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Local levers for change: Mainstreaming ecosystem-based adaptation into municipal planning to foster sustainability transitions

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ABSTRACT

Unprecedented global challenges demand wide-reaching societal modification to ensure life support functions and human well-being. In the absence of adequate international responses to climate change and the need for place-based adaptation, local governments have a pivotal role in fostering sustainability transitions. In this context, the importance of ecosystem-based adaptation is increasingly recognized as a multi-benefit approach that utilizes ecosystem services to harmonize human-environment systems. Although research advocates the mainstreaming of ecosystem-based adaptation to advance sustainable planning, the pathways for its systematic implementation are missing and it remains unclear how local authorities can best integrate this new approach into their core work. The purpose of this study is to increase knowledge of the potential ways to mainstream ecosystem-based adaptation into municipal planning. We investigate four coastal municipalities in southern Sweden (Malmö, Helsingborg, Lomma and Kristianstad) and examine, based on vertical and horizontal integration processes, the key characteristics of existing mainstreaming strategies. Results show that, although ecosystem service planning and climate change adaptation planning together establish the conceptual foundation for ecosystem-based adaptation, related activities are often implemented separately and are rarely comprehensive. We illustrate how combined mainstreaming strategies can reinforce and complement each other and how strong leadership in the integration of processes has the ability to compensate for a lack of guidance or supporting legislation from higher decision-making levels. Finally, we conclude that systemic mainstreaming of sustainability issues is a promising avenue for initiating and promoting sustainability transitions and has the potential to address the criticism that other mainstreaming topics have faced. On this basis, we specify the core characteristics necessary to ensure its effective and meaningful application.

1. Introduction

Humanity faces unprecedented global challenges that demand a fundamental transformation of society in order to combat the degradation of functions that support life and ensure human development (Kates and Parris, 2003; Rockström et al., 2009). While sustainability challenges such as climate change or loss of biodiversity are accumulating on a global level, they are characterized by multiple scales and facets and their causes and impacts relate to regional and local dynamics (Jerneck et al., 2011; Lüdeke et al., 2004). Accordingly, the discourse on climate change now emphasizes, in addition to the mitigation of greenhouse gas emissions, adaptation to adverse effects in order to comprehensively address the global challenge and support a transition towards sustainability (Crane and Landis, 2010; IPCC, 2014a; McCormick et al., 2013; Pielke et al., 2007).

In the absence of adequate responses to climate change at national and international levels, the regional and local setting is increasingly considered as an effective fulcrum to address the underlying processes of this sustainability challenge (McCormick et al., 2013; Roberts, 2008; Wiek et al., 2012; Zborel et al., 2012). Specifically, local governments have a pivotal role in guiding

Abbreviations: ES, ecosystem services; CCA, climate change adaptation; EbA, ecosystem-based adaptation.

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comprehensive responses to climate change (Rauken et al., 2014; Roberts, 2008; Roberts et al., 2011) and "acting ... to incorporate climate change adaptation into their development plans and policies and infrastructure investments" (IPCC, 2014b, p. 6). In this context, spatial planning is a key avenue for adaptation (McDonald, 2011; Measham et al., 2011) and draws attention to respective governance arrangements (Agrawal, 2008).

Ecosystem-based adaptation, that is, the "use of biodiversity and ecosystem services as part of an overall adaptation strategy" (CBD, 2009, p. 41), is increasingly recognized as a comprehensive approach to reducing the adverse effects of climate change. It offers multiple benefits while being tailored to place-based characteristics (Chong, 2014; Roberts et al., 2011). Such benefits include greenhouse gas mitigation, livelihood protection and improvement, creation and conservation of recreation areas, support for biodiversity, improving human well-being, as well as the potential to be more cost efficient than alternative adaptation approaches (Doswald et al., 2014; Georgescu et al., 2014; IPCC, 2012; Smith et al., 2013; Uy and Shaw, 2012a). Ecosystem-based adaptation is increasingly considered to be an effective way to reassess the prevailing paradigm of dealing with risk and natural disasters which, for decades, has been dominated by technical solutions and grey infrastructure (Jones et al., 2012a; Sovacool, 2011). Although the concept is still in its infancy (e.g. Doswald et al., 2014), systematic integration of ecosystem services into municipal planning addresses the inherent linkages between nature and human well-being and, ultimately, has the potential to harmonize human-environment systems and foster sustainability transitions (Andersson, 2006; Chong, 2014; Huq et al., n.d.; IPCC, 2014a; Roberts et al., 2011; Wilkinson et al., 2013; Wu, 2014).

Research on the conceptual foundation of ecosystem-based adaptation advocates mainstreaming of both ecosystem services and climate change adaptation to foster sustainable planning and comprehensively address the impacts of climatic extremes and variability (Cowling et al., 2008; Daily et al., 2011; Kok and de Coninck, 2007; Preston et al., 2010; Vignola et al., 2009). Although the term mainstreaming often has no clear definition, it relates to the "deliberate perturbation in the natural order of things" and undermines the status quo to radically expand and enhance the topic under consideration (La Trobe and Davis, 2005; Picciotto, 2002, p. 323). However, pathways for systematic integration and institutionalization are largely missing (Vignola et al., 2009; Andrade et al., 2011), and it thus remains unclear how local authorities can best integrate this new approach into municipal planning.

Against this background, the purpose of this study is to increase knowledge about the potential ways of mainstreaming ecosystem-based adaptation into municipal planning to foster sustainability transitions. On the basis of in-depth studies of four municipalities in southern Sweden, we examine how ecosystem-based adaptation planning is integrated into municipal planning practice and assess the key characteristics of mainstreaming strategies and their ability to foster sustainability transition.

2. Conceptual framework

Ecosystem-based adaptation is a relatively new concept which aims to systematically harness the services of ecosystems to buffer communities against extreme events and thus facilitate adaptation to the adverse effects of climate change (Foster et al., 2011; Gaffin et al., 2012; Gill et al., 2007; Jones et al., 2012a; Munang et al., 2013). Accordingly, the concept is embedded in theories and research regarding both ecosystem services and climate change adaptation (Chong, 2014; Uy and Shaw, 2012a, 2012b). Ecosystem services are, on the one hand, "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Daily, 1997, p. 41). They include, but are not limited to, natural processes that regulate local climate, erosion, soil retention, water and air quality, and natural hazards (De Guenni et al., 2005; Larondelle et al., 2014). Developed to integrate ecological principles into economic considerations and decision-making (De Groot, 1987; TEEB, 2010), the ecosystem services concept is considered as an effective way to advance sustainable urban planning at local government level (Ahern et al., 2014). On this basis, ecosystem service planning refers to a place-based approach that focuses on the creation, restoration and conservation of ecological structures to provide society with specific services from nature (Chan et al., 2006; Staes et al., 2010). Climate change adaptation focuses, on the other hand, on the modification of human-environment features to moderate adverse effects of climate extremes and variability or exploit concomitant benefits (IPCC, 2007; Janssen et al., 2006; Thompson et al., 2006; Wamsler et al., 2013). Consequently, climate change adaptation planning assesses and modifies contemporary and planned activities, policies and the built environment according to the current and projected impacts of climate change and related societal vulnerabilities (Dannevig et al., 2012; Füssel, 2007; Smit et al., 2000; Wamsler, 2014).

