Jari Lyytimäki

The environment in the headlines
Newspaper coverage of climate change and eutrophication in Finland

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Jari Lyytimäki

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Original publications

The dissertation is based on the following peer-reviewed articles which will be referred by their roman numerals.


**Article II:** Lyytimäki, J., Tapio, P., 2009. Climate change as reported in the press of Finland: From screaming headlines to penetrating background noise. *International Journal of Environmental Studies* 66(6): 723-735 DOI: 10.1080/00207230903448490


**Author’s contributions**

Jari Lyytimäki took the initiative for Article I, performed the literature review forming the basis of the analysis and outlined the first versions of the manuscript. Finalizing the manuscript and drawing the conclusions was a collaborative effort with professor Mikael Hildén.

Jari Lyytimäki took the initiative for Article II, performed the media analysis and outlined the first versions of the manuscript. Adjunct professor Petri Tapio collected the data for indicators presented in Figure 2. Finalizing the manuscript and drawing the conclusions was a collaborative effort between the authors.

Jari Lyytimäki was fully responsible for the articles III, IV and V.

Jari Lyytimäki took the initiative and wrote the first version for the Article VI. The further development and finalizing of the article was a collaborative effort with adjunct professor Timo Assmuth and professor Mikael Hildén.
# List of abbreviations

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<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>CCM</td>
<td>Circuit of Culture Model</td>
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<tr>
<td>COP</td>
<td>Conference of Parties</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>HELCOM</td>
<td>Baltic Marine Environment Protection Commission (Helsinki Commission)</td>
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<td>HS</td>
<td>Helsingin Sanomat</td>
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<td>IAM</td>
<td>Issue-Attention Model</td>
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<tr>
<td>IMO</td>
<td>International Maritime Organisation</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>PAM</td>
<td>Public Arenas Model</td>
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<td>PE</td>
<td>Piercing Effect</td>
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<td>PEM</td>
<td>Punctuated Equilibrium Model</td>
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<td>PSSA</td>
<td>Particularly Sensitive Sea Area</td>
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<tr>
<td>QCT</td>
<td>Quantity of Coverage Theory</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNCED</td>
<td>United Nations Conference on Environment and Development</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<td>US</td>
<td>United States</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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The environment in the headlines
Newspaper coverage of climate change and eutrophication in Finland

Jari Lyytimäki
University of Helsinki, Faculty of Biological and Environmental Sciences, Department of Environmental Sciences


Abstract

Media representations are an important part of the dynamics of contemporary socio-ecological systems. The media agenda influences and interacts with the public and the policy agenda and all of these are connected to the changes of the state of the environment. Partly as a result of media debate, some issues are considered serious environmental problems, some risks are amplified while others are attenuated, and some proposals for remedies are highlighted and others downplayed. Research on environmental media coverage has focused predominantly on the English-speaking industrialised countries. This thesis presents an analysis of Finnish environmental coverage, focusing on representations of climate change and eutrophication from 1990–2010. The main source of material is Helsingin Sanomat (HS), the most widely-read newspaper in Finland. The analysis adopts the perspective of contextual constructivism and the agenda-setting function of the mass media. Selected models describing the evolution of environmental coverage are applied within an interdisciplinary emphasis. The results show that the amount of newspaper content on eutrophication and climate change has generally increased, although both debates have been characterised by intense fluctuations. The volume of the coverage on climate change has been higher than that of eutrophication, especially since 2006. Eutrophication was highlighted most during the late 1990s while the peaks of climate coverage occurred between 2007 and 2009. Two key factors have shaped the coverage of eutrophication. First, the coverage is shaped by ecological factors, especially by the algal occurrences that are largely dependent on weather conditions. Second, the national algal monitoring and communication system run by environmental authorities has provided the media with easy-to-use data on the algal situation during the summertime. The peaks of climate coverage have been caused by an accumulation of several contributing factors. The two most important factors contributing to the increase in coverage since 2006 include international policy negotiations and mild and snowless winters. Between 2006 and 2008, other factors included the releases of major scientific reviews, expressions of concern by key actors, and the related debate on energy policy. Changes in the anthropogenic driving forces of the environmental changes, namely nutrient discharges and greenhouse gas emissions, had only a marginal impact on the level of coverage. Based on the results, it is suggested that wide-ranging climate reporting has caused what has been called a piercing effect. This means that after the phase of intense and widespread media coverage, climate issues will not disappear but will shift from highly visible environmental headlines to less visible but more pervasive background information presented in various contexts. Such a piercing effect was not identified for eutrophication. This thesis highlights the importance of taking media coverage into account as a key factor in the formulation and implementation of environmental policies aimed at broad-based actions.

Key words: climate change, environmental issues, eutrophication, newspaper coverage
Ympäristö otsikoissa
Sanomalehtiutuisointi ilmastonmuutoksesta ja rehevöitymisestä
Suomessa

Jari Lyytimäki

University of Helsinki, Faculty of Biological and Environmental Sciences, Department of Environmental Sciences


Tiivistelmä (Abstract in Finnish)


Asiasanat: ilmastonmuutos, rehevöityminen, sanomalehtiutuisointi, ympäristökysymykset
1 Introduction

This chapter introduces the departure points for this thesis, focusing on the media representations of environmental issues. First, the meaningfulness of the chosen focus is justified by a brief review of the role of media representations describing the information on the state of the environment. Second, the design of the study is presented using the Vee heuristic as an organising tool. The thesis is based on six peer-reviewed articles.

1.1 The perpetuity and perplexity of environmental concern

“But man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords.”
George Perkins Marsh, 1874

Despite all efforts towards environmental protection, the state of the global environment is deteriorating. This overall conclusion can be drawn from state of the environment reports describing environmental trends at the supranational level (UNEP 2007, EEA 2010), from indices merging several social and ecological indicators (Emerson et al. 2010, van de Kerk and Manuel 2010) as well as from what can be termed mega-assessments (Toth 2003) tying together vast amounts of scientific results and monitoring data on issues such as climate change (IPCC 2008), biodiversity (SCBD 2010) or the state of the aquatic environment (UNEP 2006). The most comprehensive environmental mega-assessment so far, the Millennium Ecosystem Assessment (MEA 2005), concluded that during the past 50 years human activities have led to unprecedented change in the world’s ecosystems and that the harmful consequences of these changes could become significantly worse in the next 50 years in a business-as-usual scenario.

This development is especially worrying because of the danger of crossing the ecological thresholds of abrupt shifts to alternative stable states with undesirable properties for human societies (Article I). If these shifts are characterised by points of no return, i.e. points after which the changes become difficult or impossible to reverse, the search for prevention is much more urgent than if we are faced with smooth, gradual and reversible changes. Recently, large-scale critical thresholds related to climate change have raised particular concern (Lyytimäki and Hildén 2011). Such tipping points at which a tiny perturbation can qualitatively alter the state or development of a system include, for example, the collapse of the Atlantic thermohaline circulation, the destruction of the Amazon rainforest or the decay of the Greenland ice sheet (Lenton et al. 2008). The disruption of nutrient cycles is another key environmental threat that includes risks of crossing local or regional level thresholds, such as the emergence of recurring harmful algal blooms or large-scale oxygen depletion (Article I). These are not only ecological phenomena, but they are determined within a coupled socioeconomic–ecological system where human actions are feedback responses (Horan et al. 2011).

Warnings of humanity’s harmful impacts on the global environment were voiced generations ago, as exemplified by the seminal book Earth as Modified by Human Action (Marsh 1874). Until the latter half of the 20th century, reading these kinds of dismal words remained the uncomfortable privilege of a small elite of educated people. However, on a level of everyday activity, people have faced the adverse effects of local level environmental deterioration since the dawn of human civilisation (Hughes 2001) and local environmental problems have been presented in the pages of newspapers since the late 19th century (Lahtinen 2005, Knight 2010).

The concern over large-scale and long-term environmental deterioration only started to reach wider audiences after the period of intensive rebuilding and economic recovery following the Second World War. This public environmental awakening was based on the combined effect of several contributing factors. First, the pace and extent of human activities increased rapidly and the deterioration of the state of the environment intensified. Some scholars have
depicted this as the acceleration phase of the Anthropocene (Steffen et al. 2011). The Anthropocene is a term coined to highlight the appearance of a novel geological epoch characterised by worldwide human dominance over natural forces (Crutzen and Stoermer 2000). This term points out that the current global level systems are formed by the interaction of biophysical, ecological and social factors. In the Anthropocene, local environmental changes are intertwined with a globalised society, and local level human activities are intertwined with global environmental changes.

Second, key factors behind the environmental awakening in the latter half of the 20th century include the continuous accumulation of scientific knowledge describing the state of the environment and the emergence of new social movements modifying knowledge and concern into political action. Rising levels of affluence and education gave people better opportunities and motivation to pay attention to environmental issues. As a result of these factors, the 1960s is generally considered to be the advent of modern environmental concern in Western Europe and North America (Torgerson 1999, Jamison 2001). In Finland, the focus of environmental protection started to shift from the conservation of or isolated natural milieus towards a wider and more inclusive understanding of environmental issues as something that is combined with the everyday practices of all human beings (Haila 2001, Massa and Ahonen 2006).

Third, the generation of widespread environmental concern would not have been possible without the widespread use of mass media. Communication technologies have created possibilities to reach millions – sometimes even billions – of people simultaneously. During the latter half of the 20th century in particular, the media has become a pervasive factor in society. Radio and the printed media remained commonly used media while television and more recently the Internet have emerged as new forms of communication. The mass media became a widely used tool for information delivery, market advertising, political persuasion and war propaganda (Kempf and Luostarinen 2002, Cox 2010). In Finland, three main periods of national media system can be identified (Jääsaari et al. 2010). The early period of media publicity during the 19th and early 20th century was largely characterised by newspapers aimed to enlighten and educate the public or to advance various political aspirations. The period between the late 1940s and the 1980s was the era of the formation of national media system characterised by improved printing technologies and increased ownership of television. The latest main phase of the Finnish media from the 1990s onwards is characterised by the increasing globalisation of media technologies, content and ownership (Herkman 2010, Jääsaari et al. 2010).

The activities of individuals such as Rachel Carson are often presented as the key factor triggering wide-based environmental concern (Torgerson 1999). Carson was an American biologist who popularised knowledge on the vulnerability of marine ecosystems, (e.g. Carson 1951) and especially the dangers of the use of pesticides (Carson 1962). Her book on pesticides, Silent Spring, is widely credited as one of the most important landmarks in environmental awareness, (e.g. Discover 2006). The importance of Silent Spring can be largely explained by the publicity it gained through the mass media. The book attracted a relatively large readership, but it also influenced through other media manifestations aimed at different audiences. In addition to interviews with the author and reviews by the media, the book itself was modified into magazine articles aimed for cosmopolitan readership longing for entertainment, paperback books aimed for the suburban audience and a TV series reaching an audience which was critical of science and progress (Kroll 2001). Translated excerpts from the book were published in distant countries, even in Finland by the newspaper Helsingin Sanomat (Suhonen 1994, p. 84). In Finland, Silent Spring served as a background for the intense debate over the potential effects of methyl mercury originating from the discharge of forest industries (Nuorteva 1976).

