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PILOT PROJECT DEVELOPING SUSTAINABILITY IMPACT ASSESMENT TOOLS ON THE FIELD OF FOREST POLICY

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ABSTRACT

The ongoing environmental dialogue brought sustainable forest management to the centre of discussions in the beginning of the 1990's. Followed by this, a wide variety of initiatives concerning the development of both governmental- and private sector forest policies have taken place throughout the world. Due and on the side of the development of the forest policy field, the methods and approaches for forest policy analyses have also evolved, bringing the scientific viewpoints part of the policy debates.

The main objective of this thesis was to study the opportunities to create a Policy Analysis framework for a sustainability impact assessment tool (ToSIA) by developing a national policy database consisting of the most relevant national forest policy data and indicator-based thresholds for Finland.

To create a database, an excel sheet for data collection was created. Pilot data from this created database was then added to the EFI Policy Portal under development to test a way of presenting the collected national data. After this a conceptual linkage was designed between ToSIA and the EFI Policy Portal to bring the data easily available for the ToSIA user. Last, the idea of using the collected national data in decision support was tested by comparing a small number selected targets/thresholds found from the documents with the results derived from ToSIA.

Including other document and data information, the created national policy database consists of a total of 193 forest policy targets/thresholds found from the 19 documents used in the data collection. In the database each target/threshold is linked with a sustainability indicator. From the targets/thresholds the 147 non-legally binding targets were immediately usable, while 46 legally binding targets need further development.

The results from the test comparison between ToSIA results and the database targets/thresholds point out the importance of policy information in the decision making process, and the potential of using a target specific database making this information available for the decision maker. Further development of such a tool could open a dimension to examine forest policy documents.

Keywords: sustainability impact assessment, decision support, forest policy, policy database, policy targets/thresholds

FOREWORD

As the concentration ability of a human being tends to be at its best when starting something, it is good to begin with one of the nicest parts of this work; thanking the people involved. So, many thanks to my supervisors Paavo Pelkonen for advice and support along the entire process, Diana Vötter for guiding me through the world of SIA and to Blas Mola for taking the wheel in the end and bringing the work over the finish line. Also many thanks to Michael den Herder for sacrificing his time to help me with the ToSIA chains, to the friendly people of EFI, to Jouko Tuovola Foundation for the very much appreciated financial support, to Janne Immonen for peer support and accommodation and of course to mom and dad for providing me an "office" for the last few months.

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1 INTRODUCTION

Since the beginning of the 1990's, the policy aspects of sustainable forest development have been greatly influenced by the ongoing global forest dialogue (Buttoud, 2004). Followed by the United Nations Conference on Environment and Development (UNCED) held in Rio 1992, a great number of initiatives concerning the development of both governmental- and private sector forest policies have taken place throughout the world (FAO, 2002). Followed by the discussion, the forest policy related issues have grown ever more complex, addressing issues such as climate change, forest fires, inequality and poverty, loss of biodiversity and forest-based sustainable development (Tikkanen, 2010). The wide variety of actors and issues on the global forest policy field creates great challenges for the international forest governance, making it "a complex hybrid mix of international law, soft law, and non-government performance-based measures" (IUFRO, 2010).

In Europe, the policy tools for promoting and implementing sustainable forest management (SFM) have been developed and implemented for many years and addressing the issues related to climate change, SFM brought the forest issues in the centre of discussion in the 1990's (MCPFE, UNECE/FAO, EFI, EfE/PEBLDS, 2008). The European Union does not have a common forest policy, however there are numerous legislation and policy initiatives within different sectoral EU policies which have a great impact on the forest policy of the member states (EC, 2003).

The two main instruments at the EU level designed especially for forest issues are the EU Forest Strategy (1998) and the EU Forest Action Plan (2006) (Winkel & al., 2009). Independent from the EU, the Forest Europe process (Ministerial Conference on the Protection of Forests, MCPFE), a pan-European, inter governmental policy process, has been working towards protection and sustainable use of forests in Europe since 1990 (Pelli & al., 2009), and since 2011 officially been aiming towards a legally binding agreement on forests in Europe (Ministerial Conference on the Protection of Forests in Europe, 2011). On national level in Europe, progress concerning SFM policies has been made within the context of preparation and implementation of National Forest Programmes (NFPs), developed in the framework of MCPFE (Commission of the European Communities, 2005).

Due and on the side of the development of the forest policy field, the methods and approaches for forest policy analyses have also evolved, bringing the scientific viewpoints part of the policy debates (Buttoud, 2004). As there is a clear need for inter sectoral policy approach on national and EU level (Janse, 2007) and demand for new methodologies and tools to meet the new challenges (Päivinen & al., 2010), forest policy analysis used in the forest policy research could become a useful tool for policy makers when formulating and implementing new forest policy means, programs and processes (Benko, 2010).

On a global scale, the World Summit on Sustainable Development of Johannesburg (2002) brought forests firmly in to the context of sustainable development (Commission of the European Communities, 2005). To support the implementation of the Strategy for Sustainable development [COM 2001 264], the European Commission published in 2002 a communication on impact assessment (COM (2002) 276). The idea of the communication was to establish a new integrated method for sustainability impact assessment (SIA), which could work as one global instrument and aid decision making by identifying tradeoffs and positive and negative impacts of proposed policy actions (EC, 2002). The EFORWOOD project which developed a Tool for Sustainability Impact Assessment (ToSIA) is an example of an EU funded project aiming to develop such a tool for sustainability impact assessment of Forest Wood Chains (FWC) (MCPFE, UNECE/FAO, EFI, EfE/PEBLDS, 2008). The SIA was set to be implemented in all the major initiatives presented in the Annual Policy Strategy or Work Programme of the Commission (EC, 2002). The agreements about the implementation and creation of the tool for sustainability impact assessment were made at the Göteborg (June 2001) and Laeken (December 2001) European Councils (EC, 2002). The term sustainability impact assessment itself can be defined as: "A means of identifying and assessing the likelihood and scale of the economic, social and environmental impacts of a policy change or rules-measure" (George & Kirkpatrick, 2003).

1.2 Research objective

The main objective of this work is to study the opportunities to create a Policy Analysis framework for (To)SIA by developing a national policy database consisting of the most relevant national forest policy data and indicator-based thresholds for Finland. Secondary objectives are:

- Enter pilot data from the created database to the EFI Policy Portal, which is currently being developed by EFI.
- Design a functional linkage between ToSIA Policy Analysis and the EFI Policy Portal.
- Create a simple test of the functioning of the ToSIA Policy Analysis Tool (with linkage to the EFI Policy Portal).

This study serves as a pilot sub-project in the development of ToSIA and the EFI policy portal. It is addressed for people working with sustainability impact assessment and to provide easy access to forest policy documents and information. The collected national data will be added to the EFI Policy Portal in the future by EFI. In this work merely a part of it is used to illustrate the designed functioning of the EFI Policy Portal. The purpose of this thesis is work as a part of the ongoing process of developing the Policy Analysis tool of ToSIA to become a functioning decision support tool for various users of ToSIA.

2 THEORETICAL FRAMEWORK

Even as the thesis is conducted in a rather pragmatic manner, the thematic areas of SIA tools and their use in decision making offer interesting examples from the theory points of view. The chosen examples; Industrial Ecology (IE) and Evidence Based Policy (EBP) are selected because their ideas can also be applied on the field of SIA tools for FWCs. The idea is to bring more theoretical depth to this thesis by introducing these two ways of thinking and to provide a glimpse to the ongoing discussion related to the thematic areas of this thesis.

Due to the practical nature of this thesis, the theoretical framework was decided to function on a more broad level of ideas, instead of diving into details and computer science. The aim is to provide the reader with notions of what the ideas in this thesis partly are based on and also raise a couple of questions about their role in possible practical use. These two theoretical areas were chosen because of ToSIA. IE was chosen because ToSIA shares its ideas of examining material flows and investigating ways to use materials during their life cycles. Because ToSIA is a decision support tool, EBP was selected to point out some questions regarding the use of such a tool. Together these two theoretical areas will provide one possible angle to clarify the fundamental ideas responsible for the development of SIA tools today.

2.1 Industrial Ecology

The idea of measuring the sustainability of an entire FWC, presents a perfect opportunity to connect it with the thoughts of IE. As the name Industrial Ecology suggests, IE is considered to be industrial, focusing on product design and manufacturing processes (Lifset, 2009). Strongly simplified, as in the history of business the leading idea has been to extract energy and materials from the natural environment and then flow the wastes back to the environment (Rosen, 1997), the idea of IE is to move from linear use of raw materials towards a more cyclical system (Garner & al, 1995) or as stated by Frosch and Galloupoulos (1989); towards an industrial ecosystem , this way minimizing the production of waste and maximizing its economical potential by making the wastes serve as inputs to other industries and processes (Frosch, 1992).

