy, biomaterial, and bioproduct supply chains. A welcome message follows, stating the conference will take place from April 17th to 19th, 2018, at the University of Copenhagen. On the right side, there are logos for 'norden' (Nordic Council of Ministers), 'IEA Bioenergy', 'iea Energy Technology Network', 'NKJ' (Nordic Joint Committee for Agricultural and Food Research), and 'SNS' (Nordic Forest Research). A navigation menu on the left lists: Home, About the conference, Call for abstracts, Organizers and scientific committee, Contact us, and Disclaimer.

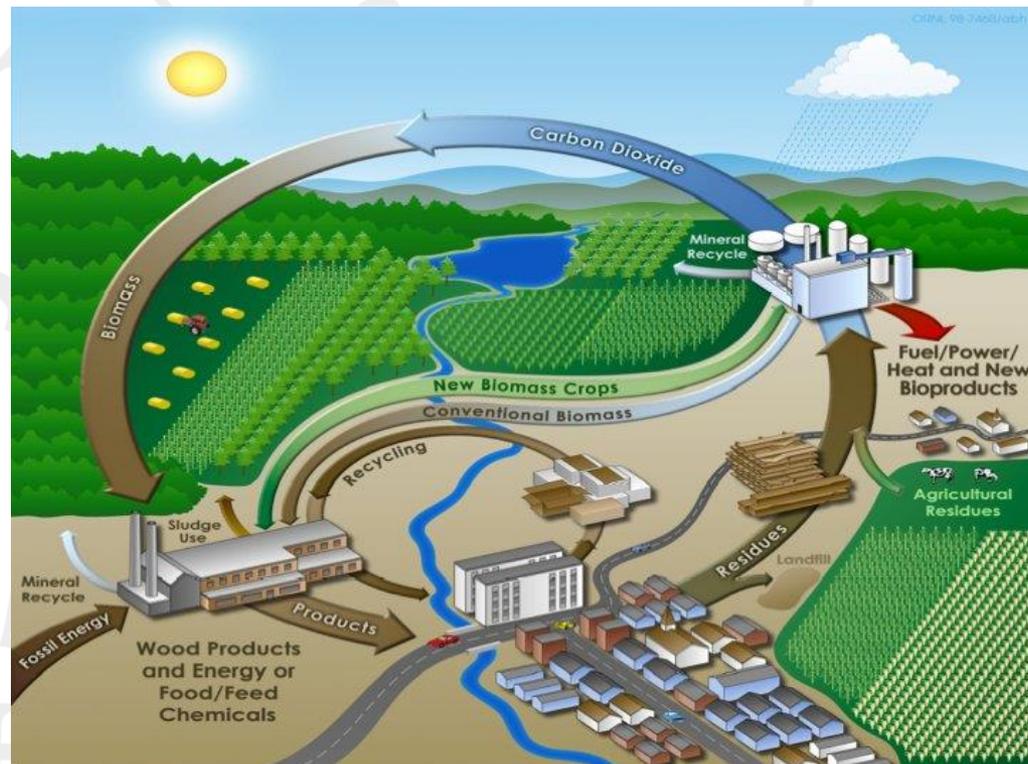
- **Book of abstracts** and most **presentations** and **posters** available from the conference website, <http://ign.ku.dk/bioenergy-conf-2018/>
- **Special issue of the peer review journal Thematic Series of 'Energy, Sustainability and Society' (ESSO)** is being compiled, including **synthesis paper**, <https://www.biomedcentral.com/collections/sbbb>
- Governing sustainability of biomass producing landscapes and biomass-based supply chains - **Key messages** from a conference on state of the art and future prospects. Presentation at EUBCE, Copenhagen, 14-17 May 2018, <http://ign.ku.dk/bioenergy-conf-2018/>
- **Short communications and webinars** (to come)

Acknowledgements

- This presentation is the fruit of more than three years study of sustainability governance of bioenergy.
- We sincerely acknowledge the aid and input which we have received in those years from collaboration with all the many colleagues from the IEA Bioenergy, Nordic networks and participants in the conference in Copenhagen, April 2018.
- No attempt has been made at this stage to comprehensively include knowledge emerging from the all cases studies.

Approaches to creating trust in sustainability of bioenergy through effective governance

Results from collaboration within IEA Bioenergy and other research networks



CIF and IEA Bioenergy Webinar, 13 September 2018

Authors

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with

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Aim

- Build theory on how to increase granting and achieving trust and legitimacy of sustainability governance systems for bioenergy and the bioeconomy, by...
 - exploring and comparing the variety of approaches to sustainability governance that are emerging or exist in and among different geographical regions, for different types of biomass-based supply chains
 - identifying lessons learned on how data and scientific knowledge may inform development of well-functioning, credible and legitimate sustainability governance systems for bioenergy and the bioeconomy
- Provide a forum for discussion of knowledge and experiences on this topic.

Emerging themes – key points

- # Defining concepts and terms is not trivial
- # Sustainability is not dealt with in a holistic manner
- # Sustainability governance often incentivize development of bioenergy markets through different phases (financial incentives)
- # Bioenergy markets incentivize development of sustainability governance through different phases (synergies and mitigation of trade-offs as markets develop)
- # Flexibility and prescriptiveness of sustainability governance is not necessarily correlated with trust and legitimacy, but it may be. A mix of approaches is often used
- # Voluntary approaches for part of the supply chain are gaining acceptance through risk assessments
- # Databases for documentation of sustainability against multiple standards are emerging
- # Existing monitoring systems are increasingly being used for documentation of voluntary sustainability standards

Defining concepts and terms is
not trivial

Sustainability governance

Sustainability governance refers to the set of regulatory processes, mechanisms, and organizations that seek to influence sustainable actions and outcomes



Sustainability

A sustainable development intends to ensure that the environmental, social, and economic needs of the future are not compromised to meet the needs of the present.



Sustainability is an **aspiration goal**, which is operationalized through a process of making informed choices for continual improvements, wherein improvements are:

- the best available opportunities to achieve specified targets
- identified using scientific analyses
- based on criteria, indicators and targets prioritized by current stakeholders while considering impacts on future generations
- better relative to other options, including business as usual or status quo,
- context-specific for a time, place and set of conditions.

No human endeavor is indefinitely sustainable but one option is more or less sustainable than another based on defined criteria.

Sustainability is a moving target.

Trust

The willingness to be vulnerable to the actions of another, or belief of the community that a given governance institution and its conduct are appropriate



Receiving /achieving →	Individuals, the public		Organizations in the market		Governments	
Granting ↓	Type of trust granted to individuals by...	Strategies of individuals to achieve trust of...	Type of trust granted to organizations by...	Strategies of organizations to achieve trust of...	Type of trust granted to governments by...	Strategies of governments to achieve trust of...
Individuals The public	Inter-personal trust	Agreements on how to work together	<u>License to operate</u>	Corporate Social Responsibility (CSR)	<u>Legitimacy</u> , tax payments	Quality of Government, democracy
Organi- zations	Bought goods and services	Resignation from naming and shaming campaigns	Trust in the supply chain	Agreements on how to work together	Economic prosperity, tax payments	Political stability, Quality of Government
Govern- ments	Freedom, equality, welfare	Law-abiding behavior	License to operate	Law-abiding behavior	International relations	Agreements on how to work together

Legitimacy

Society accepting a governance institution as an authoritative figure that may appropriately influence the actions of societal actors, that are also willing to obey the rules of the governing institution.

Legitimacy		
Input	Output	Throughput
Gaining consent of actors through their participation and involvement in the governance system	Gaining the approval of actors through success of the governance system in what it attempts to achieve.	Efficiency of the administrative aspects that compose governance institutions

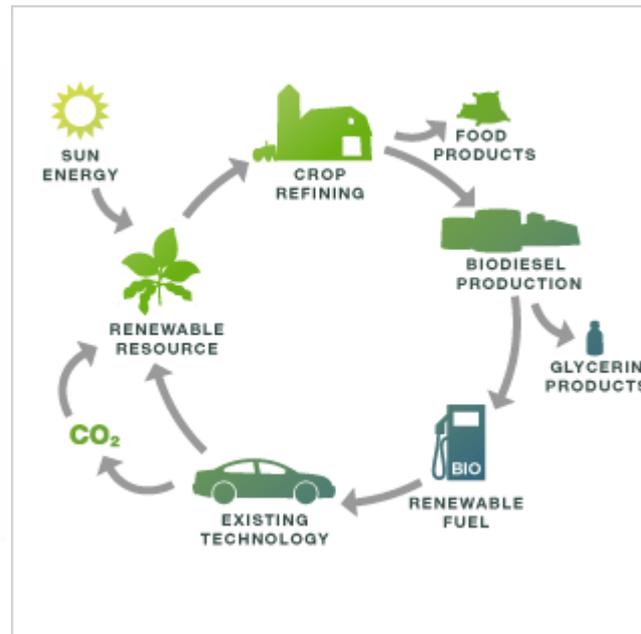
Legitimacy granted to a governance institution means that society sees the actions of the governance institution as proper and desirable.

How to ensure trust and legitimacy of sustainable practices for these cyclic bioenergy systems?