The generation of simply more knowledge on climate change is insufficient to achieve sustainable adaptation planning; rather, solution-oriented approaches are urgently needed (Miller et al., 2013; Wiek et al., 2012). Research efforts are increasingly focused on the conceptualization of multi-dimensional and radical change to achieve goal-oriented system-wide alterations that foster sustainability. Related literature is found under the topics of sustainability transitions (e.g. Forrest and Wiek, 2014; Markard et al., 2012; Van den Bergh et al., 2011) and sustainable transformation (IPCC, 2012; McCormick et al., 2013; Westley et al., 2011), and several research approaches have been developed (Forrest and Wiek, 2014; Geels and Schot, 2007; Markard et al., 2012; Rotmans and Loorbach, 2009; Sarewitz et al., 2012; Van den Bergh et al., 2011). Nevertheless, there is a lack of knowledge about the dynamics at play in "real-life experimental governance processes", how transitions unfold and "the specifics by which such processes contribute to change for sustainable development" (Bos and Brown, 2012, p. 1341).

The question of how to support the implementation of ecosystem-based adaptation and overcome barriers in local governmental bodies is investigated in the fields of ecosystem services (e.g. Daily and Matson, 2008; Daily et al., 2009) and climate change adaptation (e.g. Clar et al., 2013; Moser and Ekstrom, 2010) and has been addressed by several sets of guidelines (e.g. Andrade et al., 2011; Naumann et al., 2011; Roberts and O'Donoghue, 2013; Travers et al., 2012; Vignola et al., 2013, 2009; WWF, 2013). Further efforts have been undertaken to compile guidelines and checklists and translate general principles into consecutive steps (e.g. Dalal-Clayton and Bass, 2009; Travers et al., 2012). What is however missing is a systematic identification and characterization of particular strategies that have the potential to support comprehensive mainstreaming of sustainability issues into governments (Runhaar et al., 2014; Westley et al., 2011).

The motivation for mainstreaming originates from the need to change the dominant paradigm. Accordingly, mainstreaming is framed as incorporating new aspects into existing core work and it has been used for cross-cutting issues such as gender (e.g. Mazey, 2002), environment (e.g. Dalal-Clayton and Bass, 2009; Jordan and Lenschow, 2010), risk reduction (Benson et al., 2007; La Trobe and Davis, 2005; Wamsler, 2014), HIV/AIDS (e.g. Holden, 2004), education and learning (e.g. Ferreira et al., 2007) and climate change adaptation (e.g. Adelle and Russel, 2013; Wamsler, 2014). Ultimately, mainstreaming processes will change the rules of the game and challenge ideas, attitudes, or activities that are

considered as mainstream or normal (Oxford Dictionaries, n.d.; Picciotto, 2002) which in turn relates to the concept of sustainability transitions and sustainable transformation.

The need to mainstream the conceptual components of ecosystem-based adaptation, namely ecosystem services and climate change adaptation, into urban planning is advocated within the scientific literature of these two fields. The motivation is, firstly, that since ecosystem services are predominantly generated outside of protected areas, conservation needs to be mainstreamed across sectors, institutions, and stakeholders that are not primarily concerned with conservation (Cowling et al., 2008; Daily et al., 2011, 2009; Petersen and Huntley, 2005; TEEB, 2010). Secondly, adaptation is not a separate process but an integral part of urban planning; a coherent integration of climate change-related issues could thus generate multiple benefits from different sectoral policies (Kok and de Coninck, 2007; Persson and Klein, 2009; Swart and Raes, 2007; Wamsler, 2014).

Drawing on environmental policy integration, mainstreaming approaches can be classified according to horizontal and vertical integration, which distinguish and characterize the quality of governance relations between different actors (Lafferty and Hovden, 2003; Persson and Klein, 2009; Rauken et al., 2014). The vertical dimension refers to implementation by powerful governmental bodies (such as city councils) and to conditions that are characterized by strong guidance by core legislative powers or actors during the integration process (Jacob and Volkery, 2004). Horizontal dimensions can be defined as processes that refer to the implementation by less powerful entities (such as departments), and specifically to conditions that are characterized by a single department or actor that encourages or coordinates mainstreaming but has insufficient authority to exercise top-down control (Nunan et al., 2012).

The mainstreaming themes that emerge from the literature can be assigned to six strategic activities. Regarding on-the-ground operations, they consist of the initiation of new activities that directly focus on the topic under consideration (Holden, 2004; Roberts and O'Donoghue, 2013; Wamsler, 2014) and the alignment of departments' activities to integrate the topic under consideration (Holden, 2004; Roberts and O'Donoghue, 2013; Pelling et al., 2008; Wamsler, 2014). At the institutional level, the identified activities are the strategic collaboration between relevant stakeholders (Burch, 2010; Holden, 2004; Roberts and O'Donoghue, 2013; Pelling et al., 2008; Sitas et al., 2014; Wamsler, 2014), the revision and creation of regulations and policies (Burch, 2010; Roberts and O'Donoghue, 2013; Sitas et al., 2014; Wamsler, 2014) and the modification of organizational working structures (Burch, 2010; Holden, 2004; Roberts and O'Donoghue, 2013; Pelling et al., 2008; Wamsler, 2014). Finally, there are accounts of directed instructions from higher decision levels to support the integration of the topic under consideration (Burch, 2010; Pelling et al., 2008; Wamsler, 2014).

The framework for structuring mainstreaming activities by Wamsler (2014) encompasses and consolidates the strategic activities identified by other authors (Table 1). It was developed in an iterative process that included the distillation and analysis of existing approaches, close cooperation with governmental and non-governmental organizations, and its application in the field.

3. Methodology

A multiple case study approach (Yin, 2009) was used to analyze the key characteristics of local government activities regarding the integration of ecosystem-based adaptation into municipal planning. In this context, we identified four municipalities (Malmö, Helsingborg, Lomma and Kristianstad) in the Scania region in southern Sweden (see Fig. 1 and Supplementary Material, Table 1). Sweden is of particular interest as it expects substantial climate change impacts (Länsstyrelserna, 2012; SOU, 2007), whilst the country is described as "a pioneer in environmental governance" (Granberg and Elander, 2007, p. 538), and the importance of ecosystems for climate change adaptation was acknowledged at the national level in 2007 (SOU, 2007). Due to the exploratory character of the research, purposive sampling (Flyvbjerg, 2005; Tongco, 2007) was used to select municipalities with a high environmental or sustainability profile, and that have been proactive in regional research circles ("Planning under increased uncertainty" and "Ecosystem Services Planning") and two major research projects ("Ecosystem Services as a Tool for Climate Change Adaptations in Coastal Municipalities" and "Sustainable Urban Transformation for Climate Change Adaptation").