As the idea of IE has been developing for several decades (Frosch, 1992) the concept was made widely known in the late 1980's by engineers who were looking for ways to deal with industrial waste which was causing harmful environmental impacts (Rosen, 1997). In the early concept, industrial system was portrayed to able to function through a web of connections like an ecological system in which organisms live and consume each other and each other's wastes (Frosch, 1992). This new approach was seen as a way for developing the industrial design and moving towards more sustainable manufacturing strategies (Jelinski & al., 1992).

One fundamental goal of IE is to trace and calculate the flows of energy and material through different systems (Garner & al, 1995). The tracking of these flows is also known as Industrial Metabolism (Lifset, 2009). By pursuing to optimize these flows, IE is able to draw the boundary for analysis instead of just stating the role of risks (Lifset & Graedel, Industrial Ecology: Goals and Definitions, 2002). The idea of calculating the material flows is also the basis of the functioning of ToSIA, which then links the flow to a set of sustainability

indicators (Werhahn-Mees & al, 2011). As the concept field of IE is full of terms such as; closed cycles and material flows, it is good to mention Life Cycle Analysis or Life Cycle Assessment (LCA), which is considered to be one of the key subfields of IE (Suh & Kagawa, 2009) and a common technique when evaluating forest sustainability issues (Straka & Layton, 2010). LCA is defined by Rebitzer et al. (2004) as "a methodological framework for estimating and assessing the environmental impacts attributable to the life cycle of a product".

Jelinski et al. stated already in 1992 (Industrial ecology: Concepts and approaches), that it is clearly obvious that the resources of this planet are beginning to be overrun by human activities, and called for a new industrial design. The same statement was made by Ehrenfeld in 2004 (Industrial ecology: a new field or only a metaphor?), however he also pointed out that to tackle this issue, IE has managed to produce a community of practice in several sectors such as business, government and academia. Without questioning the importance of sustainability, however he also states that as a young field, IE has problems to achieve consensus even among its users and advocates (Ehrenfeld, 2004). One problem has been the diverse group of users as IE has also been accused for the use of broad terms and vague interpretations, lack of objectives and clear strategies, enabling it to work merely as a broad catch phrase similar to sustainable development (O'Rourke & al., 1996) as no single definition has been generally accepted (Garner & al, 1995).

2.2 Evidence Based Policy

Since the forest-based sector has been one of the forerunners in operationally implementing the sustainability concept and many methods have been developed to study the impacts of forestry activities (Berg & al, 2012), it is interesting to examine the idea of SIA supported decision making from the view point of EBP to raise questions about the role of research in policy making. Although EBP is not considered to be a novel concept, it became widely known by the Blair Government after the 1997 election in UK (Banks, 2009) and has also gained popularity for example in Australia (Marston & Watts, 2003). It has also been stated that the trend of EBP has been beneficial for the interaction between researchers and decision makers around the world, also including the institutions of the European Union (European Commission, 2010).

The easily acceptable idea of EBP is that the public policy making and practice should be based on the best available evidence (Nutley & al, Evidence Based Policy and Practice: Cross

Sector Lessons From the UK, 2002) (Marston & Watts, 2003) and its primary goal to improve the reliability of advise concerning different policy options (Productivity Commission, 2010). "Without evidence, policy makers must fall back on intuition, ideology, or conventional wisdom — or, at best, theory alone" (Banks, 2009). However Perri (2002) notes that instead of lacking evidence, the policy makers are more likely to meet the problem which information to lean to, when facing the "information overload". Balancing between these two extremes, it seems as if "there is the potential for policy decisions to be better informed by available evidence than has often hitherto been the case" (Nutley, 2003).

The overreaching goal of the ToSIA Policy Analysis tool, to which this thesis serves as one of the pilot projects, is to inform and support the decision-making of FWC stakeholders and especially policy makers (Vogelpohl & Rametsteiner, 2011). This goes hand in hand with the idea of EBP of supporting the decision-makers with the best possible information. However, within the EBP discourse there is an ongoing discussion around the question; what should be the relative value of research and other evidence for policy making? (Marston & Watts, 2003) For example Nutley et al. (2002) take the middle ground by stating that while evidence is just one necessary part of policy making and "policy making itself is always inherently political" EBP should rather be referred to as evidence influenced or evidence aware policy.

To function, EBP is considered to require good data, analytical skills and political support (Productivity Commission, 2010). Also Nutley (2002) has listed requirements for improving the use of evidence in policy and practice:

1. Agreement as to what counts as evidence in what circumstances

2. A strategic approach to the creation of evidence in priority areas, with concomitant systematic efforts to accumulate evidence in the form of robust bodies of knowledge

 3. Effective dissemination of evidence to where it is most needed and the development of effective means of providing wide access to knowledge
 4. Initiatives to ensure the integration of evidence into policy and encourage the utilisation of evidence in practice

As the idea of EBP developing policy settings by using high quality evidence is prestigious (Productivity Commission, 2010), however it is also rather easy to be cynical towards the idea of it gaining a stronger position (Nutley, 2003). Even if policy choices

could be made purely on technical grounds the complexity and uncertainty involved would make them difficult (Banks, 2009). In addition to difficulties fulfilling the criteria stated above, policy making involves a long list of other factors than evidence, such as: habits and tradition, lobby system, consultants and pressure groups, timetables, policy making process itself, unanticipated events, capacities of institutions and of course one of the major driving forces of policy making; political ideologies (Davies, 2004). To conclude, as it is not reasonable to think that research can provide definitive answers to policy questions and that policy process could or should be based on some clear rational model of thinking, however it is as unreasonable to assume that there was no way of bridging the policy/research divide (Nutley, 2003).

3 METHODS AND MATERIALS

3.1 Approach

This work is firmly linked with two other projects: the EFORWOOD project and EFI Information Portal on Forest Policies, Institutions and Instruments project.

The EFORWOOD project – Sustainability Impact Assessment of the Forestry-Wood Chain, was a consortium comprising from 38 organizations from 21 countries and was funded by the Sixth Framework Programme of the EU. The aim of the four year project (2005-2009) was to create a tool for Sustainability Impact Assessment (ToSIA) of forest wood chains (FWC). A very important element of the EFORWOOD project concerning ToSIA was the creation of a set of sustainability indicators (SI) gathered in a Data Collection Protocol (DCP); (Berg, 2008), aimed to cover the whole FWC. (Lindner & al., 2011) (Päivinen & al., 2010) Another product of the project was the created EFORWOOD Policy Database, which included all relevant international and European FWC-related policy and legislative documents. The EFORWOOD Policy Database information was also collected by using the above mentioned SIs in the DCP. (Aggestam & Weiss, 2010) These three products: ToSIA, EFORWOOD Policy Database and the SIs all play a central role in this work.

3.2 ToSIA

The most significant product of the EFORWOOD project was the tool for sustainability impact assessment, ToSIA. This decision support tool is specifically designed for the use of

forestry sector to help the industry, policy makers and researchers to analyze the sustainability effects of various actions and external forces affecting FWCs. ToSIA covers all three main areas of sustainability, environmental, social and economic, using a consistent framework covering the full life cycle from forest to the end of life products. (European Forest Institute) A set of indicators linked with forest sector production processes are used to assess the sustainability impacts. The sustainability impacts are linked to forest sector operations, by using the material flow of the FWC. (Lindner & al, 2010)



Figure 1. ToSIA uses environmental, social and economic indicators which are linked to the processes of the FWC to analyze the sustainability impacts of FWCs enabling to cover the full life cycle of wood material.

Source: (Lindner & al, ToSIA-A tool for sustainability impact assessment of forest-wood-chains, 2010).

The other project this work is firmly linked with, the EFI Information Portal on Forest Policies, Institutions and Instruments, is an ongoing 12 month project of the EFI, which started in the autumn of the year 2011. The vision of the project is to make the EFI Information Portal, in this work referred to as EFI Policy Portal, the most comprehensive forest policy information system at the pan European level and to provide information for forest policy research and advice. (Baycheva, 2011)

The EFI Policy Portal uses the same software as the widely known Wikipedia, the online encyclopaedia and is a part of a Wicri (Wikis for the Communities in Research and Innovation) project of the University of Lorraine, which started in September 2008. Currently the Wicri network consists of 106 different wikis, which are further categorized into 44 different "families". The EFI Policy Portal is located in the Wicri/Wood community.

(Daunois & Duclos, 2011) The Wiki format was chosen by the Policy Portal Project staff because it was considered to fit the purpose of the portal and to be easy to update and maintain.

3.3 Information from SIA to the users

In their report Aggestam and Weiss (2010) pointed out the potential benefits of using ToSIA type of tool within the context of policy-making in the future. As an example they provided the idea of connecting the ToSIA output values with the EFORWOOD Policy Database to provide an overview whether the set policy targets are reached. This examination was to be done on EU level, since the EFORWOOD Policy Database consists only of EU level information.

The idea of Aggestam and Weiss is carried out in this work by taking it one step further. The aim is to create a national forest policy database of Finland, listing individual targets within the documents for specified indicators, to bring the national forest policy targets and thresholds on the side of the ToSIA output values for comparison. By combining this detailed national data with the already collected global/EU level forest policy data in the EFI Policy Portal and connecting it with the ToSIA output values, it will bring the ToSIA result examination to a new level and support the decision making process.