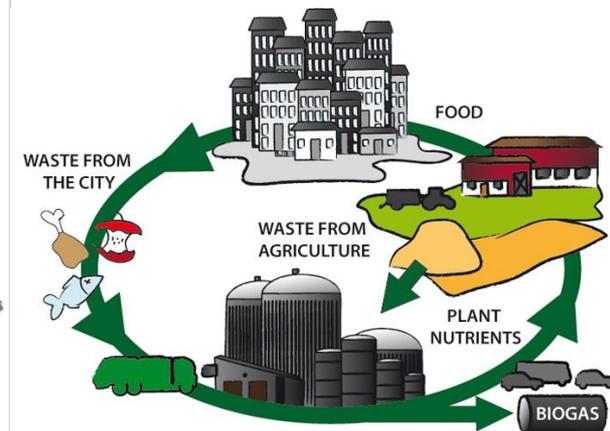
Forest bioenergy



Plant-based agricultural bioenergy



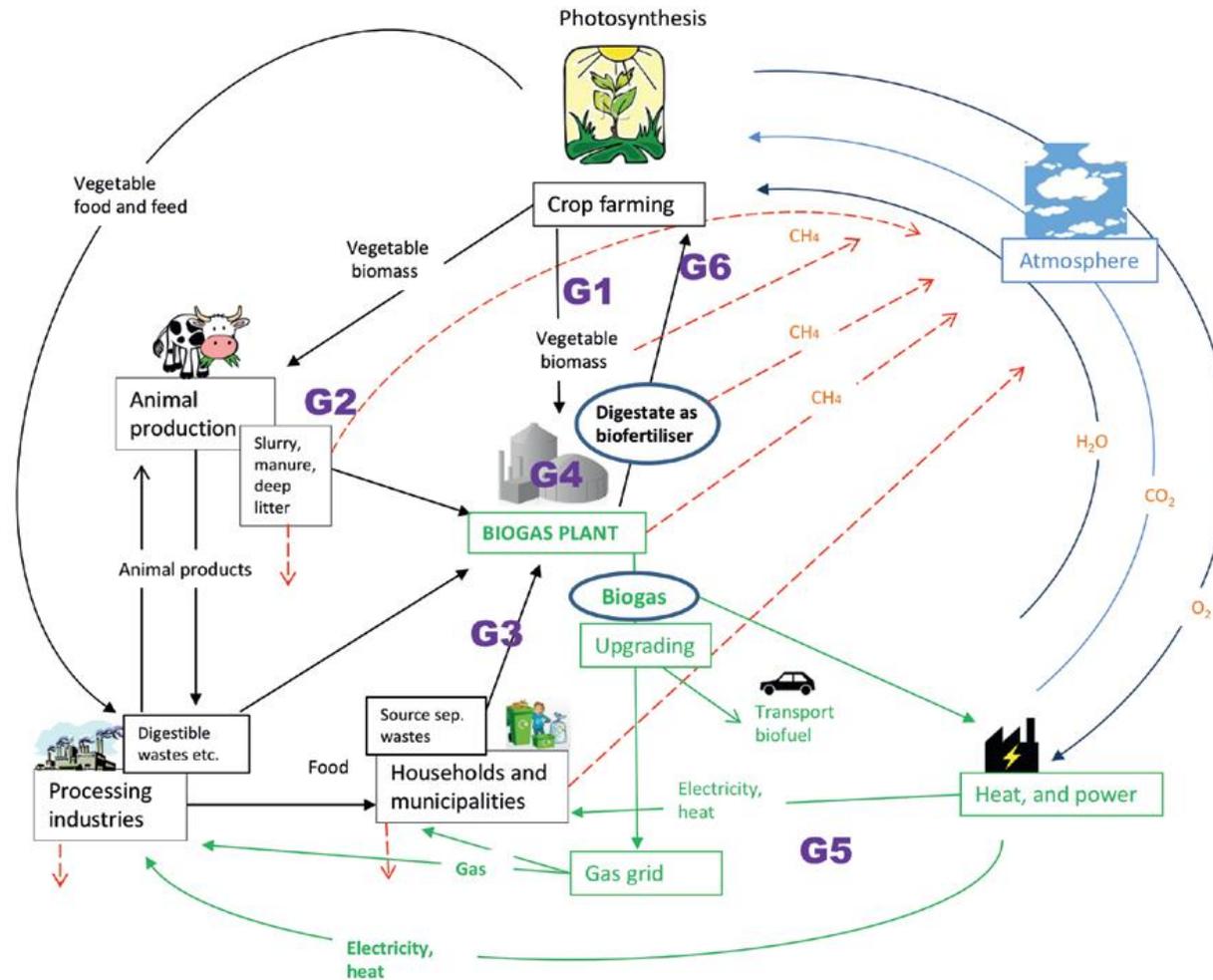
Biogas



Sustainability is not dealt with in a holistic manner

Case study - Biogas in Denmark

Designed to solve environmental challenges



Case study - Biogas in Denmark

Sustainability issue groups

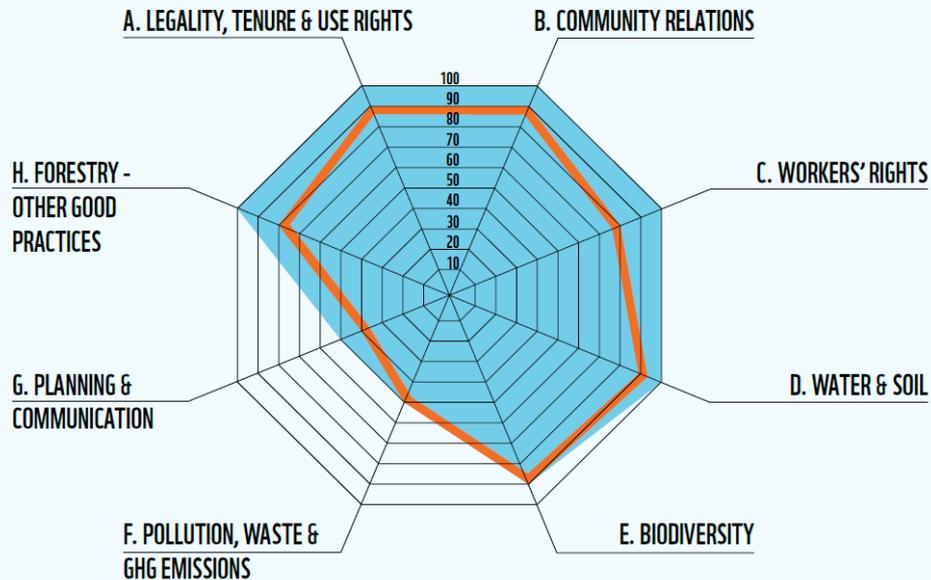
Table 1. Overview of the main sustainability issues in biogas production in the centralised manure co-digestion concept as used in Denmark.

No	Governance issues at different links in the closed loop supply chain of the centralised manure co-digestion concept
SB/GB	All sustainability benefits of manure-based biogas production
S1/G1	Sustainability of plant-based feedstock produced in the fields
S2/G2	Sustainable management of animal manure and slurry feedstock
S3/G3	Sustainable management of organic waste feedstock
S4/G4	Sustainable plant operation
S5/G5	Biogas and biomethane as renewable biofuels that reduce GHG emissions
S6/G6	Sustainable recycling of digestate as biofertiliser.