3.1. Data collection

As proactive civil servants have been identified as key factors in the mainstreaming of climate change adaptation (Roberts, 2010), interviewees were selected through purposeful sampling, based on

Table 1
Mainstreaming dimensions and related strategies.

Mainstreaming Dimensions[a]	Strategies	
Horizontal mainstreaming	(1) Add-on mainstreaming	Refers to the establishment of specific on-the-ground projects or programs that are not an integral part of the department's core objectives but directly target ecosystem-based adaptation or related aspects.
	(2) Programmatic mainstreaming	Relates to the modification of department's core work by integrating aspects related to ecosystem-based adaptation into on-the-ground projects or programs.
	(3) Inter- and intra-organizational mainstreaming	Promotes collaboration of individual sections or departments with other stakeholders (departments, organizations, committees, or governmental bodies) to inform, consult, advise or collaborate for shared knowledge generation, competence development and action-taking for advancing ecosystem-based adaptation.
Vertical mainstreaming	(4) Regulatory mainstreaming	Refers to the modification of planning procedures and related activities by formal and informal plans, regulations, policies and legislations that lead to integration of ecosystem-based adaptation.
	(5) Managerial mainstreaming	Refers to the modification of organizational management and working structures including related internal formal and informal norms and work descriptions as well as the configuration of sections or departments to better address aspects related to ecosystem-based adaptation.
	(6) Directed mainstreaming	Supports or redirects the focus onto aspects related to integrating ecosystem-based adaptation by providing topic-specific funding, promoting the initiation of new projects, supporting the education of staff, or directing responsibilities.

[a] Activities that relate to coordination are categorized according to horizontal mainstreaming (add-on, programmatic, and inter- and intra-organizational mainstreaming). Activities characterized by a high level of guidance are categorized as vertical mainstreaming (regulatory, managerial and directed mainstreaming). For a detailed description of the strategies and related examples see Wamsler (2014); strategies 4–6 are here included under the term organizational mainstreaming; strategy 3 is in the main included under inter-organizational mainstreaming.

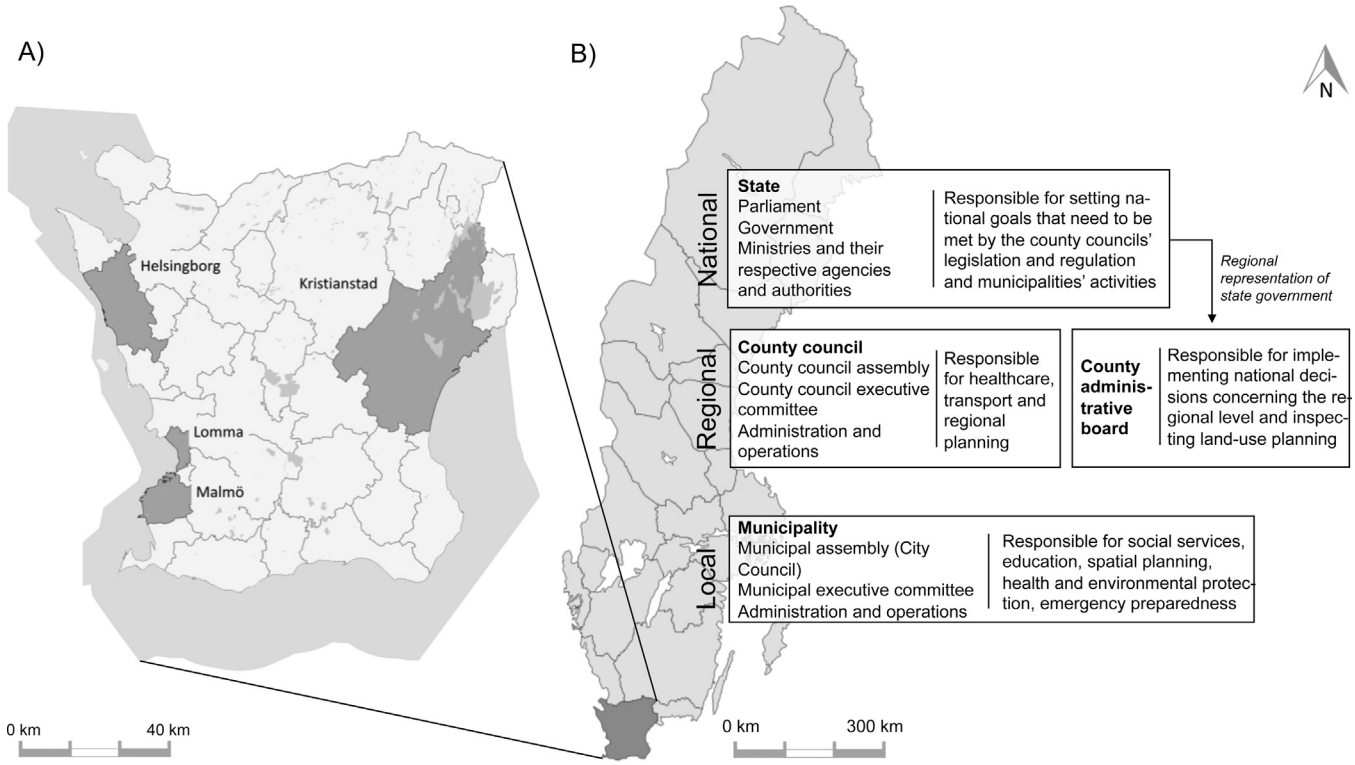

Fig. 1. Case study municipalities and respective levels of governance in Sweden. A) Map of Scania County and the location of the selected cases. The four municipalities (indicated by the dark grey area) are located on the east and west coast of Scania, bordering the Baltic Sea (Source: computed with ESRI 2011 based on data from the Centre for Geographical Information Systems at Lund University (n.d.)). B) Map of Sweden (Lokal Profil, 2009) and the three levels of governance namely the state, county councils and municipalities and their respective responsibility. The principle of self-governance has a long tradition in Sweden; it gives a pivotal role to municipalities as employers, service providers and supervisory authorities (SALAR, n.d.). Due to the financial system, all local governments and regional councils have the same economic conditions for pursuing their activities (ibid.).

their field of activity within the municipality and their participation in ecosystem services and climate change adaptation activities (see above). We conducted face-to-face interviews with 11 municipal staff members from departments engaged in spatial and environmental planning in 2014. Additional information was gathered in the context of Master's level courses at Lund University held in 2013 and 2014 that included interviews with 12 civil servants. In addition, literature extended the analysis by providing background and contextual information on the integration of ecosystem-based adaptation in planning structures and instruments.