3.4 Data collection on policies at national level

The examined policy documents were selected by using the categorization presented in the State of Finnish Forests (2011) document and by consulting with Professor Paavo Pelkonen from the University of Eastern Finland. Selection was made to cover only the publications from public institutions of Finland ruling out the company and NGO documents. This was done to keep the work load on an acceptable level.

The documents used in the data gathering:

- Finland's National Forest Programme 2015
- Goverment Resolution on the Forest Biodiversity Programme for Southern Finland 2008-2016 (METSO)
- Renewable energy obligation Package
- Long-Term Climate and Energy Strategy
- Strategy for biodiversity conservation and sustainable use in Finland 2006-2016
- Action plan for biodiversity conservation and sustainable use in Finland 2006-2016

- A Natural Resource Strategy for Finland
- The national strategy for sustainable development
- National Strategy for Mires and Peatlands Proposal
- Proposal for a National Strategy on Invasive Alien Species
- National Strategy for Adaptation to Climate Change
- Forest Act (12.12.1996/1093)
- Act on the Financing of Sustainable Forestry (12.12.1996/1094)
- Act on Metsähallitus (1378/2004)
- Act on the Finnish Forestry Centre (6.5.2011/418)
- Forest Management Association Act (534/1998)
- Act on Trade in Forest Reproductive Material (241/2002)
- Act on the Prevention of Insect and Fungi Damages in Forests (8.2.1991/263)
- Act on energy support for low-grade timber (101/2011) (Still in the Commission)
- Act on the Forestry Centres and Forestry Development Centre Tapio (18.12.1995/1474)
- Act on Forest Research Institute (3.12.1999/1114)

The selected documents cover a fairly wide spectrum of documents related to forests and forestry. The list consists of documents, which have their main focus on for example biodiversity, sustainability, renewable energy, natural resources and climate change, but were chosen because of the far reaching impacts of forests and forestry. The aim was to project the directions to which Finland's forest policies are steered today.

Concerning legislation, the aim was to present the documents which have the most effect on the practical side of forestry in Finland. Environmental legislation, which of course has a certain impact on forestry, was ruled out of the list deliberately.

The institutional dimension was covered by presenting the documents, which give a legal status for the selected governmental forest institutions. This approach was chosen to narrow down the list of organizations, which have an effect on forests and forest use in Finland. The selected institutions were: Forest Research Institute (Metla), Forestry Development Centre (Tapio), Metsähallitus, Forestry Centres and Forest Management Associations.

3.5 The use of indicators

The main tool used in this work for the data collection from the selected documents is the Manual for data collection for Regional and European cases; (Berg, 2008), created during the EFORWOOD project. The PDF of the manual can be found from the following web site: http://www.efi.int/files/attachments/publications/eforwood/efi_tr_36.pdf.This Data Collection Protocol contains the information for having a common format for each indicator regarding

measurement units, boundaries, recommendations and sources and means to procure and calculate values on indicators. The manual presents this information for all the 27 different indicators developed by the publishing of the manual. The manual also lists the various sub-and sub-sub-indicators developed under the indicators. (Berg, 2008)

These 27 indicators (Table 1.) and their numerous sub-indicators are developed especially for FWCs, aiming towards SFM. The three areas of sustainability are covered as such: Indicators 1-9 are used for economic-, indicators 10-17 for social- and the indicators 18-27 for environmental dimensions. The indicator number 31 for recreation and aesthetics was created later on and can be categorized under social dimension of sustainability.

Table 1. The 27 + 1 sustainability indicators as listed in the Manual for data collection for regional and European cases (Berg, 2008)

Indicators
(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product
(02) Production cost: Average production cost and share of cost of wood-based materials
(03) Trade Balance: Imports and exports of wood and products derived from wood, and net trade
(04) Resource use, incl. recycled material: Use of renewable and non-renewable materials classified by virgin and recycled materials
(05) Forest sector enterprise structure: Number of forest holdings and forest-based enterprises classified by size classes
(06) Investment and Research & Development: Investment (gross fixed capital formation) and R&D expenditure
(07) Total Production: Production of goods and services
(08) Productivity: Labour productivity
(09) Innovation: Share of forest-based enterprises with new or significantly improved products or processes, and share of turnover
(10) Employment: Number of persons employed in total classified and by gender and by location
(11) Wages and salaries: Wages and salaries (gross earnings) classified by gender and in relative terms
(12) Occupational safety and health: Frequency of occupational accidents and occupational diseases
(13) Education and Training: Education levels and training
(14) Corporate social responsibility: Forest holdings and forest-based enterprises with third party certified management and share of wood sourced from third party certified sustainable production
(15) Quality of employment: Persons employed part-time, temporary employed persons, and self-employed persons
(16) Provision of public forest services
(17) Consumer behaviour and attitudes: Consumption of wood per capita and consumer attitudes towards forests and forest industry
(18) Energy generation and use: On-site energy generation (from renewables) and energy use classified by origin including the share of self-sufficiency
(19) Greenhouse gas emissions and carbon stock: Greenhouse gas emissions and carbon stock
(20) Transport: Transport volume and distance per mode of transport
(21) Water use: Water use
(22) Forest resources: Area of forest and other wooded land and related growing stock classified
(23) Soil condition: Soil condition as expressed by chemical soil properties, and soil compaction
(24) Water and air pollution: Water pollution classified by organic substances and nutrients, and non- greenhouse gas emissions into air
(25) Forest Biodiversity: Area of forest and other wooded land classified by number of tree species
(26) Forest Damage: Forest area with damage and damaged induced wood supply
(27) Generation of waste: total, hazardous, and categorised by type of waste management
(31) Recreation & Aesthetics

The data collection is done by finding quantitative and quantifiable targets and thresholds stated in the documents. The found individual targets and thresholds are then categorized by one of the SI and their sub-indicators. Because of the broad spectrum of the sustainability concept, many targets and thresholds are fitting under various indicators. In these cases, followed by a consultation, one indicator is chosen to be most representative.

As an example: The Finland's National Forest Programme states that at least 25 per cent of the forest sector employees should be women by the year 2015. This quantitative target can be linked with the employment indicator number 10. The target can be further categorized by the sub- and sub-sub-indicators of the employment indicator. In this case the target would fit under the sub-indicator; Number of persons employed in total 10.2. and the sub-sub-indicator; Classified by gender, female 10.2.2. The numerical values for calculations can then be derived from employment statistics.

3.6 Creation of the excel sheet for data gathering

In addition to the previously stated quantitative and quantifiable targets and thresholds, also other document information is collected. For the data collection an excel sheet is made using the previous EFORWOOD Policy Database as the main basis of the structure. To fulfil the requirements of the EFI Policy Portal also new sections were added. The data collection document consists of four different sheets.

Sheet number one is the document sheet (Figure 2) which lists the selected documents and their basic information. Point Action works as a summary field pointing out the nature and purpose of the document or institution, while sections Title and Second Title state the titles of the document. The Linkages to processes section lists most of the obvious linkages between the current document and other related documents on global-, EU- and national level.



Figure 2. Data collection sheet no. one 1/2, containing information about the documents used in the data collection

Data in the EFI Policy Portal is divided into three metadata schemes to further identify the nature of the documents. The metadata schemes are: Policy Processes, Institutions and Policy instruments. Policy processes are political processes which have not yet received a legally binding status, from which one example could be the Forest Europe process. Institutions scheme covers all the institutional processes and the metadata scheme of Policy instruments covers all the legally binding frameworks. This division is done in the Metadata scheme section of the sheet. Four different modes of governance are identified in the section Modes of Governance. Categorization of these four modes depends on the legal status and implementation type of the policy (Figure 3.). The four modes of governance are: Coercion, framework regulation, targeting and voluntarism (NewGow Project, 2005).

Legal status

		Legally binding	Non-legally binding
	Rigid	Coercion	Targeting
Implementation	Flexible	Framework regulation	Voluntarism

Figure 3. Four modes of governance (NewGow Project, 2005)

The organization field in the sheet states the body responsible for the commissioning of the current document. The sections year and geographical scope define the year of publishing and the geographical focus of the document, which in this case is always Finland.

17

	Н	l.	J	К	L	М	N	0	Р
1	Metadata scheme	Type of policy	Mode of governance	Organisation	Year 🔻	Geographical scope	URL	Media file	Created on
2									
3									
4									

Figure 4. Data collection sheet no. one 2/2, containing information about the documents used in the data collection

The second sheet, Indicators, is a list of the 28 indicators used in the data collection (Picture).