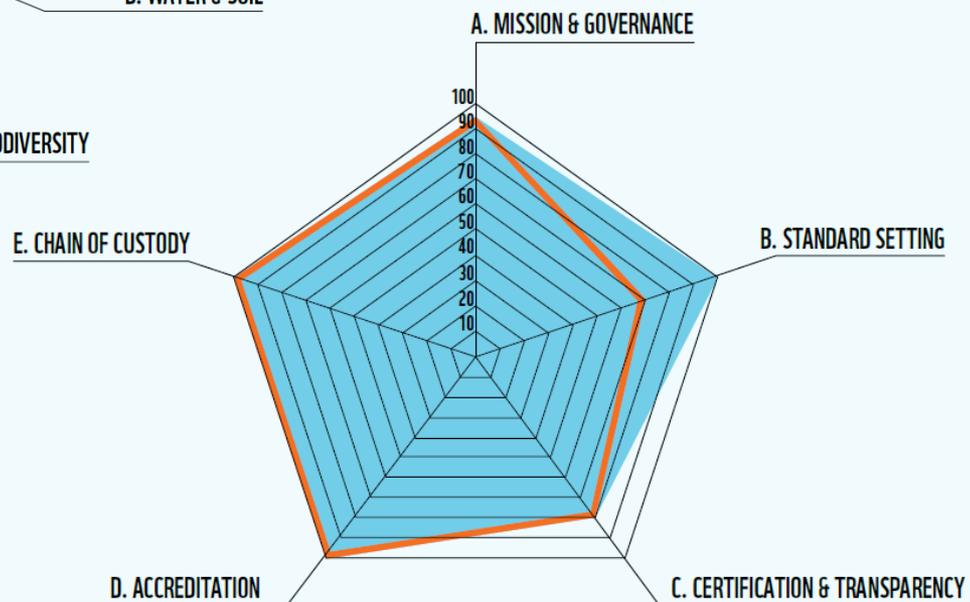


Standard and system strength

Forest certification

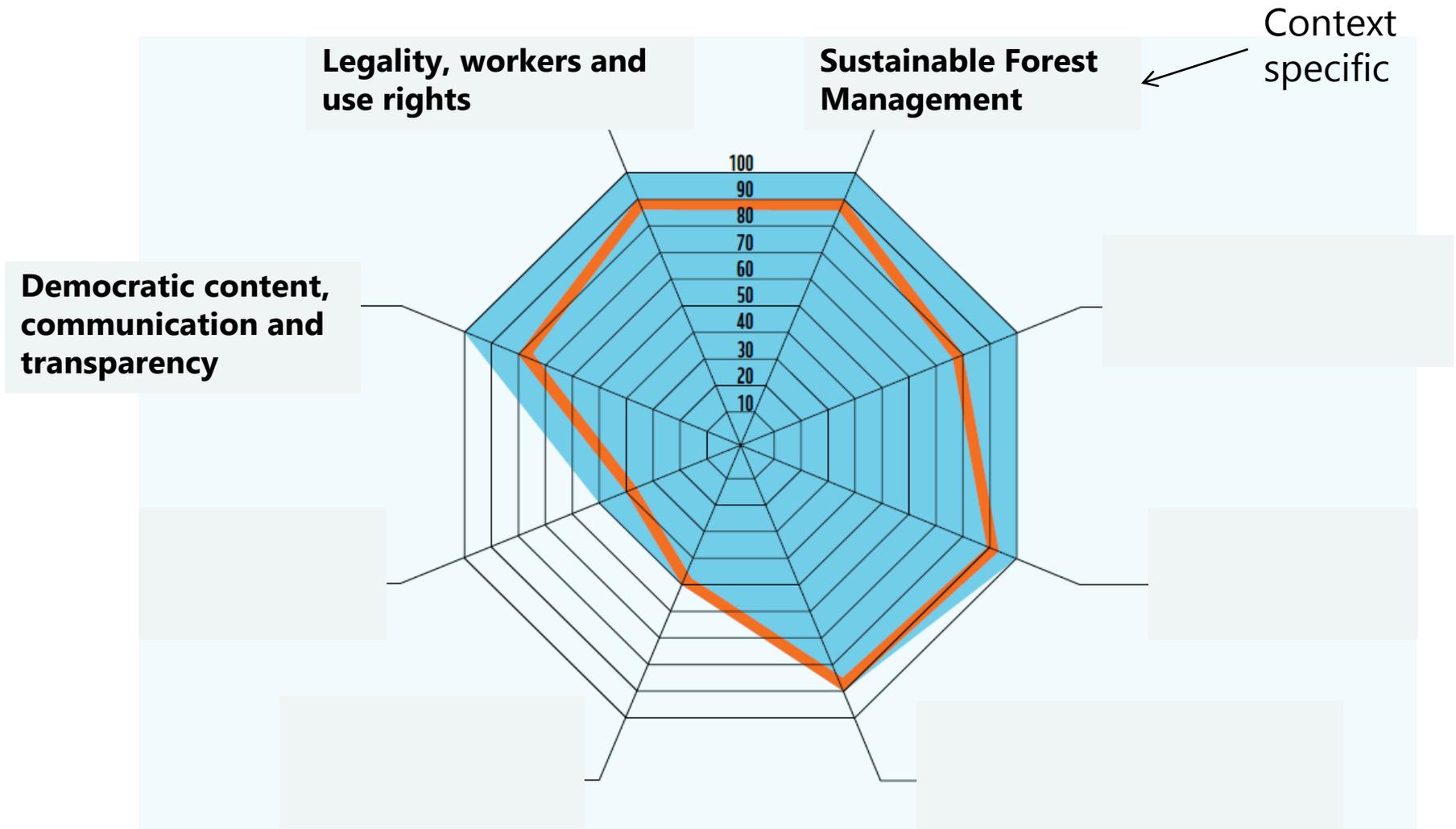


System strength
- relates to input and throughput legitimacy



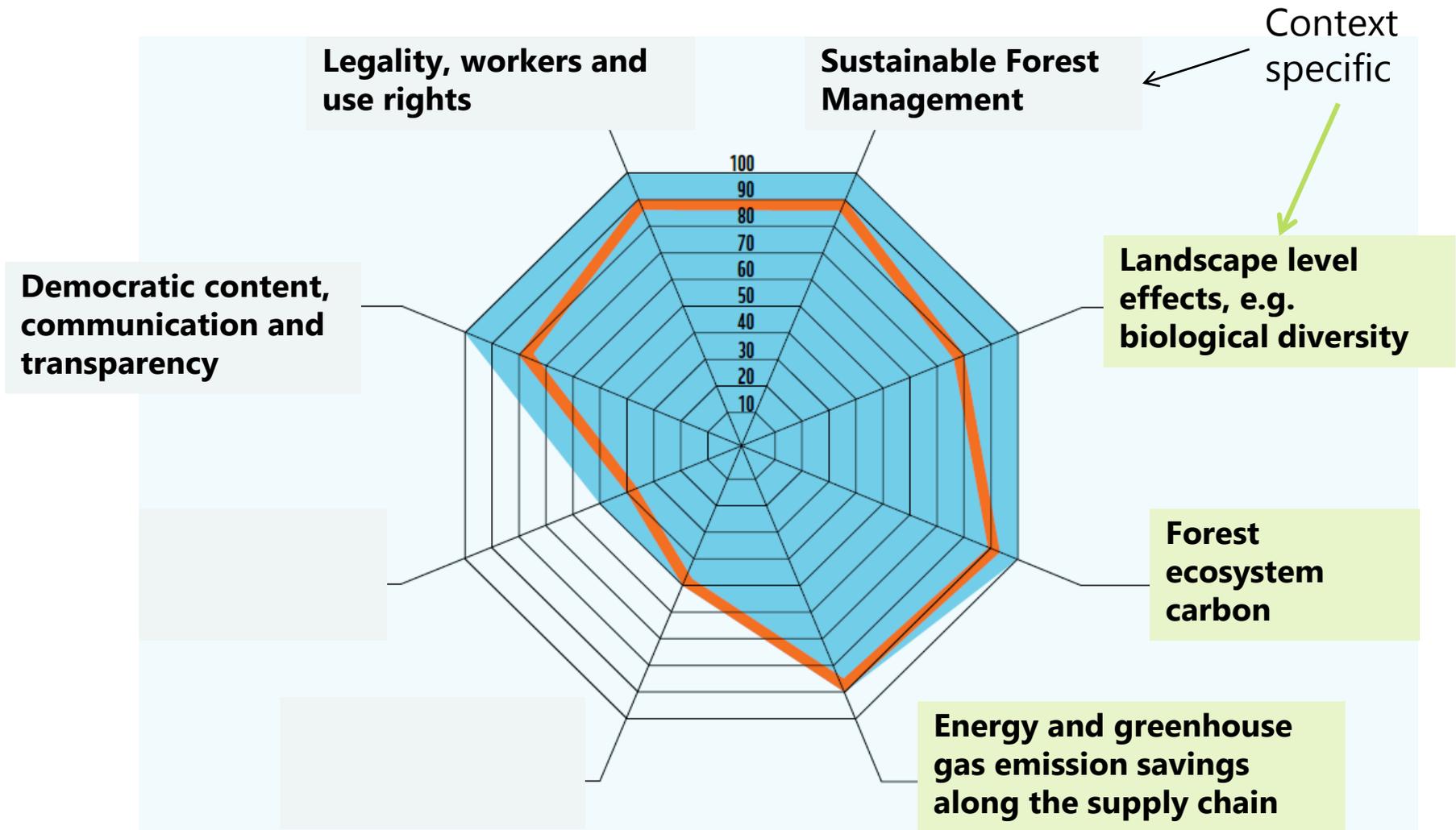
Standard strength

Forest management certification



Standard strength

Forest biomass and bioenergy certification



Proposals for new criteria for energy systems and financial incentive system design – straw dog

- Financial viability of renewables technologies.
- Bioenergy in this supply chain is the most economic, environmentally friendly, or socially acceptable renewable energy solution.
- If there are no environmental or social issues, any financial incentives for renewables should be technology neutral, to allow for the most economic solution to society
- If there are important environmental or social issues, any financial incentives for renewables should favor technologies with the least unintended effects.
- Government exit strategy exist for financial incentives and it is continuously adjusted in an adaptive framework

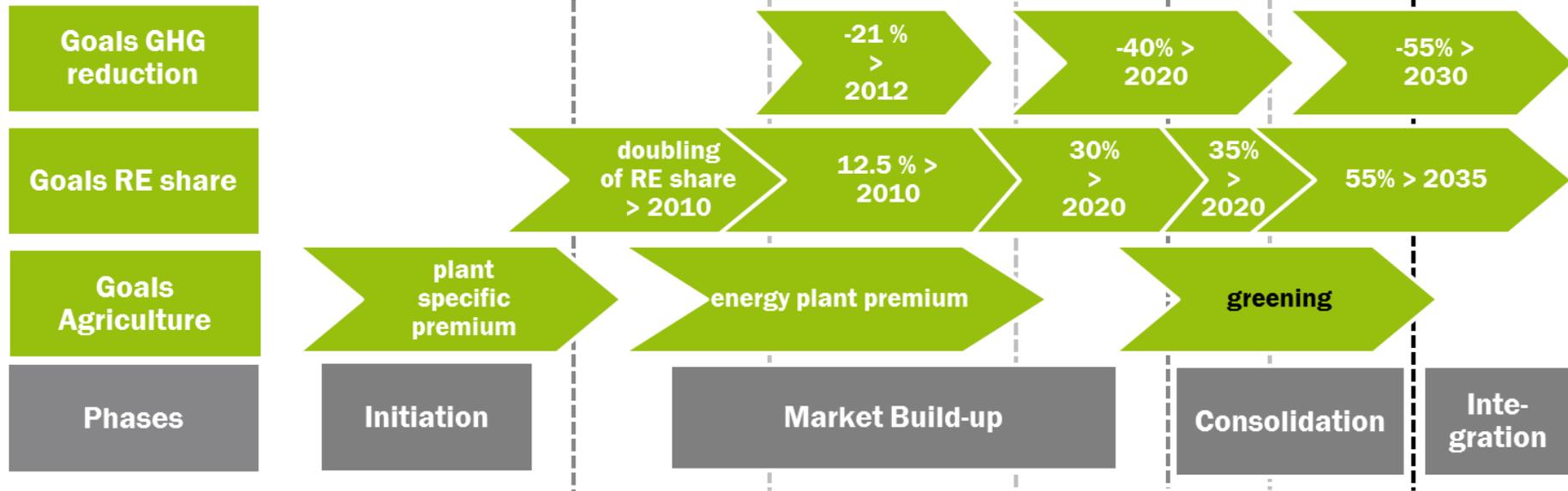
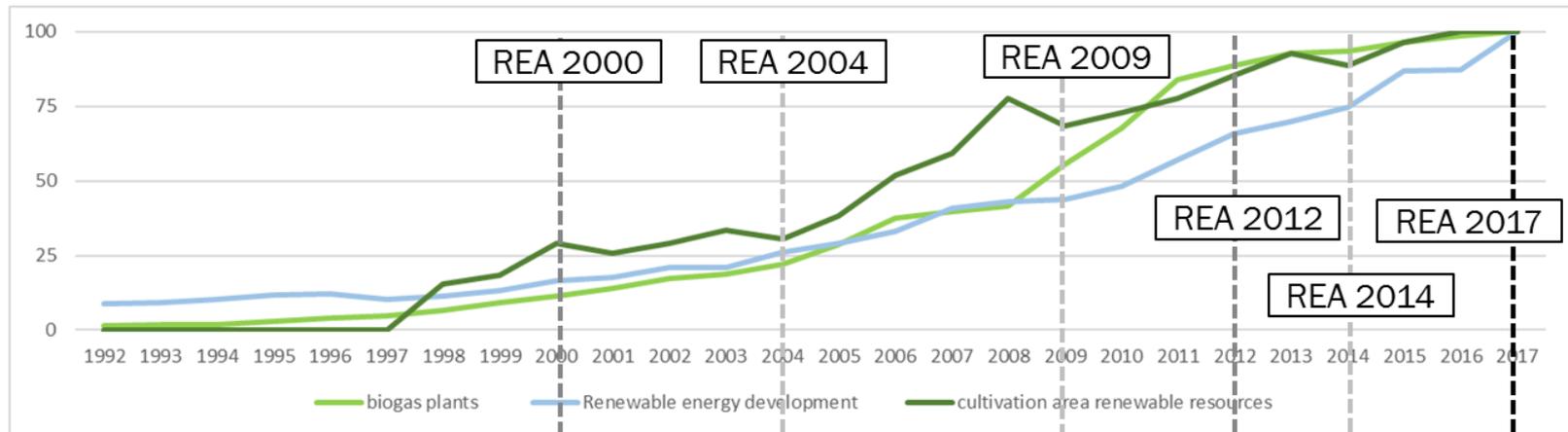
Sustainability governance incentivise
development of bioenergy markets through
different phases
(financial incentives)



Bioenergy markets incentivise development
of sustainability governance through different
phases as markets develop
(synergies and mitigation of trade-offs)