The case of Silent Spring illustrates the increased opportunities for scientists and environmental activists to have their voices heard through the mass media and, more widely, the
formation of closely-knit relationship between the media, the public and environmental knowledge. On the one hand, environmental problems based at least partially on scientific knowledge provided the media with an interesting topic to report on (Suhonen 1994). On the other hand, the media gave environmental activists the visibility they wished for. As Lowe and Morrison (1984, p. 84) point out: “The new groups were able to demonstrate that there was a great reserve of latent public concern waiting to be mobilised and considerable appetite in the media for environmental stories.”

To summarise, the rise of environmental concern through the mass media can be understood as an emergence of a new form of interaction between human societies and ecosystems. Science-based insights, such as the risks related to pesticides, made the ecological deterioration visible and sparked the concern of individual key actors. At the same time, large-scale structural changes, including the improvements of communications technologies, in the social system enabled the increased activity of key actors. These activities, in turn, had an impact on social structures guiding the actions of larger groups of actors. A key manifestation of these mutually reinforcing processes was the United Nations Conference on the Human Environment held in Stockholm in 1972 (Suhonen 1994). Eventually, these social processes may result in changes in the ecological systems. However, ecological changes may not be those that are desired or anticipated as there is always room for amplification, attenuation and unexpected reactions in socio-ecological systems (Article VI, Lyytimäki et al. 2011).

Media coverage is one important factor in this cyclical “environmental protection process” (Tapio and Willamo 2008), in which some issues are defined as environmental problems and solutions to these problems are sought for and implemented. Occasionally, the results of environmental research have gained considerable visibility in public debates, sometimes resulting in ambitious policies and management actions aimed at solving environmental problems. Perhaps the most obvious example is the public debate over the stratospheric ozone depletion that was a key factor behind the formation of the Montreal protocol and subsequent treaties (Ungar 1998). On the other hand, some environmental problems have remained largely unsolved despite the relatively high level of media coverage and public concern. Climate change and the eutrophication of water are examples of such issues (UNEP 2007, EEA 2010).

1.2 Orientation and organisation of the thesis

The main objective of this study is to empirically investigate the long-term development of newspaper coverage of climate change and eutrophication in Finland. The secondary objective is to identify the reasons that explain the changes in the coverage and to discuss which features of environmental problems are likely to be highlighted or omitted by the media. Finally, the objective is to contribute to the discussion on the theoretical models focusing on the environmental media coverage.

One prerequisite for any successful scientific endeavour is that the underlying values, assumptions and limitations guiding the study are made as clear as possible. Here I use the Vee diagram (also known as Gowin’s Vee or the Vee heuristic) to illustrate my premises and approach. The Vee diagram is a heuristic tool aimed to provide a framework for organising the conceptual and methodological elements that interact in the process of knowledge construction. It was originally developed by Bob Gowin in the 1970s (Novak and Govin 1984, Gowin and Alvarez 2005). Vee diagrams have been used for three main purposes: planning a research project, analysing a research article or document, and acting as a teaching and learning tool. In Finland, the Vee diagram has been mainly used as a tool to enhance learning in different levels of education (Ahoranta 2004, Paloniemi et al. 2010).

Åhlberg (2002) has presented a modified Vee diagram. Here an adapted version based on Åhlberg’s version is used (Figure 1). The Vee diagram consists of two interacting elements that are organised in a V-shaped pattern. The focus questions that serve to focus the investi-
gation are placed in the middle of the diagram. The level of abstraction decreases towards the tip of the V where the concrete objects or events to be studied in order to answer the focus questions are located. Originally, the left side of the V described conceptual or theoretical aspects, i.e. “thinking”, while the right side of the V was about methodological aspects of “doing” (Gowin and Alvarez 2005) or evaluating the learning process (Åhlberg 2002). Here the left side of the diagram describes the identified premises of the research. These include value-based motivating factors and theoretical, conceptual and methodological factors guiding the conduct of the research. The right-hand side of the diagram describes the expected outcomes of the research.

**Value-based starting point: Vital signs are worrying**

The value-based motivation for this research is the acute need to find effective solutions to environmental problems. As outlined in Chapter 1.1 and article I (see also Lyytimäki 2006b, Lyytimäki and Hakala 2008, Lyytimäki 2009, Lyytimäki et al. 2011), my conviction is that current ways of communicating environmental information are insufficient for finding and implementing solutions to environmental problems in a timely and efficient manner. Here the focus is on the role of the mass media in selecting, processing and communicating science-based information.

Climate change and eutrophication of water are selected as case studies representing different environmental issues that are relevant both from the global and Finnish perspectives (see chapters 4.2.1 and 4.3.1). While climate change

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**Identified premises**

**Value basis**
Importance of efficient use of environmental information in order to avoid irreversible harmful changes of socio-ecological systems (Article I).

**Theoretical basis**
Contextual constructionism. Agenda-setting function of mass media.

**Conceptual basis**
Models describing the evolution of media coverage.

**Methodological basis**
Media content analysis with an interdisciplinary approach.

**Focus questions**
How has the quantity of press coverage of climate change and eutrophication evolved in Finland?

Which features of environmental problems are likely to be highlighted or omitted by the media?

What models best explain the changes of coverage?

**Expected outcomes**

**Value claims**
Suggestions for suitable strategies enhancing the use of environmental information in socio-ecological system.

**Knowledge claims**
Identification of the key features of the coverage. Identification of suitable models explaining the emergence, persistence and absence of environmental information (Article VI).

**Records and transformations**
Interpretations based on updated and new data on press coverage

**Implementation and empirical basis**
Press coverage of climate change and eutrophication (Articles II-V).

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Figure 1. Premises and expected outcomes of the research. A modified Vee diagram presenting the overall orientation of the thesis (modified from Åhlberg, 2002; based on Novak and Gowin 1984).
The environment in the headlines

serves as a prime example of a gradually emerging and largely intangible global level long-term environmental change, eutrophication is an example of environmental change with more tangible regional and local level effects. Together, these cases can shed light on the multi-scalar nature of environmental issues: environmental problems are created by the interplay of processes operating in different temporal and spatial scales, involving non-linear dynamics of socio-ecological systems (Article I).

**Theoretical basis stemming from contextual social constructionism**

The moderate version of social constructionism is an overall theoretical basis of this inquiry. The approach of social constructionism focuses on the ways knowledge is processed by social interactions (Berger and Luckmann 1966). Social constructionist studies typically concentrate on communicative processes through which social reality is created, reproduced, transmitted and transformed (Hannigan 2006).

Several variants of social constructionism have been outlined (Hacking 1999, Demeritt 2002). The key distinction is between epistemological and ontological relativism. Epistemological relativism maintains that the reality cannot be captured exactly as it is through human perception. Ontological relativism asserts that the reality itself is determined by the observer. The moderate form of social constructionism accepts epistemological while rejecting ontological relativism. Human knowledge generation is constrained both by our limited personal capability to make observations and by various external influences affecting our interpretations. As Antal and Hukkinen (2010, p. 937-938) note: “...humans have quite universal, physiologically embodied capabilities to make sense of the world around them, but their heuristic claims about the truth can significantly differ depending on the socio-ecological context.”

The moderate form of social constructionism labelled as contextual constructivism has been widely applied in studies of environmental sociology and media studies of environmental issues (Hansen 1991, Välimäki and Palosaari 2004, Hannigan 2006). The approach of contextual constructionism focusing on the role of media representations in creating and maintaining socially shared meanings is adopted here as well. However, this thesis takes the information provided by the various methods of natural science as a key departure point – thus nearing the approach of critical realism (Dannermark et al. 2002).

Social constructs are continuously reformulated and often contested. Therefore the approach of social constructionism can be criticised for being highly capable of producing an endless parade of subjective interpretations about social constructs but less capable of providing firmly grounded solutions to environmental problems. However, as Jones (2002) states, by adopting an ontologically realist and epistemologically relativist position, the naivety of “pure” realism can be avoided and the impracticality of “pure” relativism averted.

Based on the approach of contextual social constructionism, the agenda-setting function of the mass media is adopted as an overall starting point for this study (see Chapter 2.1).

**Models of environmental coverage as conceptual basis**

This thesis draws from several conceptual models focusing on environmental media coverage. These models, including the Punctuated Equilibrium Model, the Issue-Attention Model, the Public Arenas Model, the Circuit of Culture Model, the Quantity of Coverage Theory and the Piercing Effect as an overarching notion are discussed in more detail in Chapter 2.2.

**Media content analysis as a method**

The method of data collection used in this thesis is media content analysis of press news (see Chapter 3; Neuendorf 2002, Krippendorff 2004). The classical definition by Berelson (1952) emphasises content analysis as a research technique for the objective, systematic and quantitative description of manifest content of communications. More recent definitions of
content analysis give less emphasis on the problematic concept of objectivity and outline it as “a research technique for making replicable and valid inferences from texts to the contexts of their use” (Krippendorff 2004, p. 18). The key questions of performing content analysis, namely what data is analysed, how the data is defined, what the population from which it is drawn is, what the context of the data is and what the boundaries for data collection are, is addressed in Chapter 3.

The data describing media content is only a starting point of the analysis. As Berger (2011, p. 213) notes, “[y]ou need to be able to put your data in perspective, which is provided, generally speaking, by making historical or comparative content analyses.” This thesis conducts a historical analysis of the data spanning a 21-year period and compares two different environmental problems. In addition, a background for interpretation is provided by an analysis that looks into the era prior to the principal study period, based on the secondary material consisting of results from published literature (chapters 4.2.1 and 4.3.1). Furthermore, the comparative approach is strengthened by the results from earlier studies describing environmental coverage more generally (Chapter 4.1).

Understanding complex environmental issues requires an interdisciplinary approach (Tapio and Willamo 2008). Media content analysis can be considered an interdisciplinary method in itself, since making meaningful interpretations based on data describing media content always require substantial insights from other disciplines. This thesis employs studies of environmental science and policy and communication research as a secondary material.

**Focus questions**

Based on the premises identified above, the overall task of this thesis is to study the evolution of environmental issues in the media. This task is operationalised through the examination of the press coverage of climate change and eutrophication in Finland. The primary case is the coverage of climate change, while eutrophication serves as a comparative case. Both of these are topical issues with high policy relevance and they both have been relatively widely debated in Finland, (e.g. Tirkkonen 2000, Peuhkuri 2004, Kerkkänen 2010).

The first empirical goal is to build an overall picture of the quantity of press coverage of climate change and eutrophication in Finland during the two last decades. The second empirical goal is to identify the key similarities and differences between the media representations of climate change and eutrophication. This comparison, together with insights from previous research, serves as a foundation for assessing the factors and driving forces behind the changes of coverage.

On a practical level, the overall goal is to study the implications of the presence or absence of environmental information in public debate (Article VI) within the context of the socio-ecological system characterised by the possibilities of non-linear changes (Article I). The aim is to explore how the media reflects and reinterprets the changes, creates interpretations of environmental problems and environmental risks. The goal of this thesis is also to discuss how the media could play more constructive role on creating public understanding about the changes in environment.