	А	В
1	Action	Title
2		(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product
3		(02) Production cost: Average production cost and share of cost of wood-based materials
4		(03) Trade Balance: Imports and exports of wood and products derived from wood, and net trade
-		(04) Besource use incl. recucled material: Use of renewable and non-renewable materials classified
5		by virgin and recycled meterials
6		(05) Forest sector enterprise structure: Number of forest holdings and forest-based enterprises classified by size classes
7		(06) Investment and Research $\&$ Development: Investment (gross fixed capital formation) and $R\&D$ expenditure
8		(07) Total Production: Production of goods and services
9		(08) Productivity: Labour productivity
10		(09) Innovation: Share of forest-based enterprises with new or significantly improved products or processes and share of turnover
11		(10) Employment: Number of percent employed in total electified and by conder and by logation
		(10) Employment: Number or persons employed in total classified and by gender and by location
12		(in) wages and salanes: wages and salanes (gross earnings) classified by gender and in relative terms
13		(12) Occupational safety and health: Frequency of occupational accidents and occupational
14		(13) Education and Training: Education levels and training
15		(14) Corporate social responsibility: Forest holdings and forest-based enterprises with third party
15		(E) Quality of employment Persons employed part time temperary employed persons and cell
16		employed persons
17		(16) Provision of public forest services
18		(17) Consumer behaviour and attitudes: Consumption of wood per capita and consumer attitudes towards forests and forest industru
10		(19) Energy generation and use: On-site energy generation (from renewables) and energy use
19		classified by origin including the share of self-sufficiency
20		(19) Greenhouse gas emissions and carbon stock: Greenhouse gas emissions and carbon stock
21		(20) Transport: Transport volume and distance per mode of transport
22		(21) Water use: Water use
23		(22) Forest resources: Area of forest and other wooded land and related growing stock classified
24		(23) Soil condition: Soil condition as expressed by chemical soil properties, and soil compaction
25		(24) Water and air pollution: Water pollution classified by organic substances and nutrients, and non- reachances are emissions into air.
25		(2E) Except Diadioactive Access of (access and other use ded land along ((ad by such as of the s
20		(20) Forest Biodiversity: Area or rorest and other wooded land classified by humber of free
27		(25) Forest Damage: Forest area with damage and damaged induced wood supply
20		[27] Generation or waste: total, hazardous, and categorised by type or waste management
29		(3) Hecreation α Aesthetics

Figure 5. Data collection sheet no. two, indicator sheet used in the data collection, listing all the 28 sustainability indicators.

The third sheet, Indicator use, lists how the indicators are linked with the examined documents (Figure 6.). This sheet consists of the sections listing the indicators and their suband sub-sub-indicators, document title and the relevance of the document. The relevance of the document is stated in three classes: Low, medium and high. The division was meant to provide a broad overview of the relevance of the document.

	А	В	С	D	E	F	G
1	Action	Indicator 🗾	Indicator subclass	Indicator sub- subclass	Indicator sub-sub- subclass	Document 🗾	Relevance of policy
2							
3							
4							

Figure 6. Data collection sheet no. three, the connections between indicators and documents

The sheet number four, Targets and thresholds, links the selected targets and thresholds from each document with the indicators (Figure 7.). Like the document sheet, the sheet number four contains the information of: Metadata scheme, organization, year of publishing, title of the document and the geographical scope. The targets and thresholds sheet also includes the information on indicators and their sub- and sub-sub-classes as the sheet number three.



Figure 7. Data collection sheet no four, linking targets/thresholds found from the documents with the indicators

V	W	х	Y	Z
Document title	Geographi cal scope	Type of policy	Relevance of the policy	Document created
•			•	•

Figure 8. Data collection sheet no. four, document information

The sheet number four categorises the targets and thresholds by a certain policy area, created for the EFI Policy Portal. The ten different policy areas are:

- Agriculture and land use
- Biodiversity

- Climate change and energy
- Environment (general) includes generally environmental/nature conservation, water, soil, and/or air protection, waste management, etc.
- Forests and forestry
- Rural development
- Trade
- Socio-economics
- Sustainable development
- Other

The targets and thresholds are divided into two categories according to their legal status and form (Figure 9.). The type of the target or threshold is categorized as legally binding or legally non-binding and the form as quantifiable or quantitative. The targets and thresholds themselves are stated according to their form in the quantitative/quantifiable targets and thresholds part of the sheet.



Figure 9. Data collection sheet no. four, categorising the targets/thresholds by their type and form

The comment section in the sheet includes additional information concerning targets and thresholds, such as numbers and clarifications. The bodies which are stated to be responsible for the decision making concerning the current target or threshold are listed in the section; Decision making body of the sheet. The implementing body section states the bodies responsible for the implementation of the selected target or threshold. The monitoring party is stated in the monitoring and assessing section of the sheet. The time frame set for the targets and thresholds is recorded to the duration column of the sheet.

-	N	0	Р	Q	R	S	Т	U
	Indicatorsub-	Document	Organisation	Decision	Implementing	Monitoring, assessing	Duration	Year
	subclass	reference		making body	body	and reporting		
1	•	number 💽	•	•	•	· · · · · · · · · · · · · · · · · · ·	•	· ·
2								
3								
4								

Figure 10. Data collection sheet no. four, bodies responsible for the execution of the targets/thresholds

3.6 Adding pilot data to the EFI Policy Portal

In the second phase, part the collected national data is added to the EFI Policy Portal. First, the general document information of all the documents used in the data gathering is added. Second, an example from one of the indicators is created, which is used further in the test run section of this work. The chosen indicator is the number 22, Forest resources, since it is considered to be one of the most used indicators of ToSIA when it comes to FWC calculations. As stated in the research objective, the rest of the collected data will be added to the Policy Portal in the future by EFI, while this work concentrates on describing how this is done.

3.6.1 Adding the document data

The document data is added to a user page of the Wiki based EFI Policy Portal, created specifically for this work. Access to the user page requires a password, limiting the group of people editing the pages. The pages are edited by selecting the edit section of the page (Figure 11.).



Figure 11. Select the edit button to edit the pages

This opens the editing menu of the user page to which links to the document pages can be typed in (Figure 12.). Here the documents can be categorized under the used metadata schemes.



Figure 12. Typing a new link under the institutions metadata scheme for the Finnish Forest Research Institute

After typing in the link it appears on the user page. By clicking the created link on the user page a blank editing box appears, since there is no formatting typed in for the newly created page (Figure 13.).



Figure 13. Created blank page for Finnish Forest Research Institute

The format of the document data page is added by using a readymade template (Figure 14.). This template is copy pasted in to the blank editing box.



Figure 14. The readymade template used for creating the format of the page

Depending on the metadata scheme, the fields of the template are filled with the information gathered in the data collection (Figure 15.). Rest of the fields are deleted. After all the necessary data is being inserted, the Save page button is pressed and the page following the designed format containing all the information is being created. After this it is possible to further edit the page by clicking the edit button again and saving the changes by pressing the Save page button in the end. This way a page for each policy document is created and categorized by one of the metadata schemes.



	Suprimary.			
1	This is a min	redit 🔲 Watch th	is page	
(Save page	Show preview	Show changes	Cancel Editing help (opens in new window)

Figure 15. The unnecessary fields of the template are deleted and the page is saved by pressing the Save page button

3.6.2 Creation of pages for indicator information

After creating the Policy Portal pages for each of the documents, indicator pages are created using one indicator as an example. The aim is to create a page for each document which has a link to the chosen indicator. This means that indicator pages are created for each of the documents containing a target/threshold linked with the forest resource indicator. The purpose of creating all these indicator pages for each document is to make it possible to view all the targets/thresholds stated in the documents.

The indicator pages are created by typing the name of the indicator behind the address of the page (Figure 16.).

🕻 🗲 🕅 ticri.inpl-nancy.fr/wood.en/index.php/National Forest Programme 2015 (Finland)/ToSIA Forest reso	sources 👘 🎲 🔻 🕑	
--	-----------------	--

Figure 16. Creation of a new indicator page by typing the name of the indicator to the end of the url bar

After this a blank page appears since there is no information inserted to the newly created page. The new page is created by pressing the create button on the page (Figure 17.).



Figure 17. Creating a new page for one of the indicators linked with the Finland's National Forest Programme

After this, again the blank editing box appears just like previously when creating the page for document data. This time the copy pasted code for the page content is different (Figure 18.). Again the fields are filled with information and the save page button is pressed to create the page.

```
For the [[ToSIA indicator::(to be completed)]]
*[[Quantitative target:: (to be completed)]]
*[[Country::Finland]]
*[[Scope::National]]
*[[Policy document::National Forest Programme 2015 (Finland)]]
[[Category:ToSIA indicator target]]
```

Figure 18. Readymade template to create a page for one of the indicators

3.7 Designing a conceptual link between ToSIA Policy Analysis tool and EFI Policy Portal

To bring the collected data available for the ToSIA user, a linkage must be created between ToSIA and the EFI Policy Portal. Currently ToSIA user can choose between Cost Benefit Analysis (CBA) and Multi Criteria Analysis (MCA) to evaluate the sustainability impacts of different alternatives. One of the coming steps is to develop a Policy Analysis tool on the side of CBA and MCA to support especially the decision making of policy makers. The Policy Analysis section is also where the link between ToSIA and EFI Policy Portal is designed to be created.