3.2. Data analysis

The identification and analysis of relevant passages from the selected material was organized into four phases:

(1) Coding scheme development: six mainstreaming strategies were defined (see Table 1) and coded (Mayring, 2000) (see Supplementary Material, Table 2).
(2) Identification of potentially relevant text: relevant extracts of text were identified.
(3) Application of the coding scheme: extracts were assigned to categories according to coding rules (see Supplementary Material, Table 2)
(4) Identification of change patterns: the key change patterns were identified. Preliminary findings were discussed with staff from the respective municipalities and their feedback was included in the analysis.

4. Results

This section presents the strategies for mainstreaming ecosystem-services into municipalities according to the horizontal and vertical dimensions that were identified. An overview of the identified strategies is given in Table 2 (cross-case analysis), whilst the key patterns of change for each municipality are presented in the following sections (Sections 4.1–4.4).

4.1. Malmö Municipality

In recent years, Malmö Municipality has implemented a range of projects and coordinated activities that have fostered the integration of ecosystem-based adaptation into municipal structures both horizontally and vertically. The key change patterns include:

- The establishment of pilot projects on ecosystem-based adaptation through external funding.
- Increasing integration of the ecosystem service concept into the core work of the Environmental Department through the revision of various strategic planning documents.
- Active collaboration between departments, developers, consultants and researchers to stimulate the mainstreaming of ecosystem-based concepts at different levels.
- The adoption of a planning tool to leverage the loss of green space in new development projects.
- Increasing support from politicians for activities related to ecosystem service integration (see also Table 2).

Malmö's Environment Department has been the most successful municipal department in securing third-party funding in Sweden. This led, for example, to the implementation of a project on ecosystem-based adaptation ("Green tools for urban climate adaptation", 2009–13) (add-on mainstreaming). Related on-the-ground activities included green facades and roofs, ecological stormwater management and runoff water mitigation (GreenClimeAdapt, 2014). Outcomes were disseminated through an

Table 2
Identified characteristics of mainstreaming activities related to climate change adaptation and/or ecosystem service planning.

Strategies		Key characteristics
Horizontal mainstreaming	Add-on main-streaming	• Implementation of projects that are specifically aimed at testing and developing ES-based tools for CCA [Malmö] • Implementation of major technology-driven flood protection measures [Kristianstad]
	Programmatic mainstreaming	• EbA measures were integrated into stormwater management projects [Helsingborg] • Development of certain settlements based on criteria for protecting and compensating ecosystem services [Lomma, Malmö]
	Inter- and intra-organizational mainstreaming	• Temporary working groups were established to collaborate in drafting policy documents related to ES or CCA [Malmö, Helsingborg, Lomma, Kristianstad] • Different departments work together in order to plan for new municipal developments that integrate EbA measures [Malmö, Helsingborg, Lomma, Kristianstad] • Establishment of a special working group with staff from different departments with the aim of addressing the implementation of CCA-related projects [Malmö, Kristianstad] • Collaboration between university and municipality staff leading to the development of different documents that guide strategic ES and/or CCA planning [Malmö, Helsingborg] • Collaborations with local stakeholder groups are used to integrate CCA and/or ES-related knowledge into the planning process [Malmö, Helsingborg, Lomma, Kristianstad] • Collaborations are established with adjacent municipalities to coordinate activities within the watershed [Lomma, Kristianstad] • Municipalities engage in networking activities organized by the County Administrative Board to support better connections between civil servants in different municipalities that work on either ES or CCA planning [Malmö, Helsingborg, Lomma, Kristianstad] • International networks are used to support local spatial planning of ES [Helsingborg] or CCA [Malmö, Kristianstad]
Vertical mainstreaming	Regulatory mainstreaming	• Single departments have incorporated ES terminology into Comprehensive Plans [Malmö, Helsingborg, Lomma, Kristianstad] • Crucial steps for addressing CCA were codified in policy documents to inform strategic planning [Helsingborg] • Departments responsible for ES or spatial planning have or are developing a tool to compensate for the loss of ecosystem services in Detail Plans [Malmö, Helsingborg, Lomma, Kristianstad] • Civil servants developed an extensive list of ecological criteria to systematically evaluate and minimize potential impacts on ecosystem services in new Detail Plans [Lomma] • It was specified in policy documents that new buildings have to be built at a certain height above sea level, before related national legislation was endorsed [Lomma].
	Managerial mainstreaming	• Organizational restructuring that placed responsibility for CCA at a higher decision-making level to allow for central coordination [Helsingborg] • Employment of additional staff and development of work tasks along with their official job description in order to integrate EbA-related topics into municipal planning [Lomma] • Changes in working procedures based on informal rules to ensure environmentally-sensitive planning [Lomma] • In order to translate EbA-related measures included in the Comprehensive Plan into Detail Plans, civil servants have developed informal working procedures since formal guidelines do not exist [Malmö, Helsingborg, Lomma, Kristianstad]
	Directed mainstreaming	• The City Council promoted a series of ES seminars and provided funding for projects related to ES planning [Malmö] • Local politicians initiated/supported the city's participation in the Making Cities Resilient campaign [Malmö, Kristianstad] • The City Council endorsed participation in an international city network and projects related to ES planning [Helsingborg] • Local politicians support municipal staff to strengthen ES in spatial planning [Lomma] • The City Council endorses changes in formal planning and policy documents [Malmö, Helsingborg, Lomma, Kristianstad]

online course organized by the project's partner, the Scandinavian Green Roof Institute (inter- and intra-organizational mainstreaming). In 2012, the Environment Department started the "BiodiverCity" project (Malmö Stad, n.d.) to develop solutions that promoted biodiversity, including roadside trees, green roofs, mobile plant systems and three-dimensional greenery (add-on mainstreaming).

> *"we have had the fortune to get some projects which allow us to free up time [beside regular responsibilities] to work with it [ecosystem-based adaptation], and to discuss it."*

In the past two years the integration of the ecosystem service concept into the core work of the Environmental Department has been fostered by the inclusion of ecosystem service terminology into the department's objectives and strategic planning documents (to promote programmatic mainstreaming). Civil servants have used the concept to motivate the creation and conservation of ecological structures outlined in the Comprehensive Plan[2] (Malmö Stad, 2014). In addition, the Action Plan for Climate Adaptation (Malmö Stad, 2012) uses ecosystem-based adaptation principles and makes explicit links to other planning documents considered important for adaptation planning in the future, e.g. the Environmental Program and Stormwater Strategy (regulatory mainstreaming) (Malmö Stad, 2008, 2009).