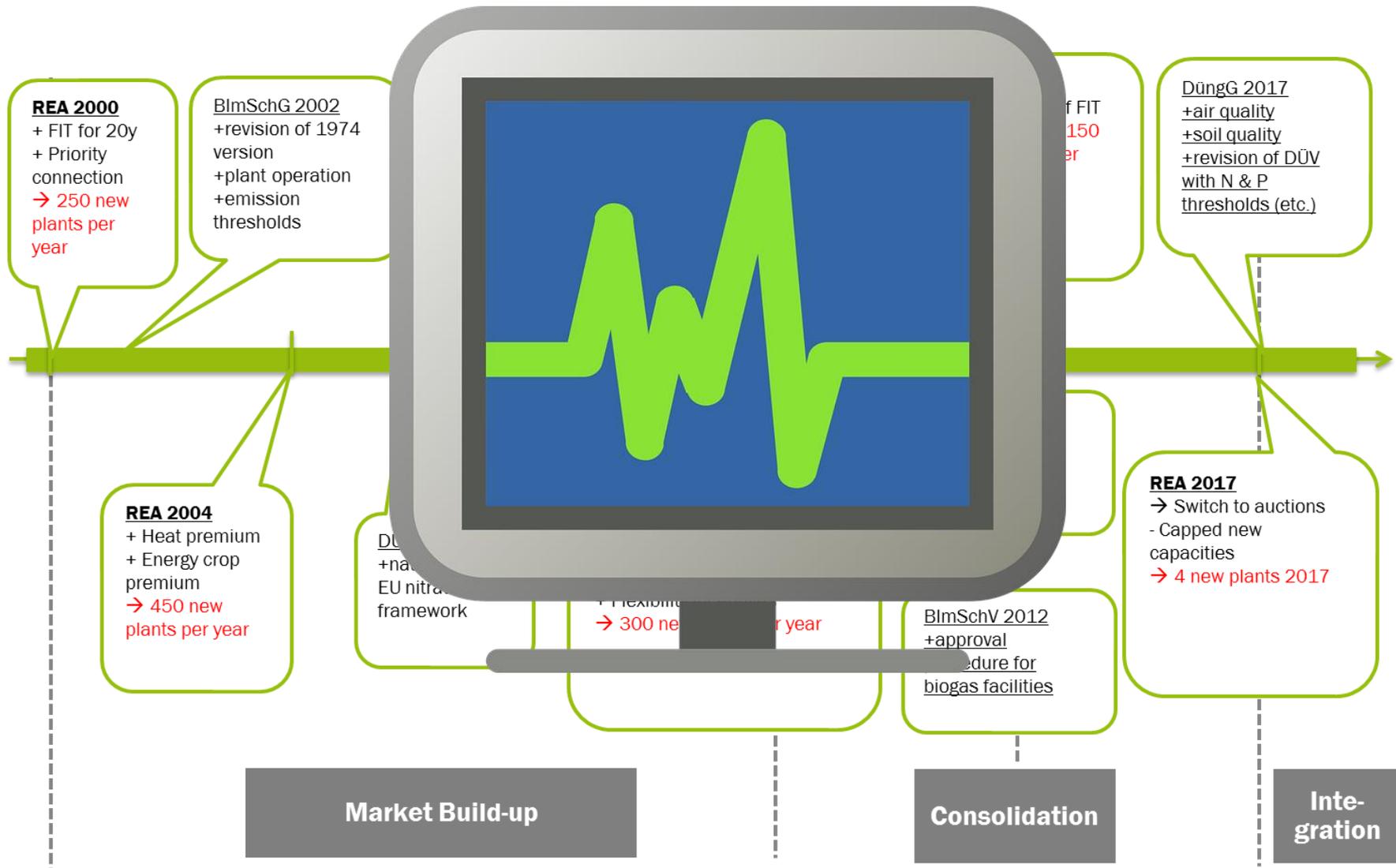
Case study - Biogas in Germany

Three phases of market development



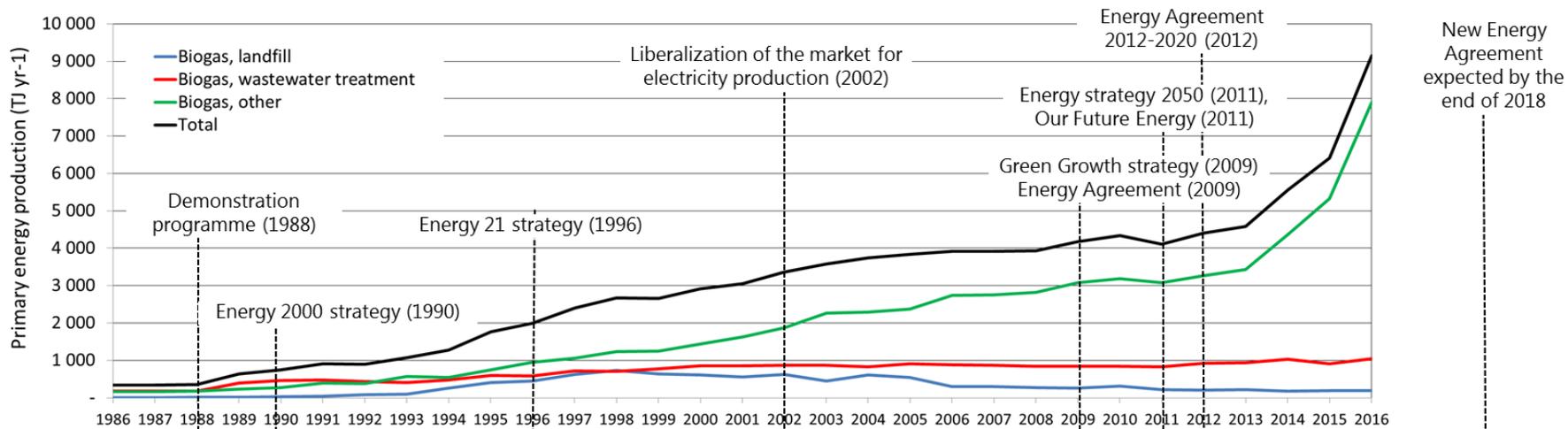
Case study - Biogas in Germany

Continuously *challenged and reshaped* through monitoring



Case study - Biogas in Denmark

Four phases of policy and market development



Phase I: Pioneering

Phase II: Build-up and innovation

Phase III: Market liberalization and biogas stagnation

Phase IV: Dedicated policies and large scale production plants

Policy focus on environmental sustainability and climate, following the Bruntland report. The goal is to reduce the CO₂ emissions with 20% by 2005 compared with the 1988 levels.

Change in focus of energy policies to energy security, economic growth, and liberalization

Fossil free economy by 2050, a 33% decrease in fossil fuels consumption by 2020. Broad focus, especially climate

Some uncertainty about contents of the upcoming agreement

Investment grants of 20-40% of the investment costs, funding of R&D projects, exemption from energy taxation, feed-in tariffs of 0.27 DKK kWh⁻¹, long term loans (20 years), at low interest rate.

Follow up and action programmes; collection, systematization and dissemination of the gathered experience among farmers, plant operators, consulting companies, plant constructors and authorities

Energy Agency target to increase the biogas production fourfold by 2005, compared to the 1995 level

Use 50% of the produced manure for energy

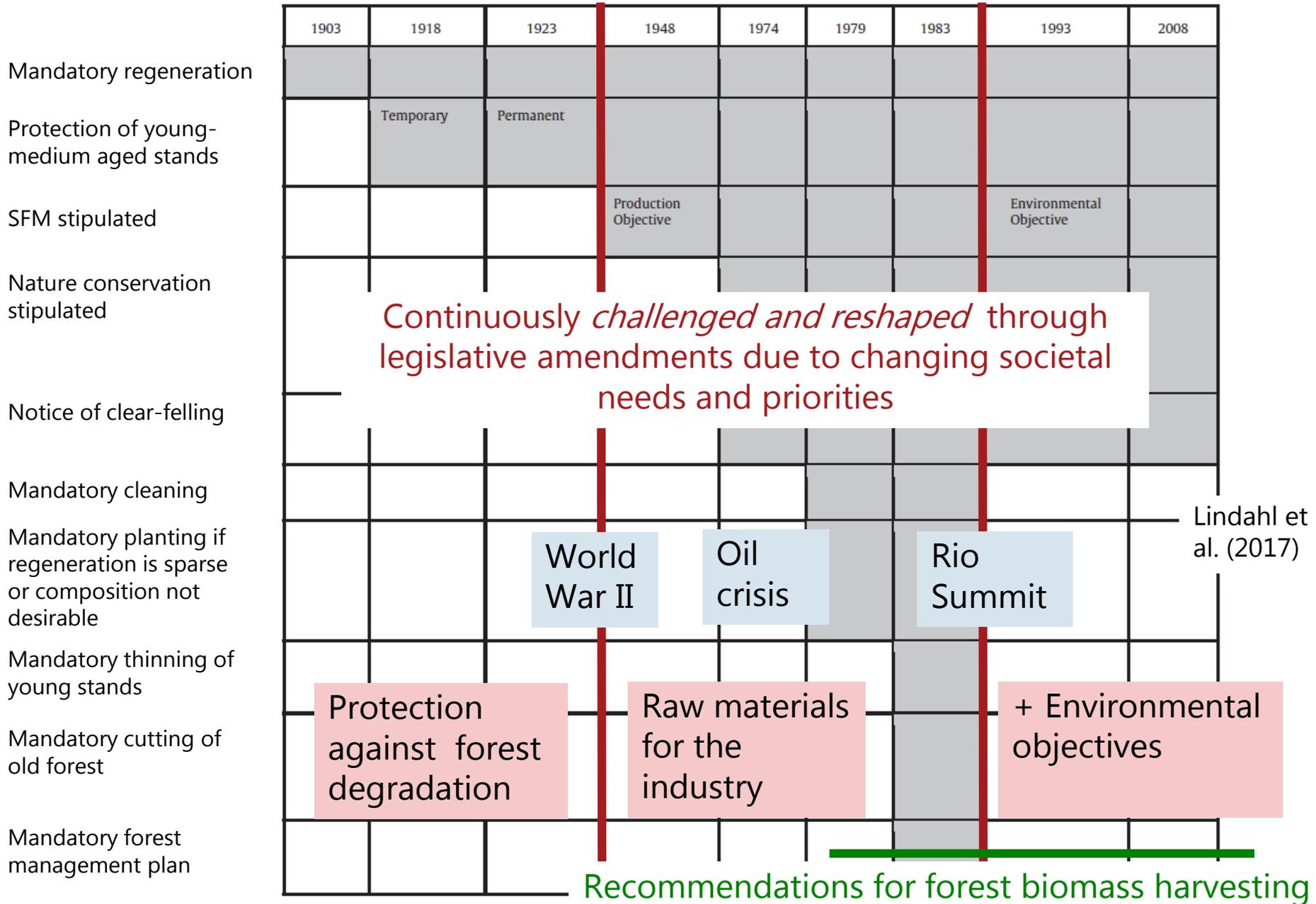
Better framework conditions for biogas, and establishing a biogas Task force to ensure improved biogas deployment. Shift in biogas paradigm towards focus on energy policy goals. The supporting frameworks were adopted and approved by the EC in 2013. A restriction that the support cannot be given for both investments and operation was removed by the EC in 2014.