In the technical report no. 38 of EFI (Vogelpohl & Rametsteiner, 2011), the authors go through in detail the functioning and the design of the Policy Analysis tool, and call for the creation of a linkage between ToSIA and the database, which at that time was the EFORWOOD Policy Database. They have divided the questions for the Policy Analysis tool into three main categories, which would also work as separate operating sections in the Policy Analysis interface of ToSIA:

- Input: Which policy documents exist on EU and international level? How are they related with FWC sustainability? Which indicator they are linked with?
- Output: What is the affect of the policies to the FWS sustainability and indicator results? Are the targets/thresholds stated in the documents met in the scenario results?
- Results/outcomes: What are the impacts of the outputs on policy level? Possible policy implications? Could the results be responded on a policy level?

In this work, the focus is on the first two categories of questions; input and output. Documentand indicator data is collected and specific targets/thresholds linked with the matching indicators. In this case the data is collected from the national level instead of the EU/global level, which already exists due to the creation of the EFORWOOD Policy Database. The aim of the linkage is to provide easy access to FWC information directly from ToSIA. This means that the document information, targets/thresholds and indicator linkages, all would be brought visible for the user. This would for example enable the user to compare if the results from the ToSIA chain runs are in accordance with the targets set in the policy documents. As Vogelpohl and Rametsteiner (2011) state in their document, one the simplest ways of creating the linkage between ToSIA and the database is by creating a URL link between these two. The URL link approach is also the method chosen in this work due to its simplicity and functionality. The aim here however is merely to conceptually design the linkage instead of executing the idea. For that further development of the Policy Analysis Tool is required.



Figure 19. The overall setting of the work, where the national and EFORWOOD data is inserted to the EFI Policy Portal and a link with ToSIA is designed

3.8 Test run using ToSIA results

In the fourth phase of this work the idea of a functioning Policy Portal is tested on an example level. The aim is to create an illustrative example of a possible future user experience. In this example the results of an already existing ToSIA chain are linked with the EFI Policy Portal by using the conceptual design created in the previous phase of this work. Then the results are compared with the targets stated in the policy documents, by using three selected indicators as examples.

The used ToSIA chain is created in ongoing the bioE-bioD project, conducted by EFI, the Finnish Forest Research Institute and the Finnish Environment Institute to investigate the bioenergy production in Eastern Finland. This selected chain is focused on the North Karelia region, describing the material flows from young/medium aged tree stand to burning of pellets and wood chips for energy generation (Figure 20.).

The chain was created by using the ToSIA Database Client program, in which all the ToSIA chains are structured. The chain is developed to examine multiple indicators, such as

greenhouse gas emissions, employment, gross value added, forest resources and production costs. As previously stated, in this case the ToSIA results are examined by using three indicators to merely elaborate the idea of this work instead going for a full scale analysis of the results. The chosen indicators are; Forest resources (22), Energy generation and use (18) and Green house gas emissions and carbon stock (19). The Forest resources indicator was chosen because it is the most common indicator used in ToSIA FWC calculations. The other two indicators were chosen to present the idea of functioning on the field of bioenergy.



Figure 20. The used ToSIA chain, created in the bioE-bioD project to investigate the bioenergy chains of Eastern Finland

In the test run, four different scenarios are used and the time frame is set from the year 2009 to 2027. The scenario 2009 is based on the calculated annual removal data published in the annual forest statistical yearbook 2010. This scenario is used as a baseline scenario. In addition, three different scenarios are derived from the results of METLA's MELA-program calculations. These are the Business as usual scenario (BAU), Maximum sustainable cuttings scenario and the Biodiversity scenario. In the BAU-scenario, the development is expected to continue till the year 2027 without any greater disturbances. In the Maximum sustainable

cuttings -scenario, the annual cuttings are increased to meet the top level where they are still considered to be sustainable. In the biodiversity scenario, 10 percent of the forests in North Karelia are expected to be under protection by 2027.

The examination is carried out by comparing the ToSIA output values to the indicator related targets found from the documents for each of the previously stated indicators. The idea is to point out whether the results produced by the specific ToSIA scenario are in accordance with the policy documents, when it comes to these three indicators. Again, the idea is to point out the functioning and potential of the database by using a simple example, while the development work is still ongoing.

4 RESULTS

4.1 National policy database

In total 20 documents were used in the data gathering (Figure 21.). From the 20 documents 10 were non-legally binding and 11 legally binding. The collected data material was divided into three metadata schemes: Policy processes, policy instruments and institutions. Ten of the documents were categorized as policy processes, five as policy instruments and five as institution related legally binding documents. Due to the size of the created database, the excel sheet containing all the collected data, will be made available at http://tosia.efi.int/analysis/PA. During the work the Act on energy support for low grade timber (101/2011), did not go through in the European Commission, meaning the results concerning this act will be left out from this point onwards.

	Finland's National Forest Programme 2015 Goverment Resolution on the Forest Biodiversity Programme for Southern Finland 2008-2016 (METSO) Benewable energy obligation Package	
Non legally binding	Long-Term Climate and Energy Strategy National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Finland 2006-2016 A Natural Resource Strategy for Finland The national strategy for sustainable development National Strategy for Mires and Peatlands - Proposal Proposal for a National Strategy on Invasive Alien Species	Policy processes
	Finland's National Strategy for Adaptation to Climate Change	
binding	Forest Act (12.12.1996/1093) Act on the Financing of Sustainable Forestry (12.12.1996/1094) Act on energy support for low-grade timber (101/2011) (Still in the Commission) Act on the Prevention of Insect and Fungi Damages in Forests (8.2.1991/263) Act on Trade in Forest Reproductive Material (241/2002)	Policy instruments
Legally i	Forest Management Association Act (534/1998) Act on the Forestry Centres and Forestry Development Centre Tapio (18.12.1995/1474) Act on Forest Research Institute (3.12.1999/1114) Act on Metsähallitus (1378/2004) Act on the Finnish Forestry Centre (6.5.2011/418)	Insitutions

Figure 21. Categorization of the documents used in the data collection by their legal status and metadata scheme

From the 19 documents a total of 193 targets/thresholds were selected in the data collection. To see a simplified example part of the filled Targets and thresholds sheet of the excel document, see Annex 1. From targets/thresholds 46 were legally binding targets and the rest 147 were non-legally binding. The number of targets found varied dramatically among documents (Table 2.). Especially the documents related to environment provided many forest related targets. Legal documents concerning the state forest institutions provided only the description of the institution and its functions.

Table 2. Number of targets/thresholds selected from each document in the created national policy database

Document	Number of selected targets/thresholds
National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Finland 2006-2016	48
Goverment Resolution on the Forest Biodiversity Programme for Southern Finland 2008-2016 (METSO)	31
Finland's National Forest Programme 2015	18
National Strategy for Mires and Peatlands - Proposal	18
Forest Act (12.12.1996/1093)	18
Act on the Financing of Sustainable Forestry (12.12.1996/1094)	16
Renewable energy obligation Package	9
Finland's National Strategy for Adaptation to Climate Change	8
The national strategy for sustainable development	7
A Natural Resource Strategy for Finland	5
Act on the Prevention of Insect and Fungi Damages in Forests (8.2.1991/263)	5
Long-Term Climate and Energy Strategy	2
Proposal for a National Strategy on Invasive Alien Species	2
Act on Metsähallitus (1378/2004)	1
Act on the Finnish Forestry Centre (6.5.2011/418)	1
Forest Management Association Act (534/1998)	1
Act on Trade in Forest Reproductive Material (241/2002)	1
Act on the Forestry Centres and Forestry Development Centre Tapio (18.12.1995/1474)	1
Act on Forest Research Institute (3.12.1999/1114)	1
	193

The most common policy areas of the selected targets/thresholds were forests and forestry and the environment (Table 3.). When also the policy area of biodiversity was linked with 29 targets/thresholds it shows the strong environmental orientation of the forest related policy targeting within these documents. Notice that each target might have linkages to several policy areas.

Policy area	Number of selections
Forests and forestry	95
Environment	68
Socio economics	46
Climate change and energy	30
Biodiversity	29
Sustainable development	13
Other	14
Trade	8
Agriculture and land use	6
Rural development	6

Table 3. Number of selections per policy area in the created national policy database

When looking the results from the indicator use-point of view, it is clear that two of the used indicators were chosen by far most often (Table 4.). Since the legally binding targets/thresholds were considered to be more process related, concerning the use of ToSIA, their indicator linkages were ruled out in the pilot phase. This means that the picture present the indicator linkages only from the 147 non-legally binding targets/thresholds. This result has at least a few simple explanations and will be further discussed in the discussion section later on. It is also worth noticing that in this work only 14 out of the 28 indicators in total were used.