On a methodological level, the aim is to assess what models of media coverage best explain the evolution of Finnish environmental coverage.

**Implementation and empirical basis**

This thesis is implemented on the basis of four empirical studies (Articles II-V). These empirically oriented studies include two analyses of press coverage of climate change (Articles II and III) and two studies on press coverage of eutrophication (Articles IV and V).

**Records and transformations**

The records used in this thesis include the material collected for Articles II–V, complemented with updated and additional data on climate coverage (see Chapter 3.2). Chapter 4 presents
the key findings from the original articles, together with the analysis of the new data. The results are contrasted with additional insights and key results identified from the literature. The results are discussed in Chapter 5 reflecting a conceptual review (Article VI) focusing on the role of absent information in risk communication.

Different comparisons are used in order to improve the reliability and validity of the study (see also Chapter 3.4). Comparing two kinds of environmental problems can provide fruitful insights, especially since most media content analysis of environmental issues focus on a single environmental problem. Both a longitudinal time series (Articles II, III and V) and a temporally focused detailed snapshot (Article IV) are studied. Combining quantitative time series and qualitative interpretations can help to improve the depth of interpretations and to make generalisations. The combination of empirical (Articles II-V) and conceptual studies (Articles I and V) aims to deepen the analysis and to help capture key insights from content analysis. Furthermore, the use of secondary material helps to avoid the potential bias caused by use of only one newspaper as a primary data source.

Knowledge and value claims

The outcomes of the research process as described by the Vee diagram include the knowledge claims and value claims. The results from the four case studies and subsequent analysis of additional data are transformed and combined into knowledge claims focusing on factors explaining the changes of the coverage (Chapter 5.1) and the models explaining dynamics of the environmental coverage (Chapter 5.2), as well as future research needs (Chapter 5.3). The thesis concludes with an overall value claim related to the position of environmental information delivered through the media.

2 Theoretical framework

This chapter describes the agenda setting approach that provides the overall theoretical background for this study. The agenda setting approach is discussed specifically in connection with environmental issues defined largely by research-based monitoring of the natural environment. A generic model of the relationship between public and scientific discourse is outlined. Selected models aiming to describe and explain the evolution of environmental coverage are presented.

2.1 Environmental issues and agenda setting

This thesis is about the media representations of environmental issues. The key precondition for the meaningfulness of this focus is that the media coverage somehow influences the perceptions, decisions and actions in society in general and on environmental protection in particular. Previous research has shown that this is the case (Anderson 1997, Hannigan 2006, Berger 2007, Cox 2010). Climate change is a prime example of a long-term environmental issue that needs to be made visible by the media since it is a wide-scale and long-term process that is not directly detectable by human senses. Eutrophication is an interesting comparative case of global change with tangible local level implications. However, it is characterised by shorter (years to decades) time lags during which ecological changes can be difficult to observe, until critical thresholds are crossed and algal blooms and other ecological changes become easily observable (Articles I and IV).

The roles, functions and impacts of media coverage have great variations in different socio-ecological systems. Here the focus is on social systems typically found in industrialised democratic countries that hold the freedom of speech as a basic right of the citizen. In such societies the media plays a central role in setting the agenda for environmental policies (Pralle 2009). New issues are brought into public discussion and old ones are modified or discarded largely through the media (Hannigan 2006, Cox 2010; Article VI).
The simple explanation for the changes of environmental reporting by the media is that media contents reflect the changes in the ecological environment, the levels of environmental pressures, or remedial activities. However, these factors are not sufficient, nor mandatory, explanations for the changes in environmental coverage. Media coverage may reflect changes in the ecological environment, but only rarely in a linear fashion. Occasionally, some ecological changes may be widely noticed, especially if these changes are easily observable and relevant for people’s everyday activities (Article IV). However, ecological changes do not usually result in corresponding changes in news coverage (Ader 1995, Article II). Only some changes are considered newsworthy, minor changes can be misinterpreted as important ones and implausible scenarios can be highlighted (Article VI).

Besides the ecological factors, environmental coverage is strongly influenced by social events and processes. Key factors affecting environmental coverage of the media include activity of news sources (Curtin and Rhodenbaugh 2001), competition with other issues (Hilgartner and Bosk 1988), the phase of the discussion (Downs 1972, Article III), and journalistic practices and norms (Boykoff and Boykoff 2004, Boykoff and Boykoff 2007). Changes in media ownership and economic pressures for news production, the development of new communication and information technology and practices mould media content (Anderson 2009). The media is not one independent actor isolated from the rest of the society but a sub-system of the complex web of social, economic, cultural and ecological influences.

The agenda-setting model suggests that the media may be influential in terms of defining what the social priorities are but they have less influence in defining what to do about them (Cohen 1963). Agenda-setting is a process involving of three core elements, the media agenda, the public agenda, and the policy agenda. According to the model, the media agenda largely sets the public agenda, which has an influence on the policy agenda. The agenda-setting model does not propose a direct and linear correlation between the coverage of a specific environmental problem, public opinion and a policy action. Instead, it maintains that giving prominence to certain issues and framings of the mass media influences public and policy agendas. The model was presented by Cohen (1963) in the early 1960s. Cohen focused on the contents and impacts of print news on foreign policy. Another landmark study was conducted by McCombs and Shaw (1972) on the role of the media in the US presidential campaign of 1968. In recent decades, the agenda setting approach has been widely applied to environmental issues (e.g. Mazur and Lee 1993, Pralle 2009).

The concept of agenda setting is closely related to concepts of framing and priming (Weaver 2007). The key distinction is that agenda setting focuses primarily on what issues are covered rather than how these issues are reported or discussed. The “first level” agenda-setting studies focus on the relative salience of issues or subjects themselves, while the “second level” studies are interested in the relative salience of attributes (inherent characteristics or qualities) of issues (McCombs 2005). The framing can be defined as a journalistic practice of selecting some aspects of a perceived reality and making a particular problem definition, causal interpretation and treatment recommendation salient. Thus, the “second level” agenda setting can be understood to be almost equivalent to framing. The priming studies focus on the consequences of media agenda setting for public opinion (Weaver 2007).

Science is a key factor influencing the media agenda on environmental issues. However, only a fraction of all environmental scientific knowledge becomes a subject of media, public or policy agendas. The media saliency of environmental research results is dependent on various factors, from the attributes of the issue itself to the social context. Research results have several characteristics that decrease their public appeal and salience, as opposed to the general favouring of tangible, personalised, forward-looking and timely treatment of issues (Anderson 1997). First of all, scientific studies are complicated and narrowly focused. Producing research results is slow and results
The environment in the headlines are often backward-looking descriptions of past development. Results are conditional, full of uncertainties and open questions. They aim for general level explanations instead of specific and personalised answers to topical questions.

Focusing on climate change news, Boykoff and Boykoff (2007) differentiate between first-order and second-order journalistic norms. The first-order journalistic norms include personalisation, dramatisation and novelty that initiate and inform second-order journalistic norms of authority-order and balance. The norm of authority-order refers to the tendency of journalists to consult authority figures who typically reassure the public that order, safety and security will soon be restored. The norm of balanced reporting requires journalists to present the views of all legitimate spokespersons in dispute situations. Together these norms are likely to lead to the episodic framing of news instead of thematic framing connecting issues with a larger, thematic context (Boykoff and Boykoff 2007).

Some level of public attention is needed in order for an environmental issue to become socially relevant (Hannigan 2006). Public attention is especially important in order to initiate the processes leading to implementation of measures aimed at solving large-scale environmental problems with no simple technological fixes. What level of coverage can be considered sufficient depends both on how the state of the environment is perceived and what kinds of targets are set for environmental protection. Sufficient attention can turn into exaggeration of risks, or vice versa, if the perception regarding the state of the environment is changed, for example due to new research or monitoring results or actual changes in the ecosystems.

Much scholarly attention has been paid to why and how new issues emerge into public discussion. Media researchers have extensively studied the emergence of environmental issues; especially in the press media (see Article II). Less attention has been paid to why some issues tend to stay on public agenda, and especially, why and how they disappear from public debate (Article VI). A general level illustration showing the potential contribution of scientific knowledge to public discourse is presented in Figure 2. An issue can be presented as a serious environmental problem in the public media discussion. An issue can be noticed as important in science (a) and then in public discourse (b). If the issue is not considered interesting any more, it may be forgotten in public discourse (c). An issue can also be brought up by the media even when scientific evidence does not exist (d) and it can then be forgotten (e), or it can be established as a major issue due to accumulating scientific proof (f). A scientifically-based policy issue can turn into an issue that is justified mainly based on non-scientific arguments (g), and previously used scientific evidence can be regarded as irrelevant or falsified and the issue can thus be ignored (h). A discussion about a certain issue can proceed simultaneously through different trajectories and there may be several simultaneously ongoing public and scientific debates in different arenas. (Source: modified from Article VI.)

**Figure 2.** Categories of issues recognised and not recognised in scientific and public spheres, and possible process trajectories. An issue can be noticed as important in science (a) and then in public discourse (b). If the issue is not considered interesting any more, it may be forgotten in public discourse (c). An issue can also be brought up by the media even when scientific evidence does not exist (d) and it can then be forgotten (e), or it can be established as a major issue due to accumulating scientific proof (f). A scientifically-based policy issue can turn into an issue that is justified mainly based on non-scientific arguments (g), and previously used scientific evidence can be regarded as irrelevant or falsified and the issue can thus be ignored (h). A discussion about a certain issue can proceed simultaneously through different trajectories and there may be several simultaneously ongoing public and scientific debates in different arenas. (Source: modified from Article VI.)
course with or without firm – or any – scientific evidence (Mazur 2004). On the other hand, an issue can also be neglected from media debate when it is recognised as a justified cause of worry by scientists.

2.2 Models explaining the dynamics of environmental coverage

Various models describing and explaining the evolution and dynamics of environmental coverage have been developed (Table 1). General level conceptualisations such as the Punctuated Equilibrium Model (PEM) can be applied in order to understand the evolution of media coverage. PEM focuses on systems that are characterised by an extended period of stasis, and are later punctuated by sudden shifts. The model was originally suggested to describe the biological evolution in geological time scales (Eldredge and Gould 1972) and it has been applied to describe the evolution of the US policy agenda (Baumgartner and Jones 1993). As Holt and Barkemeyer (2010) note, most explorations of punctuated equilibrium commonly associate some form of an exogenous shock that affects the system described by the model. Critical discourse moments (Gamson 1992) can be understood as punctuation points that profoundly change the characteristics of the public debate, for example, by allowing journalists to publish a wider range of stories that also focus on novel issues or viewpoints (Carvalho 2005). The contribution of social processes and events to critical discourse moments has been widely studied. However, ecological factors, such as the crossing of certain ecological thresholds, can induce turning points in public debate (Articles I and IV).