Case study – Biogas governance in Denmark

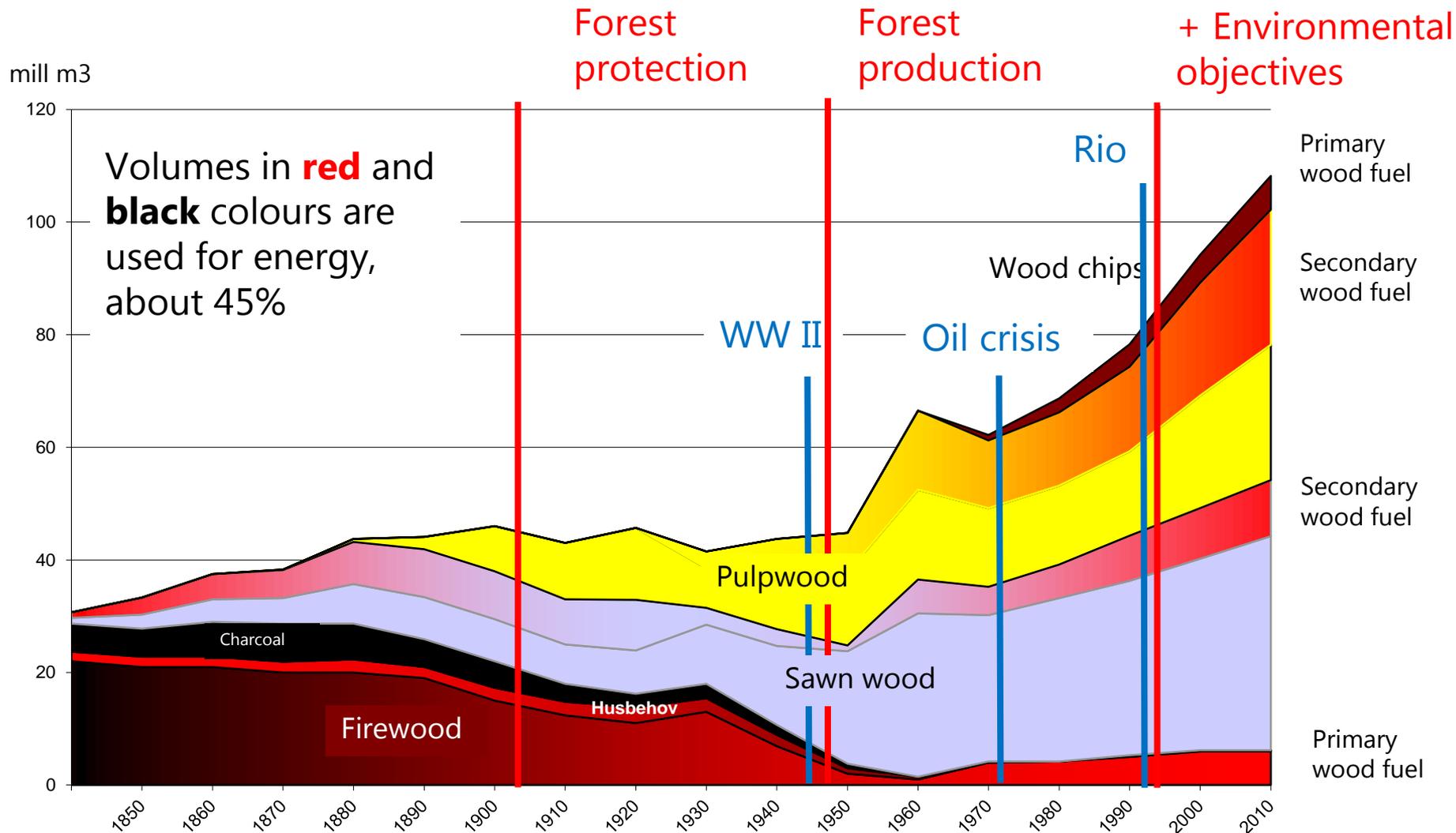
Continuously *challenged and reshaped* through the interaction of the actors in the biogas arena with the aim to promote the potential sustainability benefits and address potential sustainability challenges of the manure-based centralized biogas concept



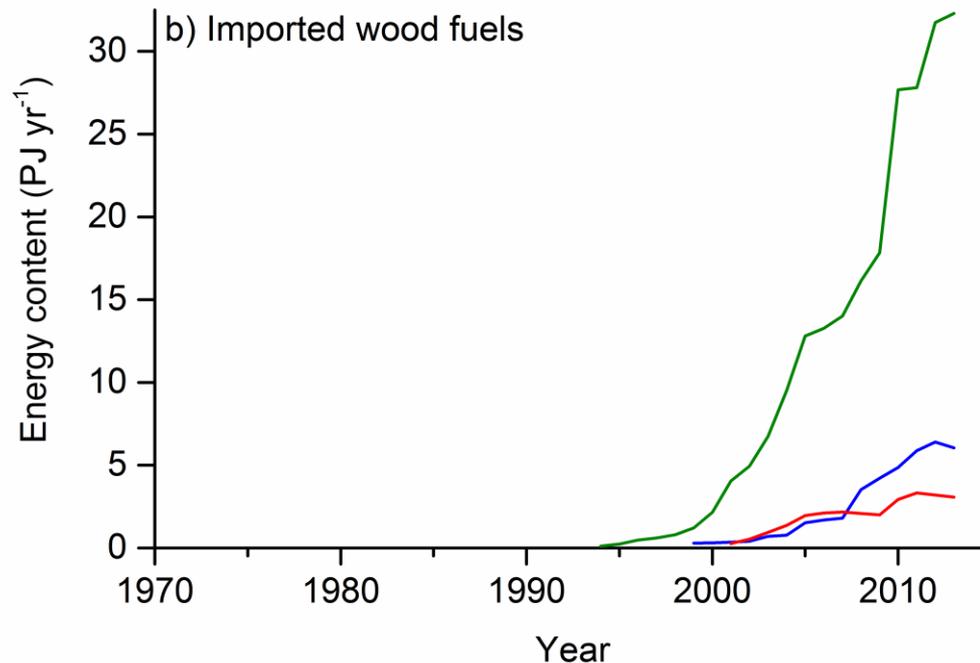
Forest legislation in Sweden – three phases



Forest harvesting in Sweden



Increasing imports of wood fuels (in Denmark and other European countries)



- Call for mandatory regulation of high prescriptiveness by NGOs and environmentalists in exporting and importing countries
- Concerns over the deforestation, forest degradation, climate benefits, biodiversity, soil and water in new energy biomass sourcing areas

Forest bioenergy in Denmark and the EU

'New' energy sector forest regulation and 'old' forest sector regulation

EU Renewable Energy Directive (RED II), 26(5) & (6)

Still to be
implemented

In place

Danish industry agreement

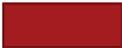
Forest certification

Biomass certification (risk-based)

Alternative documentation

Forest legislation

Recommendations, best management practices (BMPs)

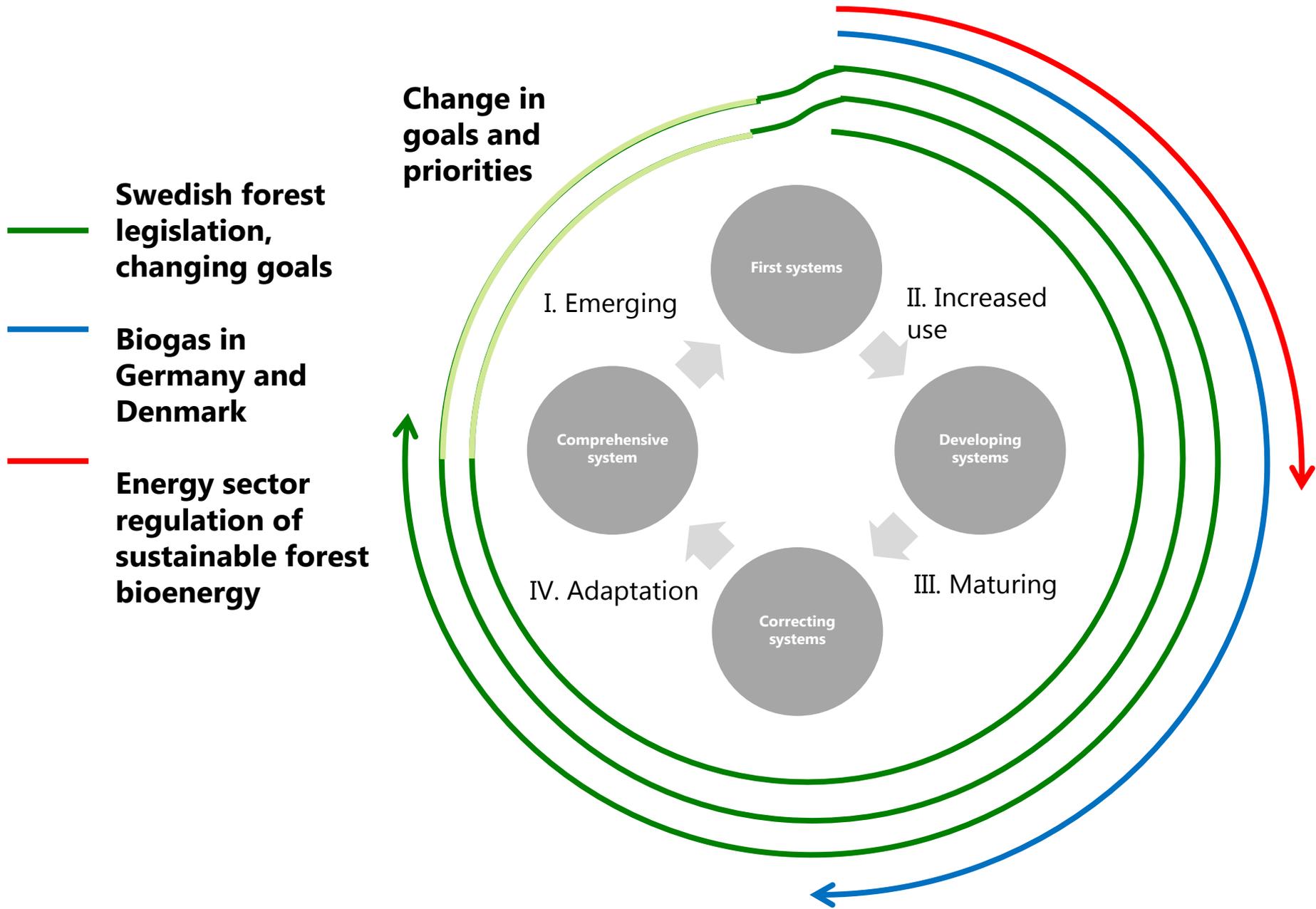
 'New energy sector regulations'

 'Old forestry sector regulations'

Hypothesis about phases of governance development

Phase		Markets	Governance
I	Emergence of systems	Initiation (investment support and financial incentives)	Emerging sustainability governance (limited use and scope)
II	Increasing use	Market build-up (continuous financial incentives)	Proliferation (broader use and scope)
III	Maturity	Consolidation (market liberalization)	Increased uptake (adjustment as response to critics or monitoring)
IV	Continuous adaptation	Integration	Continuous adaptation to new conditions and knowledge