The dissemination of the ecosystem-based adaptation concept has been promoted through close collaboration within the municipality and with external partners, including other municipalities, local stakeholder groups and university (inter- and intra-organizational

[2] The Swedish planning process is organized in comprehensive and detail planning: Comprehensive Plans provide strategic, non-legally binding orientation for spatial planning and planning on a more detailed level. They cover the whole city, focus on a time horizon between 10 and 25 years and are updated every four years. Detail Plans are legally binding and comprise a specific residential area or a single plot. They cover built-up areas, create the preconditions for construction, define the purpose for the development and determine the townscape.

mainstreaming). Cooperation and working groups have been established to develop planning guidelines and policy documents or to collaborate on a project basis (e.g. GreenClimeAdapt, 2014; Malmö Stad, 2012, 2013, 2014). The Action Plan for Climate Adaptation (Malmö Stad, 2012) was, for instance, drafted based on a collaborative project between university researchers and municipal staff (although it was never implemented due to the lack of finance).

Regulatory mainstreaming of ecosystem-based planning was further promoted by the establishment of a "green factor" tool (Kruuse, 2011), which intends to ensure that green space is included in development projects. Initially, the tool was developed for the Bo01 international housing exposition in 2001 ("The Sustainable City of Tomorrow"). Later, the tool became part of an environmentally-friendly construction program (Malmö Stad, 2012) developed in cooperation with a nearby municipality and a university (inter- and intra-organizational mainstreaming), which was accepted by Malmö's City Council in 2009. Now it is applied along with other local and national legal requirements. In addition, regulatory mainstreaming was promoted by the above-mentioned two projects, which also aimed to develop guidelines and technical instructions to help developers comply with environmental requirements (e.g. of the Environmental Building Programme, see Malmö Stad, 2012).

Managerial mainstreaming strategies were found to be rather weak. Although in 2012 two officials were formally appointed to be the focal point for climate change adaptation, this did not translate into particular responsibilities.

Finally, in general municipal staff viewed elected politicians as supportive, as they have actively promoted ecosystem-based planning activities (directed mainstreaming). Politicians have promoted mainstreaming through awareness-raising activities, clarifying responsibilities for actions, making additional funding available, and maintaining a dialog with ecologists.

> "*last year for instance they [politicians] asked us [Environment Department] to make a seminar series about ecosystem services . . . In particular one politician . . . really discusses with us [ecologists] . . . and asks us what we think and tries to inform us and then have strategies, good strategies, and he will probably give us some money, when he can.*"

The City Council also took the lead in the decision to fund the two-year project "Living Malmö", launched in 2014. This comprehensive project builds on the Comprehensive Plan (Malmö Stad, 2014) and the final report of the Commission for a Social Sustainable Malmö (2013). It aims to generate knowledge on how to operationalize the city's vision of a green and dense city and create social cohesion (which supports programmatic mainstreaming). In addition, political support led to participation in the "Making Cities Resilient" campaign run by the United Nations Office for Disaster Risk Reduction (UNISDR). As a direct consequence, the City Office established a working group, including the Environment Department, the City Planning Office, and the Streets and Parks Department, to analyze Malmö's hazard risk profile and examine how risk reduction and adaptation measures could be better coordinated (inter- and intra-organizational mainstreaming).

4.2. Helsingborg Municipality

The horizontal and vertical integration of ecosystem-based adaptation into Helsingborg Municipality followed conventional decision-making procedures, but introduced changes that resulted in the review and modification of working structures. The key change patterns include:

- The integration of ecosystem-based adaptation into sectoral core work by revising strategic planning documents and integrating ecosystem-based adaptation measures into water management projects.
- Collaboration with an international city network, which supports increased engagement in ecosystem-based planning.
- The development of a planning tool that compensates for impacts on ecosystem services.
- Giving responsibility for climate change adaptation to the highest decision-making level to better address related challenges and direct changes.
- Political support that has facilitated the establishment of stricter regulations and cooperation related to ecosystem service planning (see also Table 2).

In recent years, the Planning Office[3] and the Environment Department have pursued activities oriented towards programmatic mainstreaming. The Planning Office laid the foundation for the systematic consideration of climate change adaptation through the revision of the Comprehensive Plan and related research (Helsingborg, 2010), published as the "Promemoria Climate Change Adaptation" and approved by the City Council in 2012 (Helsingborg, 2012). This document argues that important adaptation measures include the restoration and creation of wetlands, nature reserves in coastal areas, green roofs, and expanding tree cover. In addition, both municipal bodies have promoted ecosystem-based planning by structuring their newly developed Green Structure Program around the concept of ecosystem services (Helsingborg, 2013a), which will serve as basis for the next Comprehensive Plan (Helsingborg, 2013b). In addition, the Environment Department has developed new ecosystem-based open stormwater management projects, which, unlike conventional approaches, harness green infrastructure to manage water flows and support biodiversity.

> *"we [Environment Department] provided the money to assist the development of . . . a stormwater pond; since we had contributed with some money, we obviously had some things to say [and promoted a more ecosystem-based approach]."*

Civil servants have further taken part in several collaborations to promote ecosystem-based adaptation-related activities (inter- and intra-organizational mainstreaming) (see Table 2). They include active participation in the global cities network ICLEI (since 2000), which has improved the city's sustainability performance. In 2013, the city's involvement in the network's Local Action for Biodiversity Programme resulted in the publication of a special report on Helsingborg's biodiversity, which acknowledges the role of ecosystem services for climate change adaptation (Helsingborg and LAB, 2013). In addition, the Planning Office involves local stakeholder groups in adaptation planning and in the compilation of biological inventories, and it collaborates in ecosystem service research projects. At the municipal level, different departments collaborate in the implementation of green infrastructure and ecosystem-based planning. In the context of climate change adaptation, interdepartmental collaboration is focused on emergencies and immediate hazard responses.

Regarding regulatory mainstreaming, in 2007 the City Council approved an additional tool, the *Balanseringsprincip* (balancing principle), which requires compensation for the degradation of municipal land. The balancing principle follows a four-step procedure, which aims to avoid environmental impacts and, if this is not possible, requires a replacement habitat (Helsingborg and LAB, 2013). However, because of methodological ambiguities, the Planning Office has only recently started to apply the tool.

[3] Note that spatial planning in Helsingborg Municipality is the responsibility of the City Planning and Technical Services Department. The term 'Planning Office' is used to simplify the description and to improve cross-case comparisons.

Furthermore, the municipality has recently changed its working structures and related responsibilities to better address climate change adaptation following the publication of a new policy (Helsingborg, 2012) (managerial mainstreaming). While the Planning Office was initially in charge of climate change adaptation and accordingly published the above-mentioned "Promemoria Climate Change Adaptation", this responsibility was eventually moved to a higher decision-making level, the Executive Management Office, which oversees departmental activities. The change was requested by the Planning Office to facilitate the task of instructing departments to change their practices and directing adaptation-related tasks (directed mainstreaming).