There are several models that specifically aim to explain the dynamics of environmental coverage. Most of them concentrate on the relationship between public opinion and media coverage. One widely cited model is the Issue-Attention Model (IAM) (Downs 1972). It suggests that public interest in a certain environmental issue will gradually decrease after alarmed discovery and subsequent realisation of the costs of significant progress. The IAM consists of five sequential stages. First, during the pre-problem stage an environmental problem exists but has yet to capture the public’s attention. The second stage is characterised by a dramatic event that makes the public both aware of the problem and alarmed about it. During the third phase, key actors acknowledge the costs that will be incurred in dealing with the problem. This phase is followed by a gradual decline in interest as actors become discouraged at the prospect of appropriately dealing with the issue, and crises are normalised through suppression and in some cases boredom. The last phase is the post-problem stage where the environmental problem – whether solved or not – may recapture public interest only sporadically (Downs 1972). The model focuses on the impact of events in the public interest and assumes that public interest largely determines media coverage.

The Public Arenas Model (PAM) focuses on the competition between different issues and actors for social attention (Hilgartner and Bosk 1988). The mass media is one of the public arenas through which social problems become defined and are brought to society’s attention. Other arenas include, for example, business, research, administration, education and the political system. These public arenas are assumed to have limited carrying capacities, which causes a competition between different issues for space on the social and political agenda. The media also has a limited space and because of the competition, any issue will eventually be replaced as other issues take the prominent place in discussion. This process is based on different abilities of different groups to make their voices heard in different arenas. Constant interaction between the media and other arenas such as the education system, science and the political system is a key feature of the model.

The Circuit of Culture Model (CCM), as presented by Carvalho and Burgess (2005), focuses both on texts and contexts. It maintains that the producers and consumers of media texts are jointly engaged in dynamic, meaning-making activities that are context-specific and that change over time. The model consists of four
The environment in the headlines

The main stages of transformation. These include the production of the message, the text itself, consumption of the texts, and lived cultures that give context to meaning making (Johnson 1986, Carvalho and Burgess 2005). The model aims to direct attention to the complex relationship between structural factors and individual subjectivity (values, beliefs, action). By using the coverage of climate issues in the UK broadsheet newspapers as an example, Carvalho and Burgess (2005) identified three distinct cultural circuits each depicting a different framing, and they showed how the media is responsive to changes in the political agenda.

The Quantity of Coverage Theory (QCT) focuses on the media representations of environmental risks. It maintains that public concern about an alleged hazard rises with increasing news coverage and wanes with diminishing coverage (Mazur 1990, 1998, 2006). The QCT asserts that people typically do not attend to the detailed content of news coverage and are more affected by the quantity of coverage than by detailed content. One key argument of the theory is that the specific content of the news is not particularly relevant as long as it suggests the possibility of danger or simply of uncertainty. The QCT theory was developed to explain how almost all environmental risk stories are first brought to widespread attention by a core group of news organisations, such as major newspapers, TV networks and wire services. The QCT has been used demonstrate how the New York Times and other US mass media are influential but not all-powerful in setting the world’s environmental risk agenda (Mazur 1998, 2006).

The notion of the Piercing Effect (PE) proposes that after the phase of heightened media coverage, the environmental issue will not abate entirely, but rather dilute from headlines to a ubiquitous background noise that is present in various sectors (Articles II and III). Here, PE is understood as complementary to the other mentioned models. It can describe a situation after a punctuation point of media debate as described by the PEM has been passed. If applied together with IAM, the PE can occur after the phase of high level of coverage. Whether or not the Piercing Effect related to a subject has occurred influences how different actors, as described by PAM, can take part in the debate and relate the issue with their interests (Article III). The Piercing Effect can also help to explain the shifts between circuits of culture as described by the CCM or how risk information highlighted by key news organisations penetrate public debate, as highlighted by the QCT.

Developing integrative concepts and models is important, since it appears that any model explaining the development of environmental coverage is unable to universally take into account all relevant variables. For example, while the Issue-Attention and Punctuated Equilibrium Models appear to hold in some contexts, they

Table 1. Comparison of different models of environmental coverage. See text above for the explanation of acronyms.

<table>
<thead>
<tr>
<th>Model</th>
<th>Characteristics of dynamics</th>
<th>Main driving force of changes</th>
<th>Key references</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEM</td>
<td>Evolutionary, irreversible large-scale shifts affecting coverage</td>
<td>External influences and/or internal dynamics</td>
<td>(Baumgartner and Jones 1993)</td>
</tr>
<tr>
<td>IAM</td>
<td>Cyclical, five phases</td>
<td>Internal dynamics of the issue and the media operation logic</td>
<td>(Downs 1972)</td>
</tr>
<tr>
<td>PAM</td>
<td>Fluctuating changes</td>
<td>Competition between media sources for publicity and the media operation logic</td>
<td>(Hilgartner and Bosk 1988)</td>
</tr>
<tr>
<td>CCM</td>
<td>Iterative feedback loops of media production and consumption</td>
<td>Interplay between media actors and other actors</td>
<td>(Carvalho and Burgess 2005)</td>
</tr>
<tr>
<td>QCT</td>
<td>Fluctuations caused by actions of key media actors</td>
<td>Internal dynamics of the media, dominant (US) media conglomerates as key actors</td>
<td>(Mazur 1990, 1998, 2006)</td>
</tr>
<tr>
<td><strong>Piercing effect (PE)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
do not hold in others (Howlett 1997, Brossard et al. 2004). Furthermore, models with a different focus can effectively complement each other in some cases. For example, the changes between the stages of public discourse as described by the Issue-Attention Model may be the result of a punctuation processes (Holt and Barkemeyer 2010) that includes critical discourse moments (Gamson 1992). Understanding different models as complementary is considered a fruitful starting point for this thesis.

3 Material and methods

This chapter presents the material and describes the method used for data gathering. Factors influencing the reliability and validity of data and interpretations are discussed.

3.1 Focus on newspapers

This thesis is based on empirical material describing the media debate over climate change and eutrophication (Table 2). Articles II and III present a longitudinal analysis of climate change news based on one newspaper. Article III also includes comparative material from five other newspapers. Article IV describes a case study focusing on the representation of eutrophication in a set of 24 national, regional and local newspapers. Article V contains a longitudinal analysis of eutrophication news. Materials and methods for these studies are described in the articles. Here the method used for gathering updated and additional longitudinal quantitative data from the electronic archive of the Helsingin Sanomat (HS) newspaper is described.

The analysis presented in this thesis focuses on a single newspaper, mainly because of the availability of the data. The electronic archive of HS provides the longest time series available for this study. Focusing on this newspaper is also justified because it holds a key position in the Finnish media market. HS is the leading national daily newspaper in Finland (Herkman 2010). It can be characterised as a “high quality” or “prestige” broadsheet newspaper. Despite the growing use and influence of electronic media, newspapers remain an important source of environmental information in Finland. The circulation of HS has declined in recent years but it still stands at about 380,000 copies daily, and about one million readers, i.e. almost one-fifth of the entire population (FABC 2011). Furthermore, the newspaper’s Internet site is one of the most popular in Finland.

It should be noted that HS has limited readership outside the Helsinki metropolitan area and adjacent areas. Regional and local newspapers dominate the newspaper market in other major cities and towns, as well as in the countryside. However, since it has a dominant position in the capital city, it HS has an indirect influence on other media.

In Finland, the ideological differences between widely-read newspapers have largely dissipated in the last few decades (Lehto 2002) and the influence of commercial logic on news production has increased (Herkman 2010). Like most of the Finnish newspapers, HS declares that it is independent of party politics.

The data on news coverage was collected from the online digital archive of HS (http://www.hs.fi/arkisto). This archive contains news material published by the newspaper from 1990 onwards. It includes the titles and texts of the

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Table 2. Empirical material used in this study.

<table>
<thead>
<tr>
<th></th>
<th>Temporal focus: Climate change</th>
<th>Temporal focus: Eutrophication</th>
<th>Number of newspapers</th>
</tr>
</thead>
<tbody>
<tr>
<td>This summary</td>
<td>1990-2010</td>
<td>1990-2010</td>
<td>1</td>
</tr>
<tr>
<td>Article II</td>
<td>1990-July 2009</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Article III</td>
<td>1990-2010</td>
<td>-</td>
<td>1 (+5)</td>
</tr>
<tr>
<td>Article IV</td>
<td>-</td>
<td>July 2005</td>
<td>24</td>
</tr>
<tr>
<td>Article V</td>
<td>-</td>
<td>1990-2010</td>
<td>1</td>
</tr>
</tbody>
</table>
The environment in the headlines

3.2 Data gathering procedure for climate news

In order to produce results that allow for international comparison, the selection of keywords describing climate debate followed the typical selections used in other studies. Typically, the keywords “climate change”, “global warming” and less often “greenhouse effect” or “greenhouse gas” are used in international literature (e.g. Mazur 1998, Boykoff and Boykoff 2007, Boyce and Lewis 2009). In Articles II and III the search string “climate change” (ilmastonmuutos) was used. Here this data is complemented with data from additional searches including the term “warming of climate” (ilmaston lämpeminen) and terms related to greenhouse effect. In Finnish, the term “global warming” is not suitable since there is no corresponding and widely used translation for it. Furthermore, news items mentioning the compound words including the term “greenhouse” (kasvihuone) were searched for. This search string included expressions such as greenhouse effect (kasvihuoneilmiö, kasvihuonevaikutus) and greenhouse gases (kasvihuonekaasut). The standalone term “greenhouse” was left out since it refers typically to greenhouse farming. Selected results from preliminary searches testing several different search options are presented in Table 3.

The accuracy of the results was checked in order to eliminate duplicates and reduce other biases caused by the use of an electronic database. For example, the search string “climate change” produced 34 news items not related to climate change as an environmental issue but including metaphorical notions such as a changing economic climate. These were removed. The number of duplicates related to the search string “climate change” was relatively high (234). Most of these resulted from double inclusion of the same news item published in different editions. The highest annual percentage of duplicates (33%) was found in editions from 1990. During the 2000s, the average yearly share of duplicates was 5% or less. Duplicates were removed and only hits found from the latest edition were included.

Information about the section in the paper was missing from 221 hits. 108 of these were clearly related to science issues and they were coded as science news. The search engine did not identify the section of news items that were...
published in the “Science & Nature” section prior to April 1996. This weekly section started to appear in 1989 and the column space had been between one and two pages. The section was first labelled as “Science & Environment”, but it was renamed as “Science” in September 2001, “Science and Nature” in September 2001 and again “Science” in November 2009. Additionally, missing information about several hits from TV and radio pages could be deduced on the basis of the contents.

Furthermore, the search engine misleadingly presented 99 hits describing TV or radio information as free time news items. These hits from the period of 2000–2004 were recoded as TV programmes.

Based on the titles, a coding was developed to estimate whether the main focus of the news item was on climate change, on some other environmental issue, energy-related issues or on other issues (see Articles II and III). The coding was based on the explicit formulations of the titles, i.e. manifest content. Titles mentioning climate change, global warming or greenhouse effect or otherwise clearly addressing climate issues were coded as climate changes issues. News items denoting to other environmental problems were coded as environmental news. Titles focusing on the emissions (other than greenhouse gases) of energy production were coded as environmental news, whereas titles denoting fuels, energy efficiency or energy production were coded as energy-related issues. The category “other” included issues other than environmental or energy issues as well as titles with no clear topic, such as the name of the TV channel that appeared as a title in several hits found in TV and radio programme pages.