Table 4. Number of selections per indicator in the created national policy database

Indicator title	Number of selections
(25) Forest Biodiversity: Area of forest and other wooded land classified by number of tree species?	45
(06) Investment and Research & Development: Investment (gross fixed capital formation) and R&D expenditure	41
(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product	8
(13) Education and Training: Education levels and training	8
(18) Energy generation and use: On-site energy generation (from renewables) and energy use classified by origin including the share of self-sufficiency	8
(10) Employment: Number of persons employed in total classified and by gender and by location	7
(22) Forest resources: Area of forest and other wooded land and related growing stock classified	7
(24) Water and air pollution: Water pollution classified by organic substances and nutrients, and non- greenhouse gas emissions into air	6
(19) Greenhouse gas emissions and carbon stock: Greenhouse gas emissions and carbon stock	5
(04) Resource use, incl. recycled material: Use of renewable and non-renewable materials classified by virgin and recycled meterials	4
(31) Recreation & Aesthetics	4
(16) Provision of public forest services	2
(03) Trade Balance: Imports and exports of wood and products derived from wood, and net trade	1
(05) Forest sector enterprise structure: Number of forest holdings and forest-based enterprises classified by size classes	1

4.2 Designing a conceptual link between ToSIA Policy Analysis tool and EFI Policy Portal

As previously stated, ToSIA is designed to be linked with the EFI Policy Portal by using a URL link. In the following paragraphs, the conceptual design of this linkage will be presented by using a set of screenshot manipulations from ToSIA.

The linkage will be created to the Policy Analysis section of ToSIA analysis tools (Figure 22.), which is especially designed to support the decision making of policy makers.



Figure 22. The link is designed for Policy Analysis section of ToSIA

The linkage could be created in to the output section of the Analysis Tool. This way the ToSIA results could be clearly linked with the indicator and target/threshold information in the Policy Portal.



Figure 23. In the Policy Analysis tool the link is designed to the Output side of ToSIA

ToSIA categorizes its results by indicators. So for example, when the user would be interested in one of the indicators and its linkages within the policy documents, he/she could get to the Wiki page of this certain indicator and its sub-indicators by clicking the link created (Figures 24 & 25). For example, when comparing the results of the ToSIA run, the user would like to get more information about the other productive costs, which is a sub-indicator of the Production costs indicator number 2, he/she could click the link for further information. (Figures 24 & 25)



Figure 24. An illustration of the link from the ToSIA results section

Indicator	2009	2009 again	URI
1.1 - Gross value added (at factor cost) [EURO]	9,188,754.258	9,188,754.258	
2.1 - Production cost [EURO]	29,246,957.013	29,246,957.013	
2.1.1 - Average cost - raw materials from chain [EURO]	792,987.366	792,987.366	
2.1.2 - Average cost - raw materials from outside chain [EURO]	0	0	1
2.1.3 - Average cost - labour costs [EURO]	0	0	V.
2.1.4 - Average cost - energy costs [EURO]	0	0	Å
2.1.5 - Other productive costs [EURO]	1,190,507.265	1,190,507.265	Link
2.1.6 - Non-productive costs [EURO]	0	0	\bigcirc
2.2 - Share of cost of wood-based materials [%]			
3.1.1 - Imports of wood and products derived from wood - Volume [process unit]	0	0	
3.1.2 · Imports of wood and products derived from wood · Value [EURO]	0	0	

Figure 25. Close up of the Figure 24

The link would take the user to the information sheet of the Other Productive Costs-indicator and reveal the possible connections to documents and targets/thresholds (picture).

4.3 Test run using ToSIA results

The functioning of the database was tested on a conceptual level to describe the possible future user experience. First, the chain and used scenarios are selected for the ToSIA program. Second, calculated FWC results are derived by using the Policy Analysis tool of ToSIA. Third, the designed URL link is used to bring the indicator information in the EFI Policy Portal available. Fourth, the policy targets stated in the EFI Policy Portal are compared with the ToSIA results.

We start by choosing/creating the chain in the ToSIA Database Client (Figure 26.). Then xmlfiles of the chain are generated, which the ToSIA program uses for the calculations.



Figure 26. Screenshot from the Database Client program, illustrating the selection/creation of a chain

The created xml-files which contain all the chain data are opened in the ToSIA program and the Policy Analysis tool is used in the calculations. In this case four different scenarios are used: The recorded data of 2009, Business as usual (BAU), Maximum sustainable cuttings and the Biodiversity scenario and the time frame is set to 2027.

ToSIA makes it possible to compare the results of these four scenario runs by each indicator.

The results for the Energy generation and use indicator (18) can be seen in the Figure 27. With the BAU scenario the energy generation from renewable sources would be almost three times more than in the year 2009, being around 1,6 TWh in 2009 and around 4,9 TWh in 2027 with the BAU scenario. If the timber removal would be maximized in the boundaries of sustainability, like done in the Maximum sustainability scenario, the amount of energy generated would be even higher totalling to around 5,9 TWh. However, if 10% of the North

Karelian forests would go under protection the amount of energy generated would be slightly less (4,4 TWh) than if continuing as BAU (4,9 TWh).

Lool for Sustainability Impact Assess	nent (ToSIA)	Statement Street Street	Street Street Street			- 0 - X
ToSIA						
	Welcome Data Preparation Cha	in runs Comparison And	lysis Export Results	About		
New run	Runs to compare:	Indicator 2	009	BAU	Maximum Sustainable Cu	Biodiversity (10% set aside)
× 2009 >		16.4. Number of visits to		bho		
		17.1 Apparent consum				
× BAU >	2009 >	17.2.1 - Share of populati 17.2.2 - Share of populati				
Maximum Sustainable Cuttings		17.2.3 - Share of populati				
		17.3.1 - Share of populati				
× Biodiversity (10% set aside) >		17.3.2 - Share of populati				
		18.1 - On-site energy gen	1.587.180.049.761	4.890.408.545.741	5.580.645.577.204	4,420,493,946,865
	BAU	18.1.1.1 - On-site heat de	0	0	0	0
		18.1.1.2 - Indicator name: 1	8.1 - On-site energy genera	tion from renewables	0	0
		18.1.1.3 - 18.1.2.1 - Measured in k	Wh		0	0
		18.1.2.2 - unit:			0	0
	Maximum Sustainable Cuttings	18.1.2.3 - Short indicator 1	8.1 On-site heat / electricity	/ fuel generation from rene	wable, which 0	0
		18.1.3.1 - description: a	re residues from process-	inputs / from other wood bio	mass/ 0	0
		18.1.3.3 - ft	on-wood based renewable	sources in kivin (electricity	or mo (neat, 0	0
		18.2 - Energy use (Kyring	v	v	0	0
		18.2.1.1 - Energy use - He	0	0	0	0
	Biodiversity (10% set aside)	18.2.1.2 - Energy use - He	0	0	0	0
		18.2.2.2 - Energy use - Di	0	0	0	Ő
		18.2.3 - Energy use - Ani	0	0	0	0 **
		18.2.3.1 - Electricity use	0	0	0	0
		18.2.3.2 - Electricity use	0	0	0	0
	×	19.1 - Greenhouse gas e	666,532,939.824	2,065,851,865.403	2,358,137,758.936	1,867,122,711.886
	Show results as:	19.1.1. Greenhouse gas	15,947,837.427	61,273,402.504	70,631,136.841	55,162,243.066
	Values O Percentages	19.1.2. Greenhouse gas	650,585,102.397	2,004,578,462.899	2,287,506,622.096	1,811,960,468.82
	Totals O Relative	19.1.4 - Greenhause gas	0	0	0	0
	O rouis O readre	19.2 - Carbon stock [kg C	0	0	0	0
	Select products	19.2.1 - Carbon stock in	0	0	0	0
		19.2.3 - Carbon stock in	0	0	0	0
		19.2.4 - Carbon stock in	0	0	0	0
		20.1.1.1 - Distance by mo	0	0	0	0
	~	20.1.1.2 - Distance by mo 20.1.1.3 - Distance by mo	0	0	0	0
		20.1.1.4 - Distance by mo	0	0	0	0
	Compare	20.1.1.5 - Distance by mo	0	0	0	0
		20.1.1.6 - Distance by mo	0	0	0	0
	Select visualisation	20.1.2.1 - Distance by mo	0	0	0	0
	Table Chart	20.2.1.1 - Freight volume	0	0	0	0
Clear session	2 0 0 0	20.2.1.2 - Freight volume	0	0	0	0

Figure 27. ToSIA results of the four selected scenarios 2009, BAU, Max sus. and Biodiversity for the Energy generation from renewables – indicator, comparing the amount of energy generated in different scenarios in kWh

The results calculated for the indicator 19, Greenhouse gas emissions, include the emissions from the machinery used along the chain (Figure 28). Naturally the results follow the ones derived for the energy generation above, since the greenhouse gas emissions were calculated for the energy generation. Meaning, the more energy is generated the more there is emissions. This gives the results where by maximizing the cuttings the emissions would be the highest totalling to around 2,4 million t/CO2 and by outlining 10% of the forest area for protection the emissions would be the smallest equalling around 1,9 million t/CO2. If everything would go by the Business as usual scenario the emissions would be somewhat in between these two scenarios (around 2,1 million t/CO2), tripling the emissions compared to the 2009 level (666 533 thousand t/Co2) by 2027.