Interpretation of phases as an adaptive approach³⁶

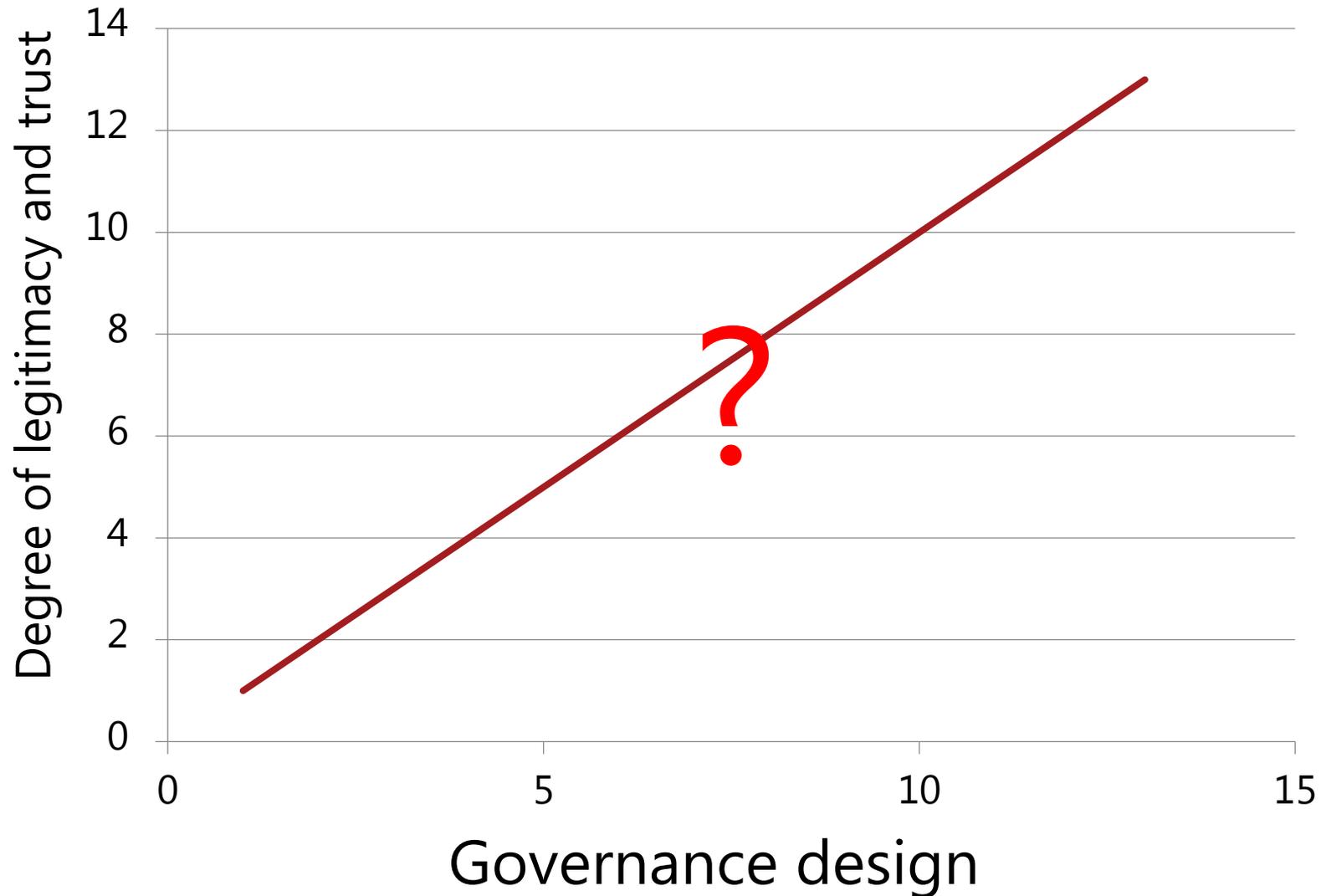


Hypothesis about increasing trust and legitimacy from one phase to the next?

Phase		Input legitimacy	Output legitimacy	Throughput legitimacy
I	Emerging	Low	Low	Low
II	Increasing use	Low	Low	Medium
III	Maturing	Medium	Medium	High
IV	Continuously adapting	High	High	High
I	New issues emerging	Low	Low	Low

How to move the next phase?

Correlation between governance design and legitimacy and trust?



- # Flexibility and prescriptiveness of sustainability governance is not necessarily correlated with trust and legitimacy, but it may be....
- # A mix of approaches is often used

Defining flexibility and prescriptiveness

		Flexibility		
		<u>Voluntary</u> Optional or recommended policies encouraging action	<u>Elective</u> Choose method of compliance to a general mandatory policy goal	<u>Mandatory</u> Specific action required
Prescriptiveness	<u>Managerial</u> Managerial, procedural systems	System or plan based. Flexible	System or plan based. Semi-flexible	System or plan based. Semi-flexible
	<u>Compliance</u> Compliance with BMPs	BMP based. Flexible	BMP based. Semi-flexible	BMP based. Inflexible
	<u>Measured</u> Measurement, monitoring, inventory to record data	Measurement-based Flexible	Measurement-based Semi-flexible	Measurement-based Inflexible
	<u>Substantive</u> Explicit on-the-ground targets and thresholds	Goals defined with specific suggestions for actions listed Flexible	Specific goals can be obtained through several methods. Semi-flexible	Policy requirements requiring specific actions Inflexible

Preliminary assessment

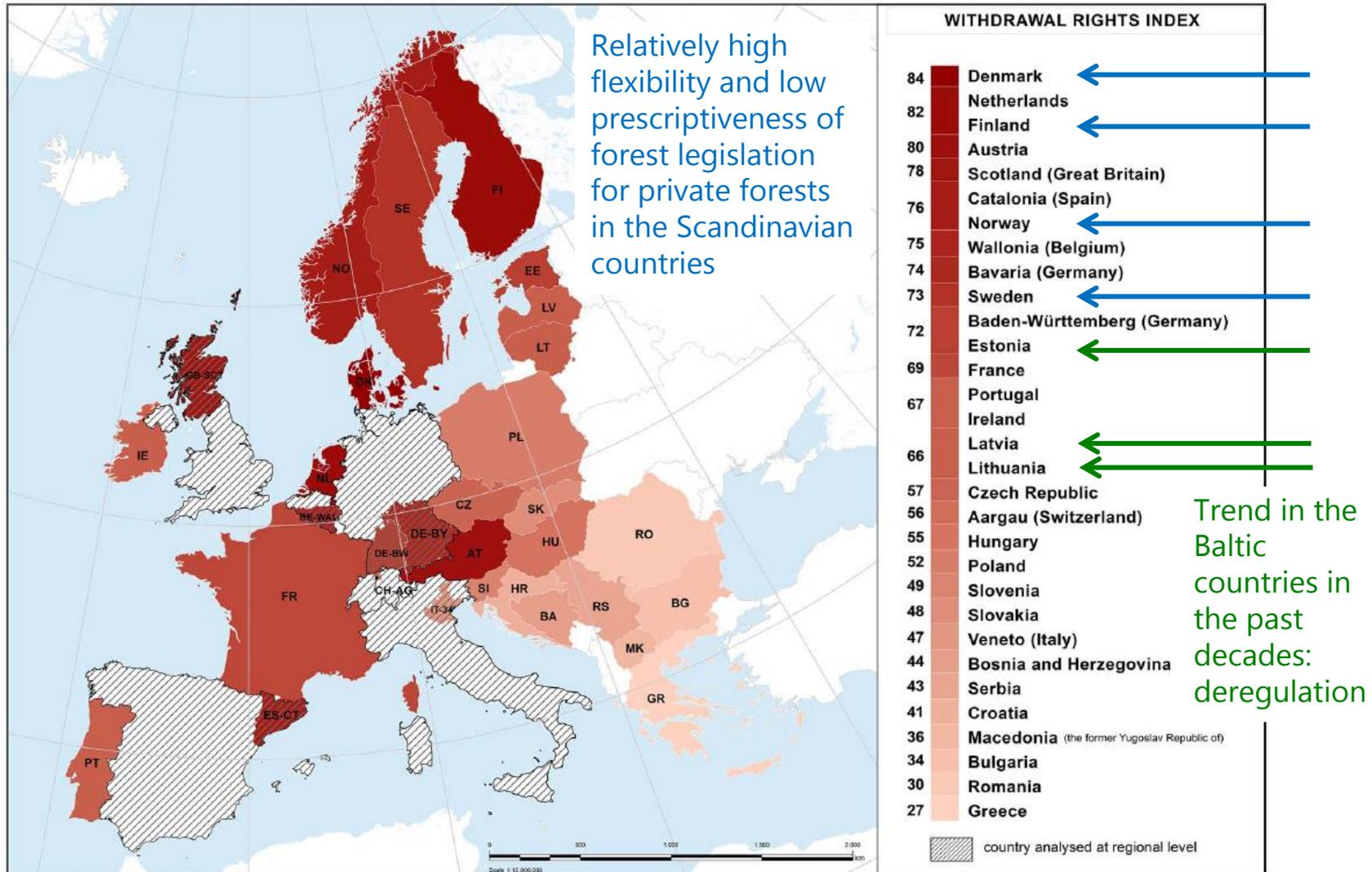
	Stand and Site Guide	FSC (IGI)	SFI	CSA
Residual Retention	<p>New clear cut harvest areas shall contain 0.5 hectares within each 50 hectare circle or hexagon across the block. Wildlife trees within clear-cut operations must be retained at a rate of 25 stems/ha with a minimum of 5 large living trees standing on the landscape.</p> <p>Mandatory/substantive</p>	<p>The organization shall effectively maintain the continued existence of occurring native species and genotypes, and prevent losses of biological diversity especially through habitat management in the management unit. Thresholds for habitat features that should be considered include guidelines for retention of trees, woody debris, and</p> <p>Elective/managerial</p>	<p>Maintenance of post-harvest conditions (e.g. retained downed woody debris) are listed as indicators for restoration of post-harvest conditions to maintain site productivity.</p> <p>Elective/managerial</p>	<p>Coarse woody debris and in-stand recognition is a core indicator for Ecosystem Diversity, but no threshold values are established.</p> <p>Documentation and planning requirements.</p> <p>Elective/managerial</p>
Riparian buffers	<p>5 gradient-based AOC (area of concern) prescriptions ranging from 30 m to 90 m. Within the AOC, no machine or felling of trees are permitted within the inner 3 meters of the bank.</p> <p>Mandatory/substantive</p>	<p>The organization shall protect or restore natural watercourses, water bodies, riparian zones, and their connectivity. The organization shall avoid negative impacts on water quality and quantity and mitigate those that</p> <p>Mandatory/managerial</p>	<p>Operations must meet and exceed all jurisdictional water quality laws within Canada and US EPA programs. Operations must implement plans, BMPs, maps and protection measures based on soil type for riparian</p> <p>Mandatory/compliance</p>	<p>Planning and identification requirements including the development of operational guidelines, mapping, and considerations for best management practices. Appropriate mitigation</p> <p>Elective/managerial</p>
Skidding Requirements	<p>Must mitigate erosion and monitor road/ road networks. Additional AOC prescriptions specify right of way widths based on species or environmental value being protected.</p> <p>Mandatory/substantive</p>	<p>In addition to measures related to soil in Principle 6 and Principle 10, Measures are implemented to reduce compaction, erosion, and land slides.</p> <p>Mandatory/compliance</p>	<p>Implement forest management practices to protect and maintain forest soil productivity. Identification of soils vulnerable to compaction, criteria for site preparation and road</p> <p>Elective/managerial</p>	<p>When monitoring of operations reveals that soil disturbance exceeds thresholds, direct measures of soil condition should be performed.</p> <p>Elective/measured</p>
High Conservation Value Forest Cheung and Smith (2018)	<p>Protections under the Endangered Species Act, including prohibitions on killing, harassing, capture or possession of any endangered, threatened or extirpated species.</p> <p>Mandatory/substantive</p>	<p>The organization shall maintain and/or enhance the High Conservation Values in the Management Unit through applying the precautionary approach. The organization shall perform assessment of values using best available information, and develop effective strategies to maintain identified values through</p> <p>Mandatory/measured</p>	<p>Program participants shall protect threatened and endangered species, Forests with Exceptional Conservation values and old-growth forests.</p> <p>Elective/managerial</p>	<p>Operations must identify sites of special, biological, geological, heritage or cultural significance within the defined forest area and implement management strategies</p> <p>Mandatory/managerial</p>

Flexibility and prescriptiveness of forest withdrawal rights in private forests in Europe: approval to harvest, amounts to harvest, and harvest trees yourself, mushrooms, game grazing

Less requirements, more flexible



Many requirements, less flexible



Case study – Biofuel production in the U.S.