References included in the latter three classes are often left out of the studies of climate coverage since they concentrate on issues other than climate change and mention climate issues only briefly or passingly (cf. Sampei and Aoyagi-Usui 2009). However, since climate change is an overarching issue, it was considered interesting to explore how climate issues are addressed outside the actual climate debate. This is an especially relevant question from the point of

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Search string (in Finnish)</th>
<th>Initial number of hits</th>
<th>Final number of hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>ilmastonmuutos</td>
<td>5665</td>
<td>5438</td>
</tr>
<tr>
<td>Terms related to greenhouse effect (excluding terms “greenhouse” and climate change)</td>
<td>kasvihuone* not ilmastonmuutos not kasvihuone</td>
<td>3039</td>
<td>2689</td>
</tr>
<tr>
<td>Warming of climate (excluding climate change and terms related to greenhouse effect)</td>
<td>ilmaston lämpeneminen not ilmastonmuutos not kasvihuone*</td>
<td>662</td>
<td>643</td>
</tr>
<tr>
<td>Greenhouse effect</td>
<td>kasvihuoneilmiö</td>
<td>1903</td>
<td></td>
</tr>
<tr>
<td>Greenhouse gas</td>
<td>kasvihuonekaasu</td>
<td>1552</td>
<td></td>
</tr>
<tr>
<td>Climate meeting/conference</td>
<td>ilmastokokous</td>
<td>811</td>
<td></td>
</tr>
<tr>
<td>Climate policy</td>
<td>ilmastopoliitikka</td>
<td>592</td>
<td></td>
</tr>
<tr>
<td>Greenhouse emission</td>
<td>kasvihuonepäästö</td>
<td>483</td>
<td></td>
</tr>
<tr>
<td>IPCC</td>
<td>IPCC</td>
<td>341</td>
<td></td>
</tr>
<tr>
<td>Carbon sink</td>
<td>hiilinielu</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>Global warming</td>
<td>globaali lämpeneminen</td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>Carbon emission</td>
<td>heilipäästö</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Carbon footprint</td>
<td>hiilijalanjalkki</td>
<td>117</td>
<td></td>
</tr>
<tr>
<td>Climate crisis/catastrophe</td>
<td>ilmastokriisi or ilmastonkatastrofi</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Carbon tax</td>
<td>hiilivero</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>

Note: the search strings used in this research are presented in italics.
view of mainstreaming climate policies (Mickwitz et al. 2009, Article III).

Only one category was assigned to one individual news item because the aim was to indicate the main perspective adopted by the news item. If aspects related to climate change were present in the title, the news item was coded as a climate story even if other categories were also present. For example, the article entitled “Globalisation helps to mitigate climate change” (8 July 2001) was considered a climate change story although it also described globalisation as a general social development. It should be noted that in some cases the titles do not correspond well with the content and emphasis of the actual article. However, even in these cases the titles are relevant since they attract people to read the article, frame the issue and guide the subsequent interpretation (Jennings and Hulme 2010).

This coding was open to subjective judgement. For example, the news entitled: “New mission of Mr Ollila” (28 January 2007) was coded as “other” although it referred to the well-known climate concern of the key businessman. The intercoder reliability was checked using Cohen’s kappa (Cohen 1960, Lombard et al. 2002). The test was based on a sample of 94 news items coded by two individuals and it showed excellent agreement between coders (κ=0.86).

The coding scheme remained at a general level since the purpose was to generate an overall picture capturing the longitudinal development of the news. The overall amount of news items was relatively high, which made it unfeasible to use a detailed and time-consuming content analysis scheme concentrating on the full contents of the news items (Krippendorff 2004). Furthermore, the search engine did not allow searches focusing only on the titles or lead paragraphs.

3.3 Data gathering procedure for eutrophication news

The longitudinal data on the comparative case, eutrophication, was collected from the HS database using a similar method to that used for climate news. Initial searches were made with several search terms in order to find the most suitable search string (Table 4). The final search strings included terms “eutrophication” (including the verb eutrophicate (rehevöityä) and the noun eutrophication (rehevöityminen)) and “blue-green algae” (sinilevä). Other tested search strings produced either too narrow a sample, or included several irrelevant hits. It was especially troublesome to differentiate between water pollution caused by nutrients and other chemical pollutants, and therefore the search strings related to nutrient discharges were discarded. This selection of keywords is also generally in line with the search strategy used for climate change.

All in all, news coverage of eutrophication appeared to be more difficult to define with a few keywords than climate change. These experiences largely correspond with the difficulties of identification of keywords related to the Swedish press analysis of environmental risks in the Baltic Sea, where eutrophication was identified as the key problem (Jönsson 2011), and with the experiences from an analysis of newspaper discourse on water quality in the Upper Mississippi river basin in the US (Schmid et al. 2007).

All results were individually checked for their accuracy and duplicates were removed. News items specifically describing the eutrophication of terrestrial ecosystems were excluded. These included, for example, several news stories about gardening. Hits denoting eutrophication as a general level environmental issue were included, even if the aquatic environment was not explicitly mentioned. Information about the section in the paper was missing from 90 hits. Missing information about the section in 44 hits could be deduced on the basis of the contents. Most of these were coded as science news. The search engine misleadingly presented six other hits describing TV or radio information as free time news items. These were recoded as TV programmes.

Based on the titles, a coding was developed to estimate whether the main focus of the news item was on eutrophication, on some other environmental issue or on other issues. The coding
procedure followed that developed for climate change news. The coding was based on the explicit formulations of the titles. Titles clearly addressing eutrophication were coded to the first class. News items denoting to other environmental problems were coded as environmental news. The third class consisted of issues other than environmental issues as well as titles with no clear topic. The intercoder reliability was checked using Cohen’s kappa. The test was based on sample of 90 news items coded by two individuals and it showed excellent agreement between coders ($\kappa=0.82$).

### 3.4 The relevance and shortcomings of methods and materials

In Finland, newspapers are the only readily available source of long-term data of media coverage. Most of this material is not available in digital format, but the main national and regional newspapers have electronic archives covering full text content from a period of five to ten years (see Article III). These archives are typically open for subscribers only. However, there is no electronic archive that would allow the search from the long-term full content of a large array of Finnish newspapers published by different media corporations. Historical material is available, since the National Library has digitised most of the newspapers published in Finland from 1771 to the early 20th century.\(^1\)

The most comprehensive Finnish reference database, the freely available ARTO database, is an index of articles from over 500 Finnish journals and magazines and occasional articles in monographs from 1990 onwards.\(^2\) It does not include newspapers. The ARTO database includes the bibliographic record and a link to the electronic version of the article, where available. The commercial Aleksi database contains references to articles from nearly 300 periodicals and about 20 newspapers, with entries from the 1980s onwards.\(^3\) However, newspaper contents are not comprehensively indexed.

The National Audiovisual Archive (KAVA) was established in 2008 and it collects and stores data from Finnish television and radio

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<table>
<thead>
<tr>
<th>Keywords</th>
<th>Search string (in Finnish)</th>
<th>Initial number of hits</th>
<th>Final number of hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eutrophication</td>
<td>rehevöityminen or rehevöityä</td>
<td>1395</td>
<td>1286</td>
</tr>
<tr>
<td>Blue-green algae (excluding eutrophication)</td>
<td>sinilevä not rehevöityminen not rehevöityä</td>
<td>987</td>
<td>876</td>
</tr>
<tr>
<td>The state of inland waters</td>
<td>(&quot;joki&quot; or vesistö or järvi) and tila</td>
<td>4140</td>
<td></td>
</tr>
<tr>
<td>The state of the Baltic Sea or Gulf of Finland</td>
<td>(suomenlahti or itämeri) and tila</td>
<td>3387</td>
<td></td>
</tr>
<tr>
<td>Wastewater</td>
<td>jättevesi</td>
<td>3203</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>vedenlaatu or veden laatu</td>
<td>1949</td>
<td></td>
</tr>
<tr>
<td>Blue-green algae</td>
<td>sinilevä</td>
<td>1152</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>vesi</td>
<td>1014</td>
<td></td>
</tr>
<tr>
<td>Lake protection</td>
<td>vesien suojelu or vesiensuojelu</td>
<td>356</td>
<td></td>
</tr>
<tr>
<td>Nutrient concentration, phosphorus concentration, nitrogen concentration</td>
<td>ravinnepitoisuus or typpipitoisuus or fosforipitoisuus</td>
<td>342</td>
<td></td>
</tr>
<tr>
<td>Nutrient discharge</td>
<td>ravinnepäästö</td>
<td>174</td>
<td></td>
</tr>
<tr>
<td>Helcom</td>
<td>Helcom</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>Leaching of nutrients</td>
<td>ravinne and huuhtoutua</td>
<td>127</td>
<td></td>
</tr>
</tbody>
</table>

Note: the search strings used in this research are presented in italics.
broadcasts and from cinema. The archived material includes complete programme streams from eleven TV channels and six radio stations, a half-year sample from nine radio stations and a one-week sample from 20 TV channels and 70 radio stations. The material has been collected from 2009 onwards. By the time of this research, keyword searches of the material were not yet available. The non-commercial Finnish Broadcasting Company (Yleisradio, YLE) has an extensive archive that contains TV and radio material from YLE as well as a wide array of newspaper material, but this archive is aimed at the company’s internal use.

**Newspapers remain the best option**

The main reasons for the selection of the HS archive as the data source were the cost-effectiveness of the data acquisition, relatively long availability of data, and the key position of HS in the Finnish media and public discussion (Suhonen 1994, Herkman 2010). Furthermore, the use of newspapers provides good opportunities for comparisons with earlier domestic and international research, since most of the national and international studies into media coverage on climate change are based on newspaper material.

Traditionally, newspapers have been an important source of information in Finland. Newspapers in general and the HS in particular indicate larger media trends since they have a strong agenda-setting influence on other media, policy and public opinion. Newspapers can serve as sources for stories that cascade through other media. The web versions of the printed newspapers are particular focal points of debate in the electronic space (Lyytimäki 2010).

Surveys of the public suggest that television is currently the most important source of information on climate change in Finland, while newspapers hold second place (Ekholm et al. 2007). According to the Finnish Science Barometer survey, television and newspapers are the most important sources of science-based information (Kiljunen 2010). Almost nine out of ten (89%) Finns consider TV and radio to be very or fairly important sources of science-based information, while 77% of the respondents consider newspapers to be very or fairly important. During the last decade, the perceived importance of TV and newspapers has declined slightly while the share of respondents considering the Internet as a very or fairly important source of science-based information has increased steadily from 37% in 2001 to 65% in 2010 (Kiljunen 2010).

**Shortcomings of newspaper content analysis**

Some limitations and possible biases related to the use of newspaper material have to be noted. This analysis and most other studies of newspaper coverage focus on “prestige” or high-quality press, leaving the “yellow” or tabloid press with relatively little attention (cf. Taylor and Nathan 2002, Boykoff and Mansfield 2008). More generally, focusing on the press may leave other important forms of communication understudied. In the US, climate sceptics gain considerable visibility through TV punditry, talk radio, magazines, journals, and the Internet, but they have been studied mainly through newspaper contents (Antilla 2010). Only a few studies exist on the environmental contents of prime-time TV series (Shanahan et al. 1997). A study focusing on the US network television coverage in the 1990s suggests that environmental aspects have been largely absent from non-news entertainment and fictional prime-time coverage (McComas et al. 2001).