Figure 28. ToSIA results of the four selected scenarios 2009, BAU, Max sus. and Biodiversity for the Greenhouse gas emissions indicator, comparing the amount of greenhouse gas emissions of different scenarios in kg CO2 equivalents

The estimated affects of different scenarios to the amount of forest area in ha can be seen in the Figure 29. The BAU scenario has no effect to the amount of forest and other wooded land area. If the timber removal is intensified according the Maximum sustainability cuttings scenario, a slight decrease in the forest area could be expected, in this case meaning -100 ha. According to the results the greatest negative effect to the forest cover would be achieved by outlining 10% of the forest area under protection when the estimated decrease would be a bit less than 140 000 ha compared to the area of the year 2009.



Figure 29. ToSIA results of the four selected scenarios 2009, BAU, Max sus. and Biodiversity for the Forest and other wooded land area indicator, comparing the amount of forest area of different scenarios in ha

By creating a link such as described previously in the link section (Figure 30.), we would have a direct access to EFI Policy Portal page of the current indicator (Figure 31.). From the Policy Portal page we could look for further information for example about the policy document linkages of the indicator, targets and thresholds linked with the current indicator, document information etc. The Policy Portal page would be the location where the information collected to the excel sheet would become available for the user, enabling him/her to see how the results fit the current policies.

Indicator	2009	BAU	Maximum Sustainable Cu.	Exclivernity (10% set aside)
19.1.3 - Greenhouse gas		0	0	0
19.1.4 - Greenhause gas		0	0	6
19.2 Carbon stock (kg-C		0	0	6
19.2.1 Carbon stock in		0	0	6
19.2.2 - Carbon stock in		6	0	6
19.2.3 - Carbon stock in		6	0	6
19.2.4 - Carbon stock in		6	0	6
20.1.1.1 Distance by mo		6	0	6
20.1.1.2 Distance by mo		6	0	6
20.1.1.3 Distance by mo		6	0	6
20.1.1.4 Distance by mo		6	0	6
20.1.1.5 Distance by mo		6	0	6
20.1.1.6 Distance by mo		6	0	6
20.1.1.7 Distance by mo.		6	0	6
20.1.2.1 Distance by mo.		6	0	0
20.2.1.1 · Freight volume		6	0	0
20.2.1.2 - Freight volume		6	0	0
20.2.1.3 - Freight volume		0	Click the	elink 🛛
20.2.1.4 - Freight volume		0	offen dry	6
20.2.1.5 - Freight volume		0	0	(6)
21.1 - Water use (freshw		0	0	(6)
21.2 . Water use (of the f		0	0	0
21.2.1 - Water use (of the		0	0	
21.2.2 . Water use (of the		0	0	(III)
22.1 - Forest and Other	1,383,008	1,383,800	1,382,900	1,364 (6)
22.2.1 . Total yoluma also				0
22.2.2 -Total vi Indicator n	ame: 22.1 - Fore	st and Other Wooded Land A	rea 0	1
22.2.3. Total vi Alexandri	and the		0	0
22.2.4 Total v			0	
22.2.5 Commy Short indic	ator 22.5, Fores	it and Other Wooded Land Ar	rea per process in 0	
22.2.6 Commy description	c ha		0	0
22.3.1 - Balance or amor			0	
22.3.2 - Balance of affor		6	6	0

Figure 30. The designed link in the output value section of ToSIA, bringing the user to the indicator specific page in EFI Policy Portal

wi 🕞 ri	A Tatu Liimatainen my taik page discussion edit history move watch	my preferences my watchlist my contributions log out				
	Forest resources (ToSIA indicator)					
	From Wicri Wood					
Wood & Forests en	Forest resources is the 22 indicator in the ToSIA system.	ToSIA indicators				
navigation	Indicator's description: Area of forest and other wooded land and related growing stock classified by type and by availability of wood supply as well as balance of increment and	Indicators of economic sustainability [show]				
Main page Community portal	fellings.	Indicators of social sustainability [show]				
Current events	Sub-indicators	Indicators of environmental sustainability [show]				
Recent changes Alphabetical Index Topics index	 Area of forest and area of other wooded land (ha) Growing stock classified by: 	Go to ToSIA indicators				
Random pageHelp	 a) forest types - predominantly confiers, predominantly broadleaved, mixed (m³ - g b) forest available for wood supply, as defined by UNECE/FAO (m³ - growing stoc) 	rowing stock measured over bark) < measured over bark)				
search	 Net increment - balance between increment and fellings (m³) 					
Go Search		Relations with FOREST EUROPE criteria				
toolbox	Related policy instruments [e	dit] Forest resources and carbon				
 What links here 	See also the discussion page.	Relations with FOREST EUROPE indicators				
 Related changes Upload file 	· ·	■ Forest area				

Figure 31. Examining the targets/thresholds and other information linked with the selected indicator in the EFI Policy Portal

In this case, we are interested about how the three indicators; Forest resources, Greenhouse gas emissions and Energy generation and use are linked with the policy documents of Finland and what type of targets/thresholds can be found. In the following paragraphs these targets/thresholds are presented for each of the three indicators, pointing out the idea of having a database consisting of individual targets. Here the examined data is narrowed down greatly by stating only the targets themselves, leaving the other collected data of the excel sheet outside this example. The ToSIA results are summarized in Table 5.

Indicator/Scenario	2009	BAU	Max sus.	Biodiversity
Energy generation and use	1,6 TWh	4,9 TWh	5,9 TWh	4,4 TWh
Greenhouse gas emissons and carbon stock	666 533 thousand t/CO2	2,1 million t/CO2	2,4 million t/CO2	1,9 million t/CO2
Forest resources	1,4 million ha	1,4 million ha	1,4 million ha	1,2 million ha

Table 5. The ToSIA results of the four scenarios according to the three examined indicators

In total eight targets/thresholds within the database were linked with the indicator number 18, Energy generation and use:

- Increase the annual amount of wood chips used for energy generation to 8-12 m/m3 by 2015
- Share of energy of renewable origin from total energy consumption is 38 % in 2020 (equalling 124 TWh)
- Amount of energy generated from wood chips is 25 TWh in 2020 (13,5 milj. m3 of wood chips)
- Increase the share of wood use in plants using both wood and peat for energy generation. Estimated potential of increase is 19 TWh compared to 2010 level.
- Replace the use of coal in heat and power generation with renewable biofuels by 7-8
 TWh
- Reduce oil dependency and raise energy self-sufficiency
- International sustainable development criteria will be written for the production of bioenergy
- At least triple the amount of wood chips made from forestry waste, cultivated biomass, recycled fuels and biogas used in primary energy from about 2 per cent in 2004 to more than 6 per cent over a period of 15–20 years

Seven out of eight targets/thresholds stated in the database call for raising the amount of energy generated from renewable sources. Many of the targets are clearly related to wood energy however without stating where the wood should come from. Also the call to raise energy self sufficiency is surely meant to cover various sources of energy. Looking from the energy generation point of view, the Maximum sustainable cuttings scenario would be most in line with the above stated targets, since it would provide most renewable energy in the future.

Concerning the indicator number 19, Greenhouse gas emissions and carbon stock, five targets/thresholds were found from the database:

- The annual carbon stock in timber and soil is at least 10-20 milj. tn CO2-ekv. in 2015
- Implement the National Climate Change Strategy (2005) and both CBD and UNFCCC recommendations on climate change
- Implementation of Climate Change Adaptation Research Programme (ISTO) by 2010
- Continue the active international expert cooperation in the northern boreal and Baltic Sea regions to prepare potential regional adaptation strategies
- Maintain and increase the carbon stock and sink ability of bogs and decrease the greenhouse gas emissions derived from peatland forestry

Two of the greenhouse gas emission targets/thresholds call for securing and increasing the carbon stock abilities of timber and soil in the future. The other targets are related with adaptation to climate change and decreasing greenhouse gas emissions. From the greenhouse gas emissions point of view the Maximum sustainable cuttings scenario would be the least favourable since it would mean circa 0,5 million tons more CO2 emissions than the biodiversity scenario (Table 5.). Forestry operations conducted on peat land areas might also have negative effects on the CO2 binding ability of the soil. However, looking at the case from the CO2 binding ability of the forests point of view, properly conducted management operations should have a positive effect on it when the timber volume per hectare increases.

For the third indicator, Forest resources, in total five target/threshold linkages were found from the database:

- Rise the area of an average private forest holding to 50 ha by 2015 (24 ha in 2006)
- Net annual increment of timber at least 100 mill/m3 by 2015
- Metsähallitus's Natural Heritage Services and Forestry shall jointly draft proposals for the extension of protected areas of significance for biodiversity in State-owned lands by a total area of 10 000 ha over the period 2008-2010, in connection with natural resource planning processes.
- Utilise the former peatland harvesting areas in farming, forestry or other use and to increase biodiversity as wetlands and water flow areas.
- Economically unprofitable forest peatlands are not in active forestry use and they represent an opportunity for other uses such as peat production and nature conservation

Here the three scenarios, 2009, BAU and Maximum sustainable cuttings all provide the same result as they suggest that there would be no change in the amount of forest area (around 1,4 million ha). The fourth scenario, Biodiversity, where 10% of the North Karelian forests would be protected by 2027, suggests that the amount of forest area would decrease with around 200 000 ha, declining to around 1,2 million ha in total. One reason for this could be that since many forests in North Karelia are founded on peatlands, maybe the decrease in human impact could bring the areas towards a more natural state, this way decreasing the forest area. This type of development would be in line with the two targets found in the database, meaning ruling out unprofitable peatland areas from forestry and increasing the amount of protected areas. However the decrease in forest area would be in contradiction with the target of pursuing the net increment target of 100 million m³ by 1015.