> "*they [the Executive Management Office] got the responsibility to work with this action plan for adaptation, because they want to point out what the municipal companies should do, what [departments] should do, and ... you cannot do it here [at the Planning Office], because we do not have influence over these companies, so that's why you have to lift it up to [...] the highest level in this organization.*"

Finally, Helsingborg's politicians support ecosystem-based adaptation mainstreaming (directed mainstreaming). However, related initiatives are generally initiated by civil servants.

4.3. Lomma Municipality

The integration of ecosystem-based adaptation into Lomma Municipality's core work has benefited from proximity to decision-makers and simple working structures that supported horizontal and vertical mainstreaming strategies. The key change patterns are:

- The integration of ecosystem-based adaptation for flood protection into spatial planning and related policy documents.
- Active engagement in internal and external collaborations for the implementation of ecosystem-based activities.
- The development of a new spatial planning tool to compensate for environmental impacts and promote ecosystem-based planning in new development projects.
- The establishment and enforcement of informal tools and working practices that support compliance with ecosystem-based adaptation principles in planning proposals.
- Increased political support for ecosystem-based planning (see also Table 2).

The Planning Section[4] sees ecosystem-based adaptation as part of their core work and has actively used the ecosystem service concept since 2008, which promotes programmatic mainstreaming. Since the 1980s, ecological structures have been used for natural flood protection. However, the City Council did not start to actively engage with the concept until 2012, when the County Council published a report on green infrastructure (Region Skåne, 2012). Adaptation terminology found its way onto the municipal agenda in 2007 following heavy flooding.

Active collaboration within the municipality and with non-municipal actors supports ecosystem service planning (inter- and intra-organizational mainstreaming). For example, in 2013–2014 Lomma organized workshops on ecosystem services planning. Like in the other municipalities, civil servants participated in seminars organized by the County Administrative Board, which facilitated the development of a common language related to ecosystem service and climate change adaptation planning. In addition, since 2009 Lomma has collaborated with two of its neighboring municipalities in improving water management and reducing water runoff (Lomma kommun, 2010).

Regarding regulatory mainstreaming, the municipality has developed informal rules and procedures for municipal planning. In 2013, the Planning Section applied a new planning tool, similar to the one used in other municipalities, which requires new projects to compensate for ecological impacts in order to prevent the degradation of green infrastructure and ecosystem services. In relation to climate change adaptation, in 2009 the municipality ruled in the Comprehensive Plan that new buildings should be constructed three meters above sea level. This regulation was later strengthened by national legislation (Planning and Building Act, 2012), which enables the County Administrative Board to reject development projects that violate the regulation. In 2012, the Planning Section developed and continued to revise an extensive checklist for the systematic evaluation of Detail Plans. In addition to legal requirements, the checklist includes criteria related to ecosystem-based adaptation planning (e.g. issues such as green corridors, stormwater management, flood risk and heat islands). In order to increase the amount of green infrastructure in new developments, planning documents, and specifically the environmental objectives (Lomma kommun, 2014), have also been revised.

Activities related to managerial mainstreaming include changes to the working structures of the Planning Section. The Planning Section is the key actor for ecosystem-based adaptation. This is due to its overall mandate for spatial planning, its formal responsibility for climate change adaptation (since 2007) and increasing environmental concerns that also resulted in the creation of a new position in the Planning Section in 2012. Furthermore, and unlike other municipalities, civil servants claim that they can more freely develop their working areas, which eases the adoption and integration of new topics.

Finally, proximity to the decision-making body (see footnote 4) is acknowledged as an important lever to lobby for political support (directed mainstreaming). Local politicians support the Planning Section's initiatives and promote the focus on ecosystem-based planning. They have for instance recently endorsed strategic objectives to reverse the effect of past developments that have significantly decreased Lomma's green infrastructure.

4.4. Kristianstad Municipality

In Kristianstad, activities related to horizontal and vertical mainstreaming were found to be significantly influenced by its flood-prone location and related decisions that have historically been guided by an infrastructure-based and technology-driven approach. The key change patterns are:

- The integration of ecosystem-based adaptation into water management-related projects/measures.
- The integration of the ecosystem services concept into the Comprehensive Plan.
- Increasing collaboration with internal and external actors to improve the integration of ecosystem services into municipal planning.
- Incremental changes in planning practices that acknowledge the importance of green and blue infrastructure for adaptation (see also Table 2).

Parts of Kristianstad are below sea level and in 2005 its peri-urban wetland *Vattenriket* ("the Rich Wetlands" or "Water Kingdom") was designated a biosphere reserve by UNESCO. Since then, climate change and nature conversation have become important topics in on-the-ground operations (add-on and programmatic mainstreaming). Following heavy flooding in 2002, the Technical Service Department

[4] Note that spatial planning in Lomma Municipality is the responsibility of the Executive Management Office, which is part of the City Council (the highest decision-making level). The term 'Planning Section' is used to simplify the description and improve cross-case comparisons.

built levees and constructed pump systems to protect Kristianstad from future climate change impacts (C4 Teknik, 2014, n.d.). However, the department has increasingly favored ecosystem-based approaches and given priority to open water systems and green infrastructure to buffer extreme hazard events (C4 Teknik, 2010). Accordingly, Kristianstad's Climate Strategy (Kristianstad, 2011) focuses on infrastructure-based and technology-driven flood protection but acknowledges the need for green infrastructure in urban cooling (regulatory mainstreaming).

The perception of Kristianstad's wetlands has changed over time (Magnusson, 2004). In recent years the municipality has changed its planning practices in favor of a more ecosystem-based adaptation approach (programmatic mainstreaming). In 2010, plans to transform parts of the urban wetland into a new housing area were rejected (Magnusson and Svensson, 2012).

There are also several activities that relate to inter- and intra-organizational mainstreaming. In 2011, as a result of its long-standing efforts in addressing flood risk, the municipality was declared an international role model for local governments during the UNISDR "Making Cities Resilient" campaign. This stimulated interest from researchers and practitioners and led to several projects on adaptation and ecosystem services. In order to better integrate the ecosystem-based planning approach, the municipality has recently started to work in six international and national collaborative projects.

Within the municipal structure, the Biosphere Office, which is responsible for the above-mentioned biosphere reserve, is the most prominent advocate of ecosystem-based planning and related regulatory mainstreaming. This is related to the fact that the reserve provides natural flood protection for the city (Naturvårdsverket, 2009). The Biosphere Office promoted the integration of the ecosystem service concept into the Comprehensive Plan (Stadsbyggnadskontoret, 2013) and collaborates with the Planning Office to strengthen the ecosystem-based approach in spatial planning projects. The Comprehensive Plan recommends avoiding urban development in flood-prone areas and, if this is not possible, promotes related adaptation measures (Stadsbyggnadskontoret, 2013). Accordingly, recent Detail Plans specify how water runoff and drainage systems must be planned. Furthermore, the development of Kristianstad's coastal tree line has translated into legislation that prohibits logging in these areas to prevent erosion. More recently, the municipality has developed a seven-step strategy to improve the city's greenery and applied a compensation principle that requires the planning of at least two new trees for every tree that is cut down (C4 Teknik, 2012).