The green marketing by companies and the use of environmental arguments by advertisers have been widely studied (Chamorro et al. 2009). These studies typically focus on qualitative aspects of selected cases and do not scrutinise the quantity of environmentally-oriented content. Research comparing advertisements and journalistic content appears to be missing from the climate communication studies. A partial explanation is that advertisements are not included in the commonly used electronic news databases. Furthermore, advertisements

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are strongly based on visual imagery, which is another understudied area of environmental communication (Linder 2006, Lester and Cottle 2009, Reineck 2009).

Relatively few cross-comparisons between different countries and different media have been conducted (Riffe et al. 2007). Most of the comparative studies focus on the English-language countries or English media in other countries. One of the few studies focusing on the treatment of environmental issues by cross-language and cross-media approach is the analysis of mainstream media and blog coverage of climate change in the US and China by Xie (2009).

The wide use of electronic databases such as the HS archive, Lexis-Nexis, Factiva or Proquest/ABI Inform, may cause various biases (Deacon 2007). The results are dependent on what media is indexed to the database in the first place. Non-English material, the Internet and broadcast contents are underrepresented in the databases. Visual elements, such as pictures, diagrams and cartoons, are usually omitted. Other possible bias is caused by the relatively short-term temporal focus of the material included in electronic databases. Data mining from data sources such as the Foreign Broadcast Information Service (FBIS) or the Summary of World Broadcasts (SWB) may help to overcome some of these hurdles (Leetaru 2011) and special information repositories such as the Carbon Capture Project or the Finnish CO₂-report may provide useful data on certain issues.

The contents of digital archives may change over time. For example, HS retains the right to change the content of the archive. In order to test the stability of the archived contents, searches performed during various time periods were compared here. Most searches were conducted during 2010 and early 2011. The results were consistent over time as no differences were observed between results from identical test searches conducted on different dates.

The use of search strings is often limited to a narrow set of keywords. News not containing these terms are therefore easily excluded from the studies. In addition to the preliminary searches presented above, some additional searches focusing on selected events and sub-topics are therefore presented in Chapter 4. However, any search strategy will leave some aspects of news outside the sample. For example, in her study on energy and climate debate of the Finnish Talouselämä magazine (focusing on economic issues), Lindroos (2009) noted that the terms “climate” and “climate change” were mentioned surprisingly rarely. Climate change was mentioned 19 times and climate twice in 2008. However, climate was mentioned as a part of compound word or compound expression denoting to climate change 27 times. Furthermore, expressions such as “strengthening of the greenhouse effect” were also used and climate issues were referred to more indirectly in other stories.

Double counts are relatively easy to identify and remove. A more serious threat to the reliability of the results is the omission of published materials from the digital archive (Deacon 2007). In addition, the unitisation, i.e. decisions on how to divide news items into separate units of digital archive, may produce distortions. Here, the potential bias caused by omissions and unitisation was checked from selected newspapers representing high (20 January 2007, four climate stories; 4 September 2010, one eutrophication and three climate stories) and low (3 March 2006, zero climate or eutrophication stories) reporting and summertime eutrophication reporting (23 August 2008, three eutrophication and one climate story). These checks were based on the electronic facsimile editions that are available from 2006 onwards.

As suggested by the search result, the newspaper published on 3 March 2006 did not contain any climate or eutrophication stories. Two news items focused on energy issues. A small news item entitled “the planning of the wind power park at Haukipudas will continue” had an indirect link to climate issues. However, it focused on the potential harm on cultural heritage. The economy section included one news story focusing on the subsidies of peat-based energy production that mentioned emissions trading.

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5 http://www.carboncapturereport.org/
6 http://www.co2-raportti.fi/
According the search results, four climate stories were published on 20 January 2007. All of these hits were found from the facsimile edition. However, one other news item related to climate issues was detected from domestic news. This piece entitled “Emission rights will not be auctioned” and it focused on carbon dioxide emission permits. Furthermore, foreign news pages included half a page of news on the Kirill storm that raged in the UK and Central Europe. This news made no reference to climate issues. However, a potential link to climate issues was created by a story focusing on the US Supreme Court decision on climate policy at the bottom of the page. This news story, included in the data studied here, was accompanied by a shorter background piece entitled “Clean air law” that was counted as a separate climate story by the search engine. The Letters to the Editor section included one piece of climate news. Furthermore, the term climate (ilmasto) was mentioned in three other news items that were not related to climate issues (climate related to travelling, and two stories related to air conditioning in cars (in Finnish: ilmastointi).

According the search results, three eutrophication stories and one climate story were published on 23 August 2008. These were found from the facsimile edition. However, the search did not capture the short front page news article entitled “Outer archipelago of the Gulf of Finland is recovering” referring to the editorial that was included in the search results and to domestic news focusing on the oxygen condition on the seabed of the Gulf of Finland and the effects of invasive comb jellyfish (Mnemiopsis leidyi) species. Foreign news included a short news item on the impact of Hurricane Fay in Florida but with no direct reference to climate change. Finally, the domestic section included a news article focusing on government subsidies for improving the energy efficiency of buildings that was partially related to climate issues.

To summarise, the main challenge for the reliability is the selection of the search terms. The following results – together with additional insights from the relevant literature – can be considered to give a valid and reliable enough overall picture of the evolution of the Finnish debate on climate change and eutrophication. However, the above-mentioned limitations and restrictions related to the data source and search strategy should be noted when interpreting the results.

4 Newspaper coverage of climate change and eutrophication

This chapter presents and discusses the key results from case studies focusing on coverage in the Helsingin Sanomat. Empirical results focus on the period 1990-2010. In order to contextualise the results, brief reviews of the development prior to the study period are presented. Additionally, results derived from selected earlier studies are used as a comparative material.

4.1 Background: Development of media coverage on the environment

Based on the available time series, describing mainly the press coverage in the North American and Western European countries, the volume of media coverage on environmental problems has been generally increasing since the early 1960s (Parlour and Schatzow 1978, Schoenfeld 1980, Bowman and Fuchs 1981, Suhonen 1994, Mazur 1998, Boykoff 2009a, Russia was planning to construct in the Baltic Sea. The environmental assessment was also featured on the front page, but without any direct reference to eutrophication. In addition to the climate stories found by the search, nuclear power security was referenced in the editorial section and the domestic news section presented a Parliament debate over permission to build nuclear power plants. These stories were not directly linked to climate issues.

To summarise, the main challenge for the reliability is the selection of the search terms. The following results – together with additional insights from the relevant literature – can be considered to give a valid and reliable enough overall picture of the evolution of the Finnish debate on climate change and eutrophication. However, the above-mentioned limitations and restrictions related to the data source and search strategy should be noted when interpreting the results.
Holt and Barkemeyer 2010, Knight 2010). However, the growth has been neither smooth nor linear. Both the amount of coverage of individual environmental issues and the overall amount of environmental coverage has been characterised by ups and downs. Some issues have faced rapid increases and decreases in coverage, while others tend to remain as a more persistent part of the discussion with different framings and concepts over the decades. For example, the use of natural resources was discussed under the label of limits to growth in the 1970s (Meadows et al. 1972), whereas in the late 1980s it was put under the wide conceptual umbrella of sustainable development (WCED 1987). In the 1990s and the early 2000s the notion of eco-efficiency (Schmidheiny 1992) emerged, and more recently, the concepts of happiness and well-being have been connected to the use of natural resources (NEF 2009, Stiglitz et al. 2009).

The general trend of environmental coverage during the last few decades has been the increase of emphasis given to the global level characteristics of environmental problems. This is partially explained by the scientific results emphasising the cross-border characteristics of many environmental issues. The debates over trans-boundary air pollution causing “acid rain”, global biodiversity loss, stratospheric “ozone holes” and, most recently, globally occurring climate change all highlight the cross-border nature of environmental issues (Hannigan 2006, Article II). On the other hand, the focus of environmental protection has also shifted towards large-scale issues because some local level problems have been at least partially solved, as shown, for example, by the success of measures aimed at curbing industrial discharges of nutrients and harmful chemicals to water in Finland (Wahlström et al. 1996, Laakkonen et al. 1999, Article VI).

The transnational character of many environmental problems is further emphasised by various economic, cultural, social and technological globalisation processes related to environmental issues. These include e.g. global trade with long production and consumption chains and the creation of global product brands, advertising and marketing. The global consolidation of media ownership, the development of new information and communication technologies detached from place, and the increased use of English as an international shared language are key trends of the globalisation of the media (Hopper 2007). However, despite these growing global influences, the national logic of environmental news production may still dominate at a local and national level (Olausson 2009). For example, the comparison between the commercially-oriented US media system and the public service-oriented system, such as in Finland, shows that public service television devotes more attention to public affairs and international news and fosters greater knowledge in these areas (Curran et al. 2009).

Environmental messages must compete for visibility and attention with other kinds of messages, both informative and entertaining in nature. The increasing amount of information has been described as information overflow, or “infoglut”, that makes it difficult to discern the relevant or useful knowledge from irrelevant, outdated or unnecessary information (Marien 1994, Article VI). In particular, the amount of entertaining information has increased in the age of the TV and the Internet. The fusion of entertaining and informative content has been labelled as “infotainment” (Thussu 2007). Although the absolute amount of environmental information delivered by the media has undoubtedly increased, it is difficult to estimate how the share of environmental coverage of all coverage has changed.

Some indicative figures can be presented. Based on the work of Lyytimäki and Palosaari (2004, p. 27), the share of environmental coverage in Finnish magazines was about 2–3% of all stories published during the 1990s and the early 2000s. The national monitoring of the Finnish news media conducted in 2006, 2008 and 2010 suggests that environmental issues hold a relatively large share of all news, between 5 to 15% of all news items (Suikkanen and Syrjälä 2010). However, less than half of these stories actually concentrate on environmental problems since also natural disasters, energy issues, housing and traffic were counted as environmental top-
ics here. The national monitoring of the Finnish news media in 2010 showed that the most common topics of the newspaper front pages and the main news broadcasts dealt with leisure time (sports, entertainment and culture, outdoor activities and human relationships) and safety or health-related topics. Other major topics are politics and the economy (Suikkanen and Syrjälä 2010). Another survey focusing on Finnish newspapers (printed and online), TV news and news service material found that only 1.3% of the more than 3,700 news items collected between 17 and 21 May 2010 focused on the environment, nature or animals (Juntunen 2011).

According to the Project for Excellence in Journalism, coverage of the environment in the US news media was at 2% in 2009, about the same level the subject generated in 2008 and 2007 (PEJ 2010). Environmental coverage accounted for an exceptionally high proportion (about 4%) of all news in December 2009 (PEJ 2010), largely because of the Copenhagen climate summit and the debate over leaked e-mails concerning global warming (Painter 2010). Other data from the US suggests that less than 2% of all media coverage is about environmental issues (Sartor and Page 2009). The share of environmental issues of all news coverage was about 1.7% in both 2008 and 2007. Despite the peak in December, this data suggests that the share of environmental coverage dropped to 1.5% in 2009 (Sartor and Page 2009).