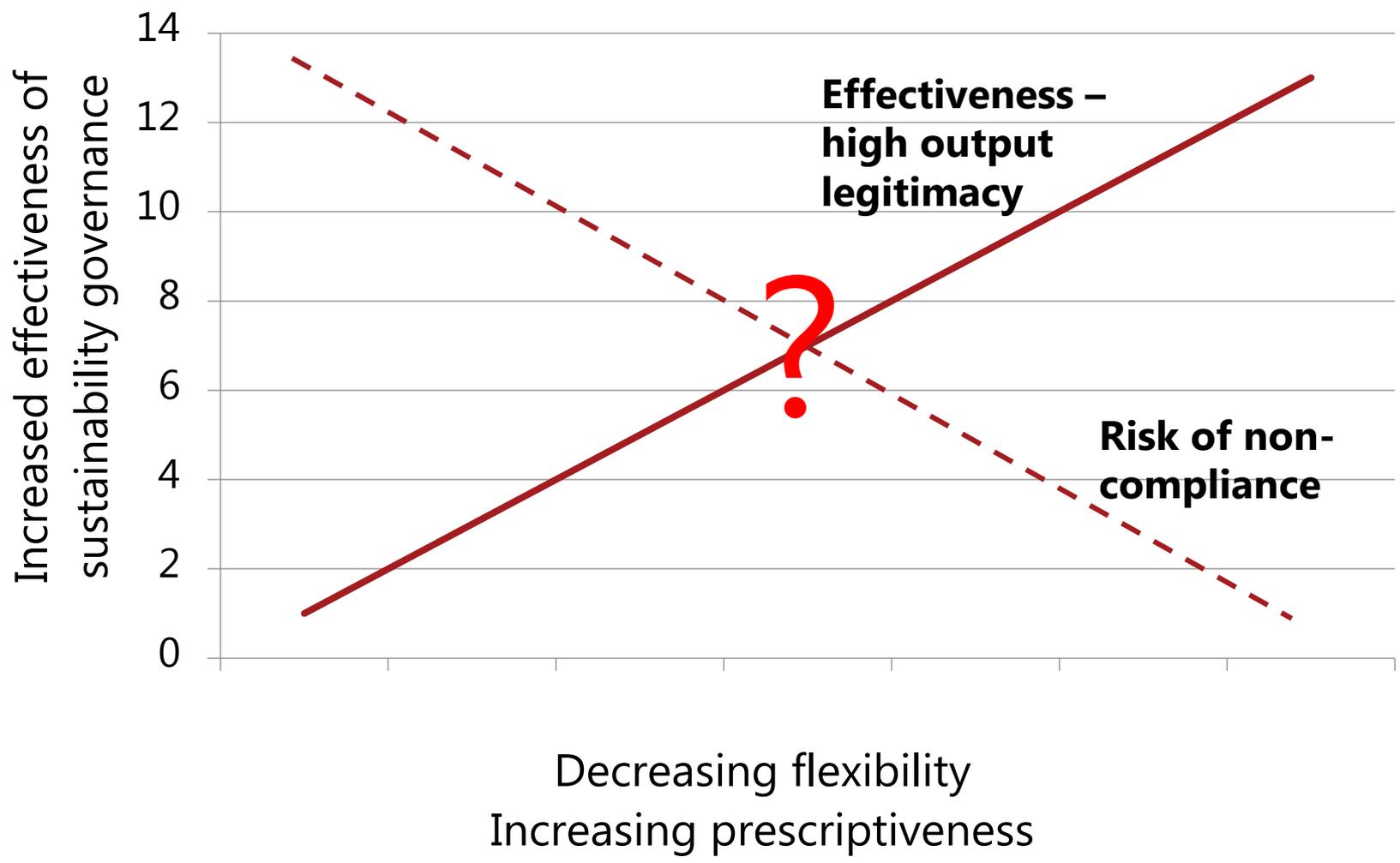
A mix of approaches are used

Major Concerns		Regulation	Conservation Incentive Program	Other Voluntary Program	Certification
Soil Erosion		SWRCA	CSP		Council on Sustainable Biomass Production (CSBP)
Water Pollution		CWA	EQIP	BMP	
Air Quality/GHG Emissions		CAA, EISA	LCI		
Biodiversity		ESA	AMAP		

...as is the case with:

- Biogas in Denmark
- Biofuels in Canada
- Forests in North America and Europe, and generally

Common hypothesis: less flexible (mandatory) and more prescriptive regulation is more effective



Voluntary approaches for part of the supply chain are gaining acceptance through risk assessments

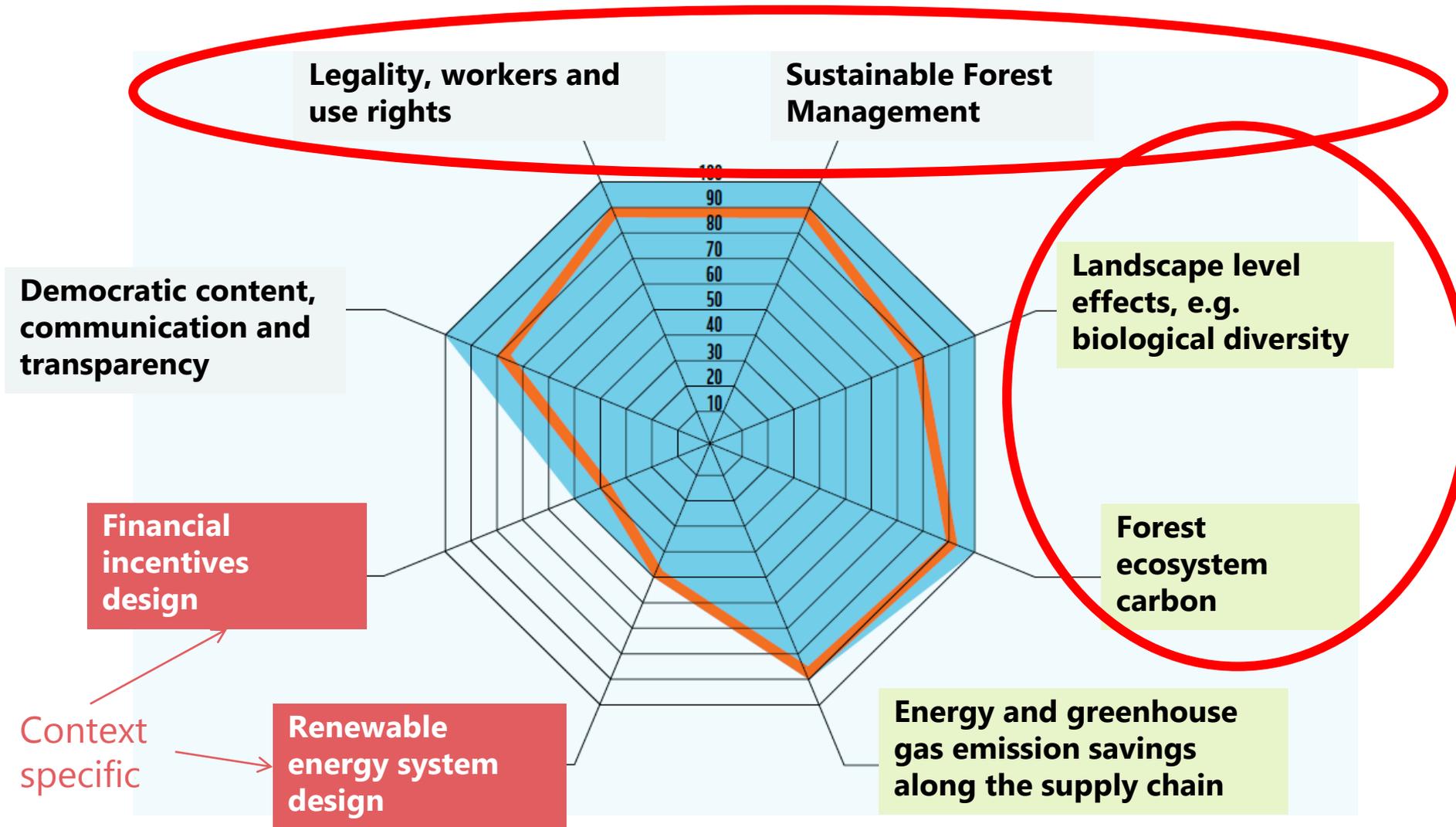


Likelihood

	Low	Medium	High
High	Yellow	Red	Red
Medium	Green	Yellow	Red
Low	Green	Green	Yellow

Impact

Emerging risk-based approaches to verification

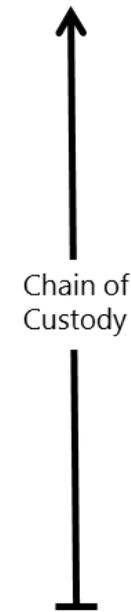
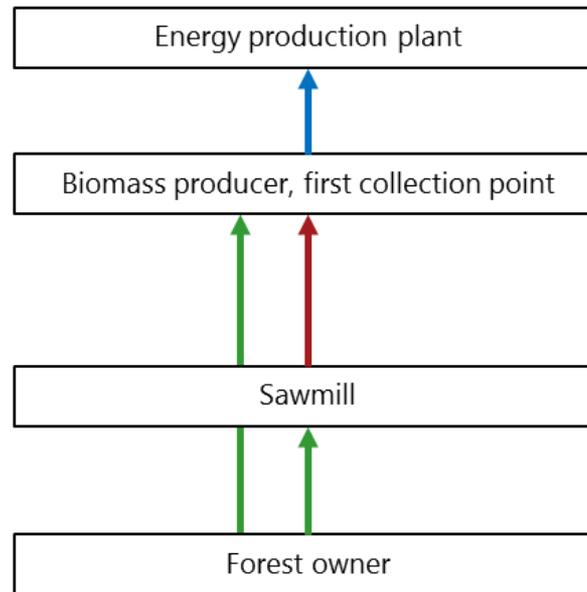