5. Discussion

The results show that all of the investigated mainstreaming strategies have been applied in practice, whilst the importance given to particular strategies and specific activities varies (see Table 2). Our analysis provides insights into the practices that civil servants use to promote ecosystem-based planning and harness blue and green infrastructure for climate adaptation. Furthermore, our results highlight a gap between the burgeoning concept of ecosystem-based adaptation and its practical implementation (Section 5.1), synergies between strategies which can help to overcome barriers to mainstreaming (Section 5.2), ambiguities regarding the mainstreaming concept and potential drawbacks (Section 5.3), and mainstreaming strategies as potential lever for change in sustainability transitions (Section 5.4).

5.1. Ecosystem-based adaptation: from concept to custom

Whilst conceptually, ecosystem-based adaptation is framed as a comprehensive approach, rooted in both ecosystem service and climate change adaptation research (Chong, 2014; Uy and Shaw, 2012a, 2012b), in practice activities are manly implemented independently. Activities are often motivated by *either* ecosystem services *or* climate change adaptation, depending on the context and the background of the principal actors leading mainstreaming efforts. In Lomma and Kristianstad Municipality, for example, past flooding has increased support for the use of green infrastructure for adaptation, while in Helsingborg Municipality the focus on biodiversity has been used to justify similar measures.

Furthermore, we found that progress in the mainstreaming of ecosystem-based adaptation tended to be associated more with increasing commitment to ecosystem service planning than climate change adaptation. This is mainly because projects and activities that highlight nature conservation are well established, which enables the responsible departments and civil servants to engage with ecosystem services by expanding their work portfolio (cf. Sitas et al., 2014). In contrast, climate change adaptation is understood as a cross-cutting issue that is not associated with a particular department. In addition, climate change adaptation measures are often dominated by an infrastructure-based and technology-driven approach, and consequently remain unrelated to ecosystem services. Like other research (e.g. Doswald et al., 2014), we found that ecosystem-based adaptation measures are not necessarily labeled as such. It takes time for these terms to be explicitly adopted, although they are already implicitly reflected in practice (Sitas et al., 2014).

5.2. Mainstreaming strategies: synergies to overcome barriers

Our results show that mainstreaming efforts can lead to synergies that can help to overcome mainstreaming barriers.

5.2.1. Synergies between ecosystem services and climate change adaptation

Whilst scholars have drawn attention to the risk of "mainstreaming overload" as different topics compete for attention in governmental agencies (Agrawala and Van Aalst, 2008, p. 188; Kok and de Coninck, 2007, p. 588), our findings suggest that, at the local level, the integration of a new topic can be enabled through departments' experience in mainstreaming other topics. For example, Malmö's Environment Department has secured external funding for projects related to biodiversity, green infrastructure and ecosystem services, which has led to mainstreaming at different levels. With the appropriate structures and knowledge in place, the Department's staff initiated some years later a climate change adaptation project (see GreenClimeAdapt, 2014).

5.2.2. Synergies between mainstreaming strategies

Our results show that a combination of mainstreaming strategies has the potential to balance shortcomings in individual activities (cf. Wamsler, 2014). For example, civil servants in Malmö highlighted the difficulty of incorporating a new topic into the department's core work and objectives (to enable programmatic mainstreaming) due to a lack of resources. This was, however, counterbalanced by external project grants (add-on mainstreaming). Furthermore, barriers to inter- and intra-organizational collaboration owing to differences in disciplines and diverging departmental objectives were addressed by increased collaboration with likeminded staff or lobbying for support at a higher decision-making level (directed mainstreaming). A lack of supporting legislation was emphasized by nearly all interviewees; this was compensated for by informal rules to ensure compliance with working procedures (managerial mainstreaming) and new planning tools (regulatory mainstreaming). We found that the latter was also actively promoted through the support and approval of dedicated politicians of the City Council (directed

mainstreaming). The ability to compensate for strategy-specific barriers by using complementary activities showed the importance of applying different mainstreaming strategies and diverse pathways to target desired features. In addition, the results confirm the importance of both horizontal and vertical dimensions as complementary strategies to reinforce and balance each other (Nunan et al., 2012; Rauken et al., 2014). This is discussed in more detail in the following section.

5.2.3. Synergies between horizontal and vertical dimensions of mainstreaming

At the local level, vertical and horizontal mainstreaming is ideally represented on the one hand, by devoted politicians who ensure the integration of new topics and on the other, by dedicated civil servants who streamline activities. However, our results provide a more comprehensive and complex picture.

First, our analysis shows that civil servants can also integrate new topics into municipal work. In Malmö, for example, civil servants successfully integrated ecosystem-based adaptation through project funding. Similarly, civil servants in Helsingborg employed commonly-used working procedures to integrate climate change adaptation and ecosystem services into the Comprehensive Plan by developing strategic policy documents. This shows that, even without support from higher decision-making levels or supporting legislation, strong leadership can lead to ecosystem-based adaptation (Roberts, 2010, cf. 2008).

Second, our analysis shows that politicians also have an interest in actively streamlining new objectives into existing regulations and strategic goals to support related measures and project implementation on the ground. Although national legislation does not encourage Swedish municipalities to introduce requirements related to ecosystem services or adaptation, local politicians supported the establishment of new planning tools. For example, in Lomma, the integration of ecosystem-based planning has only been possible because of local politicians who explicitly took action to reverse the decrease in green infrastructure. Nevertheless, in order to foster comprehensive mainstreaming and fully utilize existing efforts, supporting legislation is crucial (e.g. Pelling and Holloway, 2006).

5.3. Learning from past and present mainstreaming approaches

Our study draws attention to the limitations of the mainstreaming approach and how they can be counteracted through their explicit consideration and the development of contextualized strategies. The question of how to influence policymaking and its implementation has been the subject of research efforts in many fields. In particular, sustainable development has been concerned with the incorporation of key principles into the core of decision-making since its foundation (Gibson et al., 2005; UNCED, 1992; United Nations, 1992). While today, the empirical analysis of ecosystem services-related integration is limited (Turnpenny et al., 2014), our analysis (together with previous mainstreaming attempts) may provide critical insights into the limitations and prospects of the approach.