Some studies suggest that the share of environmental issues in mainstream newspapers may be higher than on television. Newspaper coverage of the environment in the US occupied 2.7% of all news, while the share was 1.6% for radio, 1.3% for network television news, 1.0% for the Internet and 0.8% for cable television news in 2009 (Sartor and Page 2009). An analysis of the print news coverage in Ohio, US, showed that 6.5% of the news coverage was about environmental issues (Martin 2002). In Finland it appears that newspapers usually cover environmental issues more frequently than the TV news, although there are differences between different time periods (Suikkanen and Syrjälä 2010).

In the UK, the amount of climate coverage increased more rapidly on TV than on the radio or in newspapers during 2004–2006 (Lewis and Boyce 2009). Due to the variability of national contexts and lack of comparative research, it remains uncertain whether there exists significant differences between the volume of environmental coverage in print and other media. Furthermore, there is a growing convergence between the contents of different media caused by the consolidation of media ownership, growing adoption of technologies that allow the distribution of material across different media platforms and the journalistic practices favouring the use of the same news sources (Anderson 2009, Herkman 2010, Suikkanen and Syrjälä 2010).

The increased coverage of environmental issues can be seen as a part of a long-term increase of science issues in public communication (Väliverronen 1996, Boykoff 2009b). Generally, it appears that the share of environmental coverage of all the science coverage has increased over the last few decades. For example, Kauhanen (1997, 54) has demonstrated that the share of environmental stories of all science stories published by HS increased from 2% in 1970 to 9% in 1980 and about 11% in 1990.

Several scholars and environmental activists are concerned that environmental coverage is still marginal if compared e.g. to health or economy issues – not to mention sports or other entertainment. For example, based on the British newspaper coverage of climate change up to 2006, Gavin (2009) asserts that relative to other issues, climate change is short on exposure and, consequently low on the public agenda, with little likelihood of achieving the prominence of health, crime or the economy. Lewis and Boyce (2009) note with a similar tone that climate change was featured only by 4% of science news stories in the British media outlets in 2006, receiving far less attention than healthcare technologies or science-based animal stories.

On the other hand, some commentators have suggested that too much coverage and attention is already given to some environmental issues. In other words, they argue that information de-
scribing these issues should be consciously rejected (Article VI). This kind of critique is often presented by anti-environmental lobbyists, but sometimes also by scholars criticising scientific interpretations or policy priorities. For example, Simon (1981) and later Lomborg (2001) accused non-governmental environmental organisations and pro-environmental journalists and researchers of producing and maintaining “the litany” of environmentalist doom and gloom that contributes to public worry and excessive fear which in turn helps the fundraising of these organisations and individuals.

Lomborg used a massive arsenal of indicators to justify the claim that worries over global warming, resource depletion, population growth, biodiversity loss and pollution are grossly overemphasised. However, most of these arguments have been later shown to be erroneous or flawed (van den Bergh 2010). Furthermore, Lomborg himself later presented somewhat altered interpretations and focused on the need to implement cost-efficient climate policies (Lomborg 2007).

Some scholars have presented their concern that the upsurge in climate news might overshadow other key environmental concerns and cause unnecessary fear and hopelessness at the level of individuals that discourages people from acting and, at the collective level, paralyse climate policy (Hulme 2007, Prins et al. 2010). The key issue is whether the news coverage of climate risks can produce the sustained and constructive engagement that is needed in various sectors of society in order to implement measures to combat climate change and how these measures are connected with other policies (Dilling and Moser 2004, Article III).

The question of optimal quantity of environmental coverage is a relevant one, especially in the context of affluent, information-intensive societies. In developing countries people still may be commonly unaware of global environmental challenges due to a lack of education and limited or non-existent access to science-based information (Shanahan 2009). Obviously, feeding these people with environmental information alone is not enough, since they typically lack not only science-based advice, but also the fundamental resources needed to implement the advice. This problem is evident in many developing countries and it is tackled within the field of development communication (McPhail 2009). This thesis is concerned with those actors who have adequate resources to receive or acquire environmental information as well as opportunities to digest and implement this information.

4.2 Newspaper coverage of climate change

4.2.1 Early debate on climate change in Finland

The French mathematician and physicist Joseph Fourier (1768–1830), and a Swedish chemist Svante Arrhenius (1859–1927), are often mentioned as the forefathers of the science of climate change. However, it took several generations before wider scientific interest in climate impacts of anthropogenic emissions developed (Weart 2008). In the late 1950s, concern over global warming caused by humans was presented by scientists such as the oceanographer Roger Revelle, the physicist Gilbert Plass and the physical chemist Hans Suess (Plass 1956, Revelle and Suess 1957). The climate debate of this era remained within scholarly forums without major public or policy implications.

The potential of carbon dioxide released from human activities to increase the global temperature was mentioned in the pages of Helsingin Sanomat (HS) as early as 1956, but thereafter the issue arose only occasionally, on average once a year (Karppinen 1993). For example, in 1958 one news story speculated on the effects of nuclear bomb testing on the weather. The news concluded that these effects are unlikely, but mentioned that the strengthening of the greenhouse effect is likely to increase the global temperature by 1 °C (Lähteenmäki 2006). Based on personal experiences, Juhani Rinne, an emeritus professor at the Finnish Meteorological Institute and the University of Helsinki, maintains that global warming remained
almost completely absent from public debate, although the first popular lecture on the subject was given in the early 1970s and Rinne himself wrote on the issue in the HS in the mid-1970s (Rinne 2003).

Before the 1980s, media coverage addressing anthropogenic global warming was largely absent in other countries as well. Despite warnings from a few scientists, most experts and the general public found it difficult to believe that human activities could alter the climate of the planet as a whole (Weart 2008). Furthermore, individual speculations about the issue often welcomed the potential warming as a positive development. The warming of the climate was especially difficult to perceive as a threat in Finland, a northern country characterised by long and cold winters and spring and autumn frosts threatening the harvests. Even in the 18th century the educated Finnish clergy had speculated that agricultural practices modifying the Earth – and thus fulfilling God’s will – could result in milder and more favourable weather conditions (Niemelä 2008). In the spirit of the Enlightenment, it was assumed that draining the wetlands and transforming the wilderness into farming land would make the climate milder (Holopainen and Helama 2007).

Finland was predominantly an agricultural country until the 1950s. The majority of Finns therefore had personal, first-hand experiences of the deleterious impacts of harsh weather conditions on food production and livelihoods. Industrialisation progressed rapidly during the 1950s and 1960s, causing an increase in greenhouse gas emissions from the Finnish economy. Carbon dioxide emissions from the use of fossil fuels increased from about 5 million tonnes in the late 1930s to about 50 million tonnes in the late 1960s (Kunnas 2009). Social structures of Finnish society also faced dramatic changes. For example, from the mid-1960s onwards, relatively cheap package tours directed typically to the Canary Islands and Southern Europe became increasingly available to Finns. Related to this, sunbathing on warm beaches became a common theme of newspaper travel advertisements (Juutilainen 2001). Thus, novel positive connotations of leisure time and high social status were connected with a warm climate.

The scientific basis for climate predictions remained weak and uncertainty high throughout the 1970s. The main popular fear related to climate change was the risk of climate cooling (Weart 2008, Lyytimäki 2009). In 1976, Juhani Rinne speculated in an article published by HS that if the concentration of atmospheric carbon dioxide were to double by 2030, the temperature in Finland may increase by about 4 °C. The article entitled “Threat of freezing, or destruction by warming” (16 September 1976) highlighted risks related both to the potential cooling and warming of the climate.

On the one hand, fears of climate cooling were connected with the speculations suggesting the possibility of a new Ice Age looming somewhere in the future. On the other hand, they were related to the risk of “nuclear winter” resulting from large-scale use of nuclear weapons in the context of the Cold War. Furthermore, during the 1970s, global warming was also a non-problem because the weather statistics did not indicate climate warming but rather the continuation of a relatively cool period following the warm period of the 1930s (Jylhä et al. 2004). However, in the early 1970s there were relatively mild winters with late snow cover (Ilmatieteen laitos 2011).

In the early 1980s, additional interest in global cooling was raised by scientific findings related to ancient asteroid collisions. Scientists suggested that the great mass extinction of species 65 million years ago was partially caused by a temporary global cooling resulting from a dust shading by an asteroid colliding with Earth (Alvarez et al. 1980). However, instead of climate debate, this finding was primarily linked to the debate on current loss of biodiversity caused by human activities.

During the late 1980s the number of news items dealing with global warming and other issues related to climate and air protection increased in the Finnish press (Heiskala 1993, Suhonen 1994). In the mid-1980s, the environmental coverage in foreign news sections in HS increased as the number of news items quadrupled from about 50 to about 200 news
items annually. This was partially explained by the coverage given to the Chernobyl nuclear accident (1986). Other key international topics of the 1980s and 1990s included the greenhouse effect, destruction of the rainforest, stratospheric ozone depletion, and the environmental problems of Eastern Europe that were caused primarily by heavy industry and energy production. In addition, the debate over acidifying precipitation highlighted the cross-border characteristics of air pollution (Väliverronen 1996). The debate on “acid rain” and “forest deaths” in Central Europe and Russia was particularly connected to the state of the Finnish forests.

In the late 1980s, authoritative scientific consensus over climate change was largely absent (Weart 2008). In order to answer the need for a widely acknowledged science-based synthesis, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) in 1988. Since the first reports published in 1990, the IPCC has been a key source of climate information. However, the question was not only about a need for climate information with scientific credibility, but also about political suitability. As Agrawala (1999) argues, the emergence of the IPCC owed much to the unease of the United States about UNEP’s growing international influence.

1988 has been identified as a turning point in the global debate on climate change because of the unusually hot and dry summer in the USA (Ungar 1992). Scientific theories were now backed up by concrete extreme weather events. Importantly, the wide-scale debate was triggered by the testimony of Dr James Hansen in the US Congress. The weather anomalies in North America and elsewhere were reported as signs of global warming by the Finnish media as well (Kantola 1996). All in all, climate change emerged as one of the major environmental problems in Finland in the late 1980s and the early 1990s, but it was not yet established as the environmental problem (Wahlström et al. 1996). For example, environmental historian and sociologist Ilmo Massa listed “carbon dioxide fever” as one of the key environmental problems in 1991, with several others including nuclear accidents, stratospheric ozone depletion, acidifying deposition, waste, water pollution, tropical deforestation and erosion (Massa 1998, p. 131).