5 DISCUSSION

Since the work was conducted on a very practical level, it means that this section will focus mainly on commenting the work itself and the functioning of the design. The result of this work were: the national policy database of Finland, the created conceptual link between ToSIA and the EFI Policy Portal, added pilot data to the EFI Policy Portal and the test results achieved in the test runs pointing out the idea of functioning of the Policy Analysis tool. As the database and the development of the Policy Analysis tool of ToSIA form two clear sections, they will form the division of this discussion.

5.1 Policy database

As there is nothing new in a database consisting of published forestry documents, the idea of pointing out the actual targets stated in the forest policy documents and summing it up as a database covering all the main publications, is a novel idea bringing the concept of the database to a different level. This was achieved in this work. As the design of the created national database was based on the ideas and needs of two projects, EFORWOOD Policy Portal and the EFI Policy Portal, not all of the data was found relevant when adding the pilot data to the EFI Policy Portal. The idea however was to create a flexible database, since the development work is still ongoing.

When creating the database, some documents provided notably more targets/thresholds than others. As Table 3 shows, the highest numbers of targets/thresholds came from environmentally/biodiversity oriented documents, which of course has an effect on the overall nature of the database. As this suggests that the economical and social factors could had been taken better in to consideration by maybe making slight changes in the material and/or by broadening the angle of looking at it, it also suggests that from the governmental side forest policy is strongly made from environmental perspective.

As the used sustainability indicators are in the very centre of this work it is good to give them a bit more attention. Based on the selected documents, the created national database includes 147 non-legally binding targets/thresholds, yet merely half out of the total 28 indicators were used and from these, indicators for Forest Biodiversity and R&D, covered 86 of the selections. The reason for the high number of selections for the Forest Biodiversity indicator could be that, as stated above, the targets/thresholds selected from the examined documents tended to be environmentally oriented. The reason for the number of selections concerning the R&D indicator could be that many of the documents were strategies and roadmaps this way including many targets related to investment and development. One reason could also be that as previously stated, only one indicator was chosen to represent each target/threshold. This means that even as these targets/thresholds surely were to be applied on various fields, these two were found most fitting in these cases. This might also hint towards the need of further development of the list of indicators to meet the nature of targets stated in policy documents. The above mentioned possible reasons also can be seen in the development ideas for indicators stated below as new methods may be needed to categorize protected areas and biodiversity and targets related to initiatives actions and programmes.

A few ideas for further development of indicators for the future:

- Indicator 22. Forest resources: A Ha based sub-indicator for protected areas/biodiversity
- Indicator 01 Gross value added: A sub-indicator for subsidies and taxes
- Indicator 25 Forest biodiversity: A new sub-indicator for initiatives/actions/programmes to promote biodiversity
- Indicator 14 Corporate social responsibility: A new indicator for implementation of initiatives/actions/programmes
- Indicator 01 Gross value added: A sub-indicator for tourism

Another field for future development is how to make the legislative framework function with the Policy Analysis tool. In this case the thresholds found in the legislative documents tended to be more process related, meaning that these thresholds narrowed the scale of boundaries into one single operation instead of representing the entire FWC. For example the obligations concerning timber harvesting or forest renewal were useful only for those single processes. In this work the information gathered from the legislative documents could not be used in the latter phases.

Taking into account the above mentioned questions and needs for development, the structure of the created database was well functioning and can be considered to be sufficient to provide data for similar projects beyond the pilot phase.

5.2 Development of the Policy Analysis tool and EFI Policy Portal

Entering the pilot data to the EFI Policy Portal was an important phase, since that is the format in which the collected national data is designed to be presented to the users. Since the EFI Policy Portal was originally aimed to present the data on a document level, question was how to present the data on indicator level and still make it part of the same Policy Portal? The idea of creating a page for each indicator and then creating sub-pages for documents containing a target/threshold linked with the current indicator was chosen, but in this case the data was entered only concerning the Forest resources indicator due to the development state of the EFI Policy Portal and pilot nature of this work. Due to the current state of the EFI Policy Portal, it is not topical to evaluate its qualities or functioning. However, the chosen Wiki-based structure seems to be able to give the Policy Portal a flexible and easy access basis improving its abilities also in the longer run.

Designing of the link between ToSIA output values and the EFI Policy Portal was merely a technical detail aimed for the further developers of ToSIAs Policy Analysis tool. Being a minor thing, it however underlines the importance of the indicators for ToSIA and raises the same questions as in the previous Policy database section. This means that in practice the system must be well functioning when the linkage is created by using one indicator and to make sure that all the data is easily available for the user since the targets/thresholds are connected with only one indicator still very likely having linkages to other indicators.

The secondary objectives made it possible to design a pilot future user experience using the data of the created database. As this was a done on a pilot level, the examples and therefore results were highly simplified. For example in a "real" case, the information of all the chosen indicators would had been available, several scenarios would had been used and also the questions related to the case would had been taken into consideration in much more detail. However, the examples clearly point out the potential benefits of linking the output values of

ToSIA to actual policy targets. If the information within the policy documents would be readily available for the person examining the ToSIA output results, it would give the results much more dimension by making the comparison between ToSIA results and policy targets possible. This type of comparison would provide the user with information whether any of the case-specific ToSIA results would be in contradiction with the current forestry related policies.

In this case it was not necessary to ponder which one of three future scenarios (BAU, Max sus. And Biodiversity) would be most feasible. The example however shows the current situation where the decision makers must balance in between questions related to greenhouse gas emission, bioenergy, biodiversity and forest area. And the questions can be expected to become only more complex when connecting them to for example ownership, employment and added value issues. As the results suggest, the type of policy information used in this example to support the decision maker would be very valuable offering the chance to look in to the policy documents.

5.3 Conclusions

The interest towards developing and using SIA tools on the field of forestry is expected to grow in the future and for the further development of the Policy Analysis section of such a tool, a more detailed approach to create a database was developed and the founding of a new Policy Portal provided a possibility to test the functioning of this created national database as a part of the Policy Portal under construction. As a pilot project, this work points out some of the possibilities and difficulties of developing a functioning link between a SIA based Policy Analysis tool and a database consisting of the contents of policy documents.

The idea of developing a database which could open the contents of the policy documents for the decision maker is highly attractive. The development of such a database however can be considered to be time consuming providing many questions and problems. In this work the scope was Finland. How "patchy" will the database become if other countries are also involved? Another question is that what type of information is considered to relevant for the database. In this case, as a pilot project, the policy was to take as many FWC related targets as possible, leaving it for future developers to decide whether parts of the information were considered to be difficult to use or completely useless. Also, an important quality for any database in use is that it is kept up to date. In this case, the chosen Wiki-format does not require any special computer skills from the user, making the technical side of updating possible for almost anyone. However, the amount of documents and the issues stated above would surely make the updating process challenging in the long run.

The next step for future development, would be to insert more data from the national excel database created in this work to the EFI Policy Portal and use it to test its functioning in a more comprehensive example or case study. This type of example would surely point out new areas of development in the data collection and also provide the possibility for a wider interpretation of results as more collected data would be available. If the results would prove out to be encouraging, a similar database could be created using the policy documents of a different country.

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Ympäristöministeriö. (2007). Etelä-Suomen metsien monimuotoisuuden toimintaohjelma 2008-2016. Ympäristöministeriö. **Annex 1**. A simplified example from the targets and thresholds sheet of the created national database illustrating the data collection and the connection between the selected targets and indicators

Policy area	Type of target/threshold	Form of target/threshold	Quantitative target/threshold	Indicator	Indicator subclass
Forest and forestry	Non-legally binding target	quantitative	By 2015, the value of forest and wood industry increased by 20%	(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product	
Forest and forestry	Non-legally binding target	quantitative	By 2015, the net income from private forestry 120€/ha. (98€/ha in 2006)	(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product	
Trade	Non-legally binding target	quantitative	The annual turnover of rural travel- and recreational enterprises is 637,5 m € in 2015 (turnover 25 % > than in 2004 (510)	(01) Gross value added: Gross value added (GVA) at factor cost and contribution to gross domestic product	
Forest and forestry	Non-legally binding target	quantitative	Annual removal of timber 65-70 m/m3 in 2015	(22) Forest resources: Area of forest and other wooded land and related growing stock classified	22.4. Balance of increments and fellings
Forest and forestry	Non-legally binding target	quantitative	The annual use of sawn timber at least 1,2 m3/ person by 2015	(04) Resource use, incl. recycled material: Use of renewable and non- renewable materials classified by virgin and	4.1. Volume of renewable materials in total