A central concern in mainstreaming approaches is the risk of creating results that are contrary to the targeted outcomes (see Stratigaki, 2005). However, this was not confirmed by our research. Mainstreaming builds on existing structures to disseminate a new issue, and it can be co-opted for other purposes. For example, a criticism of gender mainstreaming was that it allowed those in power to adopt the same language to legitimize their actions, which ran counter to intentions (e.g. Stratigaki, 2005; True, 2010). Similarly, research into environmental policy integration has shown how reframing environmental concerns into concepts such as 'quality of life' and 'sustainability' has diverted attention from more traditional environmental policy issues (Weber and Driessen, 2010). In the case of adaptation, development projects may aim to maximize ecosystem services, while at the same time reinforcing norms and processes that increase risk and vulnerability (e.g. waterfront development and gentrification). However, our results show that the ecosystem-based approach often calls into question the underlying structures of municipal organizations and helps to mitigate diverging departmental interests. For example, the integration of ecological structures into Helsingborg's stormwater management system has called into question the usual separation between nature conservation and construction-based, physical planning. In addition, a strength of ecosystem-based adaptation as a mainstreaming topic is that the concomitant benefits are inherently more accessible across population groups (unlike traditional adaptation and risk reduction), thereby addressing underlying risk factors and making it more difficult to misuse.

Another challenge of mainstreaming (highlighted in the context of gender mainstreaming) is that the new topic risks becoming nobody's responsibility (see Goetz and Sandler in True, 2010), resulting in a technocratic exercise that is unlikely to ever change social relationships (Palmary and Nunez, 2009; Turnhout et al., 2013). Mainstreaming concepts such as ecosystem-based adaptation and ecosystem services may promote the use of checklists and scorecards with little analysis or underlying knowledge of ecological structures, functions and processes and how they apply to local conditions. Like gender mainstreaming (e.g. Stratigaki, 2005), it may be used as a rationale for closing down projects or departments specialized in adaptation and risk reduction. This last point highlights the comprehensiveness of the mainstreaming framework we present, which also features "add-on" activities and related institutional support.

Additionally, while the implementation of mainstreaming approaches usually requires well-defined protocols to ensure quality, the implementation of ecosystem-based adaptation is quite different to the technocratic practices that have been the subject of criticism. In fact, a lack of knowledge about the implementation of ecosystem-based planning (Ahern et al., 2014) means that the integration of local knowledge is essential (e.g. Cowling et al., 2008; Sitas et al., 2014). Our results show that ecosystem-based measures challenge the conventional planning approach and the prevailing "predict-then-act" paradigm. For example, in Malmö the stormwater management system traditionally relies on the quantification and modeling of system components, while the recently introduced ecosystem-based adaptation approach builds on learning-by-doing. Several studies have shown that the former is not enough to ensure adaptive capacity (Ahern et al., 2014; Pahl-Wostl, 2009) and effective use of existing resources (Burch, 2010). These studies highlight the importance of developing local scenarios and empirical testing to develop particular measures and strategies. Nevertheless, care must be taken to consider the counteracting forces (presented in this section) in developing contextualized strategies.

5.4. Mainstreaming strategies: leverage points for fostering sustainability transitions in local government

Our results underline the need for contextualized strategies to the mainstreaming of sustainability issues. Whilst mainstreaming strategies can provide fruitful avenues for levering urgently needed transformation in local governments, systematic analyses of successful initiatives are required to inform and improve the transformation processes (Forrest and Wiek, 2014) and design transition models according to local specificities. Our results did not find a specific "success strategy" that provides local governments with well-defined pathways to sustainability. Like other studies, we found that municipalities' mainstreaming ability

depends on a range of factors such as their size, individual staff members' efforts, prior experience and external expertise (cf. Burch, 2010; Dannevig et al., 2012; Van den Bergh et al., 2011). Consequently, our results also show that mainstreaming requires flexible strategies that take account of context-specific features and utilize network governance (Steurer and Martinuzzi, 2005; Williams, 2002).

We argue that the mainstreaming strategies presented in this paper have – if applied systematically – the potential to move sustainability into the core of municipal decision-making. They can lead to the combination of governance dimensions, involve a diversity of actors to generate knowledge as well as encourage goal-oriented and learning-by-doing approaches, while taking into account the local context.

Future research needs to investigate the mainstreaming framework as a way to integrate new topics into local governments, particularly given that our analysis focused on municipalities that already perform well in terms of environmental and sustainability issues. We identified three essential elements of mainstreaming strategies that are key to such endeavors:

1. Local government structures involve a complex interplay between horizontal and vertical mainstreaming dimensions; related activities not only complement but also reinforce each other. Future research needs to test and refine strategies against context-specific barriers in order to further clarify how the interplay of governance dimensions contributes to sustainability transitions.
2. There is a need for close collaboration between scientists and practitioners to establish concepts and share knowledge in place-based applications and the development of salient solutions (Lang et al., 2012). In line with other research, partnerships between these actors (and knowledge brokers both within and external to the municipality) were shown to enable innovative solutions and create strategic alliances (Ernstson et al., 2010; Westley et al., 2011). To ensure shared ownership and the meaningful translation of mainstreaming strategies into practice, future research needs to be based on close collaboration with municipal staff.
3. Initiating sustainability mainstreaming strategies is less strategic than the term might suggest; rather, key actions evolve alongside decision-making and institutional structures, and contextual settings. This puts the emphasis on adaptive design and mainstreaming frameworks (cf. Ahern et al., 2014) that facilitate learning-by-doing (Jones et al., 2012b; Roberts et al., 2011) and safe-to-fail experimentation (Kato and Ahern, 2008). Future research needs to create opportunities for civil servants to engage with the concept of ecosystem-based adaptation and contribute to the development of solution-oriented mainstreaming approaches in an environment that facilitates learning and knowledge creation throughout the implementation processes.

6. Conclusion

This study investigated four local governments in southern Sweden (Malmö, Helsingborg, Lomma and Kristianstad) and looked at ways to mainstream ecosystem-based adaptation into municipal planning in order to foster sustainability transitions. Our analysis shows, first, that the mainstreaming of ecosystem-based adaptation is, to a large extent, compartmentalized according to the angle from which related activities are approached (i.e. ecosystem services or climate change adaptation planning). We conclude that the integration of ecosystem-based adaptation could benefit from the creation of governance structures that combine well-established conservation efforts with the coordination and management of climate change adaptation, through defined decision-making bodies at different levels. Second, it provides empirical evidence that mainstreaming strategies can complement and reinforce each other and shows how a combination of activities together with strong leadership can balance the shortcomings of single strategies. Our analysis went beyond a general description and characterization of mainstreaming strategies and investigated topic-specific activities that provide some initial insights into how goal-oriented integration processes can be achieved. Third, we showed how ecosystem-based adaptation can address criticism of mainstreaming approaches in the context of other cross-cutting topics (such as gender mainstreaming). We conclude that systematic mainstreaming of sustainability issues is inherently able to address such criticism, and provides fruitful avenues to lever the urgent need for sustainable transformation of local governments. Finally, we call for further research into mainstreaming that not only makes use of the framework to analyze existing practice, but also applies it as a tool, while working in close collaboration with civil servants to move sustainability into the core of local governance decision-making.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.gloenvcha.2014.09.008.

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