Risk-based Approaches vs. forest management unit (FMU) level verification

Risk-based approach to verification of low risk of non-compliance with SFM standards

FMU level approach to verification of compliance with SFM standards

Risk assessment (at the desk) and auditing of all indicators assessed with specified risk, when there was inadequate documentation to show low risk



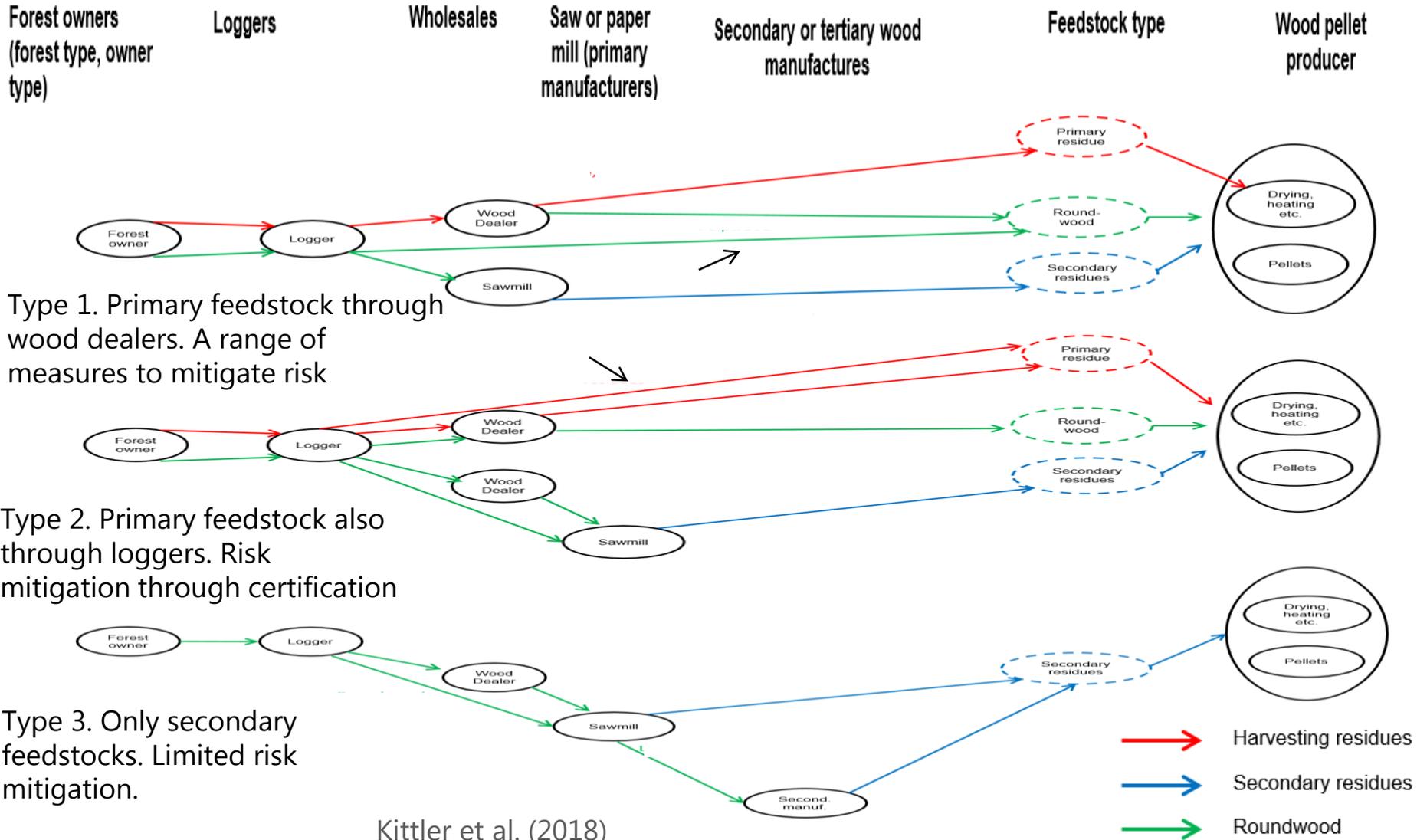
Auditing of all indicators, in principle (forest management certification)

- Wood pellets
- Sawdust / secondary residues
- Roundwood, primary residues

Case study - wood pellets in southeastern U.S.

Three types of wood pellet supply chains

Risk Assessments to standards of PEFC Controlled Sourcing, FSC Controlled Wood, and SBP



Databases for documentation of sustainability against multiple standards are emerging

Existing monitoring systems are increasingly being used for documentation of voluntary sustainability standards

Emerging (use of) databases - forestry

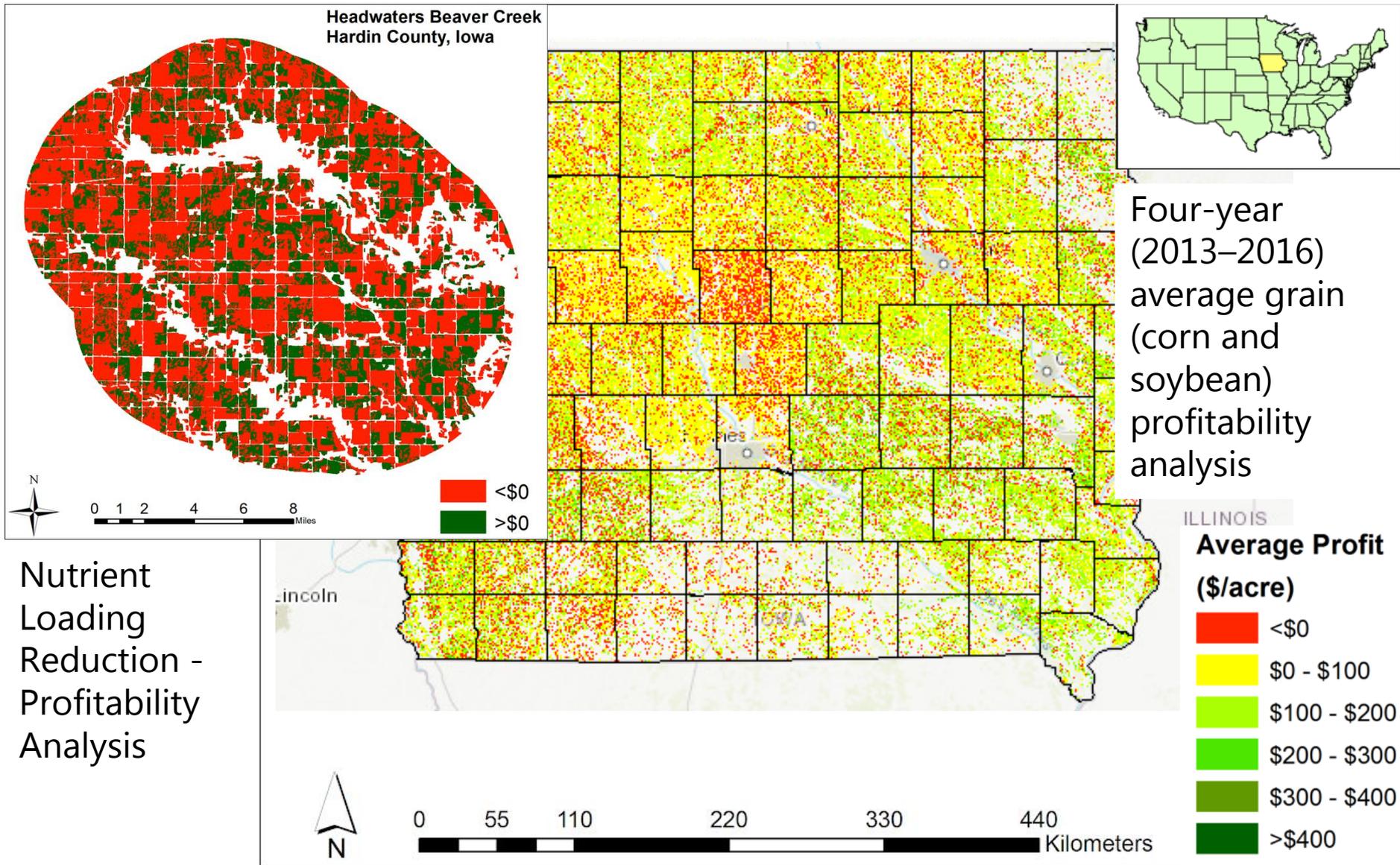
- NepCon Sourcing Hub to show compliance with the EU Timber Regulation
- FSC, NepCon, Rainforest Alliance Global Forest Registry, to show compliance with FSC Controlled Wood requirements
- The Sustainable Biomass Partnership Data Transfer System (DTS) for collection, collation and transmission of the data required by generators using biomass to produce energy, e.g. for reporting against national requirements for GHG emission savings.
- U.S. Forest Inventory Analysis data (e.g. carbon), U.S. Nature Serve (biodiversity).

Workshop in San Francisco, 5 November 2018, to explore state-of-the-art for such data, and identify 'data gaps'.

Case study – Governing sustainability of agriculture-based Bioeconomy as part of the Canadian Agricultural System ⁵¹

1. Federal Sustainable Development Strategy (2016-2019)
 - 13 long-term goals; each Ministry is required to select goals and report its progress annually
2. Environmental Legislation
 - Federal (e.g. water, pesticides) and provincial (e.g. nutrient management)
3. Environmental Monitoring
 - State of the Environment as a whole
 - Agricultural System (regional level, Agri-Environmental Indicators)
 - Local studies and remote sensing
4. Federal and/or Provincial Agreements on common objectives
 - Legislation and standards are adapted for “critical” issues where regulation is the most appropriate tool
 - Regulation is one instrument for government action; the outcome is more important than the specific instrument
5. Financial incentives to adopt new technologies (e.g. precision agriculture) or better management practices
 - Priority of the Canadian Agricultural Partnership (5 year policy framework)
6. Voluntary sustainability networks
 - Canadian Roundtable for Sustainable Crops (CRSC), Canadian Agri-Food Sustainability Initiative (CASI), Canadian Centre for Food Integrity (public trust) – building databases to provide documentation against different standards.

Case study – Profitability of integrating energy crops in non-profitable fields in Iowa



Recommendations

- Clearly define concepts and terms
- Take a more holistic approach to sustainability standards – include criteria for renewable energy systems, financial viability and incentives
- Put in place adaptive frameworks with data monitoring platforms and stakeholder communication platforms help to act with due diligence in matters of great complexity – needed as markets and governance systems go through phases of development
- Initiate studies to explore which mix of governance means that is most efficient and effective in different conditions
- Use risk-based approaches as an opportunity to obtain more cost-efficient and equally effective sustainability documentation
- Explore opportunities to use more of the existing databases for documentation of sustainability, and developing these for the future.



Thank you!

Questions and comments?