Finnish climate policies can be characterised as passive, especially when considered against the relatively high level of environmental awareness of the people (Eurobarometer 2008, Kerkkänen 2010, Teräväinen 2010). The Finnish debate over climate change has been strongly connected with energy policy and the need for energy in heavy industry (Vehmas 2002, Kerkkänen 2010). The key elements of Finnish climate policies have been outlined in strategic documents accepted by the government in 2001, 2005 and 2008. In addition, the Finnish adaptation strategy for climate change was published in 2005 (Ministry of Agriculture and Forestry 2005) and a foresight report including visions for 2050 was published in 2009 (Prime Minister’s Office 2009). Finnish Parliament adopted the UN Framework Convention on Climate Change in 1994. Finland joined the European Union in 1995 and, according to internal burden sharing within the EU, Finland’s average greenhouse gas emissions in 2008–2012 should not exceed the 1990 level. Targets set for 2020 by the EU are more demanding, including a 20% reduction of emissions and an increase in the share of energy from renewable sources in final consumption to a share of 38% in 2020. The national foresight reports sets a target to reduce Finland’s greenhouse gas emissions by at least 80 per cent from the 1990 level by 2050 (Prime Minister’s Office 2009).

4.2.2 Coverage of climate change in HS during 1990-2010

Between January 1990 and December 2010, a total of 8,779 news stories mentioning climate change or warming of climate or terms related to the greenhouse effect (hereafter: climate stories) appeared in the pages of HS (Figure 3). Generally, the news coverage was characterised by a relatively low level of attention to climate.

8 For further information, see: http://www.tem.fi/index.phtml?l=en&s=2658
The environment in the headlines

change during the early 1990s. The monthly average number of climate stories was 13.6 during 1990–1996. During this period, climate issues were commonly treated under the label of greenhouse effect with only a quarter (25.1%) of climate stories mentioning the term climate change. The monthly number of climate stories increased to 23.3 and the share of climate stories mentioning climate change increased to 46.2% during 1997–2005. The monthly average reached 91.8 during 2006–2009 and dropped to 60.8 during 2010. The share of climate stories mentioning climate change increased to 77.8% during the period of 2006–2010.

The interest in environmental issues was partly due to the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. One of the main outcomes of the conference was the UN Framework Convention on Climate Change (UNFCCC) that formed the basis for the subsequent international climate policies. However, the conference concentrated on a variety of environmental and sustainability topics and the media labelled it rather generally as an environmental meeting. As an illustrative example, an editorial summarising the meeting with the title “Disappointments and expecta-

tions from Rio” (14 June 1992) generally talked about environmental issues but mentioned the unwillingness of the US to include concrete targets for greenhouse gas emissions at the climate convention as a concrete example of difficulties in the negotiations. Overall, the meeting did not show as a major peak in Finnish climate coverage.

A peak in climate coverage occurred in November–December 1997 due to the third Conference of the Parties (COP3) of the UNFCCC meeting in Kyoto. After heated negotiations, this meeting ended up with the Kyoto protocol that included concrete targets for global climate policies. However, coverage from the Kyoto meeting itself was relatively low. A partial explanation is that the search terms related to climate change were not present in all news items describing the COP3. It was identified as the “Kyoto climate meeting”, “Kyoto climate negotiations”, “Kyoto meeting” or it was referred to indirectly as international climate negotiations (see Strandén 1998, Hagelin 1999). In order to assess the adequacy of the sample studied here, an additional search focusing on December 1997 was carried out of the HS archive. The search string “Kyoto” (Kioto) produced

Figure 3. Overall development of the climate news in HS, 1990-2010 Note: United Nations Conference on Environment and Development (UNCED), Conference of Parties of the United Nations Framework Convention on Climate Change (COP), European Union (EU), Intergovernmental Panel on Climate Change (IPCC). (Source: Articles II and III and updated data.)
60 hits, 52 of which were related to the Kyoto climate negotiations. About one-quarter (N=15) of these hits were not present in the sample studied here.

Previous research has highlighted the meeting as a turning point in Finnish climate change policy and discourse (Tirkkonen 2000, Perimäki 2002). The implications of the Kyoto protocol for the Finnish economy were discussed on various occasions during the late 1990s as shown by the peaks following the Kyoto meeting. This debate was mainly connected to the burden sharing between European Union (EU) Member States and the potential implications of climate and energy policies for the Finnish economy. The EU-level targets were discussed from the perspective of domestic policies, as exemplified by the domestic news “EU countries dispute over curbing greenhouse effect” (17 June 1998). The country-specific target set for Finland was to freeze the emissions of major greenhouse gases at the level of 1990 for the period 2008–2012. Finland signed the Kyoto protocol in May 1998 and ratified it together with 14 other EU Member States in May 2002. Since the key issues were already settled, no discernible peak occurred when the Kyoto protocol entered into force on 16 February 2005. The issue was noted by HS (e.g. 15 February 2005), but there was no major commentary on the implications of the protocol.

Climate issues received considerable attention in October 2000, when the government’s climate strategy was prepared and its implications for the national economy were debated. While the success of the COP3 meeting received relatively scant coverage, the failure of the negotiations at the COP6 meeting in The Hague, the Netherlands, in 2000 was more widely noticed. The decision of the United States not to participate in the Kyoto protocol was particularly highlighted. The November 2000 peak of coverage was also connected to the application sent to the Finnish Parliament for permission to build the fifth nuclear reactor in Finland by the energy company TVO (Kerkkänen 2010, p. 103). At the start of 2001, the potential costs of climate policy to the Finnish economy were again debated.

From 2001 to late 2003, climate coverage decreased. Mainly related to the COP11 meeting in Montreal, coverage increased again at the end of 2005, followed by a temporary dip in early 2006. Growth in coverage continued later in 2006. Two major documents that gained wide international attention were published during the summer and autumn of 2006. These were treated very differently by HS. The release of the “Stern Report” on the economics of climate change (Stern 2007) was reported on the front pages and in the economy section (31 October 2006) in a serious tone as a well-reasoned warning of a respected British economist. On the other hand, the economy section treated the documentary film An Inconvenient Truth by Al Gore with a critical and even sarcastic tone as “...a kind of extended PowerPoint presentation that won prizes at the Cannes Film Festival.” (6 September 2006). The HS presented Al Gore as the “leading preacher of global warming” and a columnist invited to evaluate Gore’s presentation in Helsinki nicknamed Gore “Al Bore” because he presented a lot of graphs in his presentation (6 September 2006).

2007 as a turning point

A sharp increase in coverage occurred in January 2007. Several reasons for this increase can be identified, including both social and ecological factors. A lively debate related to energy policy was published in the Letters to the Editor section, as well as various other expressions of concern related to climate risks. Domestic and foreign news pages reported on research results, climate policies and weather anomalies. Exceptionally mild winter weather gave an impetus to climate concern (Article II). At the end of January, an interview with Mr Jorma Ollila, Chairman of Nokia Corporation and Royal Dutch Shell was published (28 January 2007). In this interview Mr Ollila clearly expressed his concern over climate change and urged for strong climate policies. This strong expression of concern coming from a widely respected business leader previously not involved in environmental issues was widely noted.
The high level of coverage was sustained in February 2007 when the EU Heads of State and the government introduced what became known as the “20-20-20 target” (21 February 2007). These climate and energy targets to be met by 2020 include a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels; 20% of EU energy consumption to come from renewable resources; and a 20% reduction in primary energy use compared with projected levels. Coverage highlighted the risks related to climate change mitigation policies. The debate was especially fuelled by the estimation by the Government Institute for Economic Research that fulfilling the EU targets would lead to the loss of employment of some 60,000 Finns (20 February 2007).

The scientific basis of climate change projections remained unchallenged by HS. However, the media was criticised for exaggerations and misrepresentations of the risks related to climate change by Professor Atte Korhola, who spoke up against the exaggeration of risks (4 February 2007). Although based on another concrete example (see Lyytimäki 2010), this critique was connected to the news of the publication of the IPCC summary report (IPCC 2007). The front page headline describing the IPCC report stated “Report: The Finnish climate may get 9 degrees warmer” (3 February 2007). The article text maintained that the lower limit of the projected warming for Finland is 1.5 degrees and that the amount of warming is dependent on the effectiveness of climate policies. The news included a statement by the Prime Minister Matti Vanhanen that the “downplaying of climate change has to be stopped immediately”. This statement illustrates the sense of urgency and importance that was delivered through media representations during the winter and spring of 2007.

In the following months, the coverage started to decrease, but increased again during the following autumn and winter. The Nobel Peace Prize given to Al Gore and IPCC was widely noted (23 October 2007) although critical articles were also published about the decision of a British court regarding errors in Gore’s documentary film (12 October 2007). In November 2007, the COP13 meeting in Bali received substantial news coverage both in Finland and internationally (Eide et al. 2009). The main result of the negotiations in Bali was a roadmap paving the way to the 2009 Copenhagen meeting. In February 2008 the European Commission proposed binding legislation to implement the 20-20-20 targets (Uusi-Rauva 2010). This EU energy and climate package was agreed in modified form by the European Parliament and the European Council in December 2008 and became law in June 2009. HS highlighted that the EU should not engage to unilateral actions, as exemplified by the editorial entitled “The EU must persuade others to participate in emission cutbacks” (24 January 2008).

Climate coverage began to wane during 2008. This can be partially explained by the global financial crisis and the economic slowdown that began to seriously affect the Finnish economy and reduced public interest in environmental issues. After the two mild winters, there was also more normal weather during winter 2008–2009, as the whole of Finland was covered in snow (Article II). These factors were presented possible explanations for the results of an opinion poll showing that 48% of Finns considered that the effects of climate change had been exaggerated (YLE 2010). This opinion poll (N=1007) was conducted in March 2010. Another opinion poll, reported by HS on 14 April 2010, indicated that the share of Finns who agree that the climate change is the greatest environmental threat requiring rapid actions has dropped from about 80% to about one-third (Haavisto 2010). Yet another opinion poll indicated that the willingness of Finns to pay for climate actions decreased already in 2009 (8 October 2009).

Another possible explanation for diminishing coverage is the decrease in interest of both journalists and the public – climate fatigue – following the period of intense debate (Painter 2010, p. 85). In addition to results from opinion polls (Haavisto 2010, Kiljunen 2010, YLE 2010), some support for this was found from the material. In a Letter to the Editor (21 April 2009), one author commented on the news about an opinion survey showing the decline in the willingness of Finnish people to mitigate
against climate change, asserting that “people are getting fed up with the one-sided doomsday predictions. Common sense tells us that the warming of climate is a good thing for the Nordic countries.”

The most dramatic monthly decrease of coverage occurred between December 2009 and January 2010, when the number of climate stories dropped from 144 to 67. The high level of coverage was mainly related to the Copenhagen COP15 meeting and partly to the criticism presented at climate scientists. As measured by the journalists attending, the Copenhagen meeting was more popular than the Rio UNCED meeting in 1992 or the Kyoto COP3 climate meeting in 1997 (Painter 2010). The aim of the Copenhagen meeting was to agree on the global climate policies after the Kyoto protocol. Unusually high expectations created a sense of drama, increasing journalistic interest in the meeting. After the rather unsuccessful meeting, the decreasing trend of coverage continued.

Due to the so-called “Climategate” and “Himalayagate” episodes, criticism of climate science strengthened in November 2009, especially in the US and the UK (Berkhout 2010, Nerlich 2010, Painter 2010). However, despite some critique presented in the Letters to the Editor section in particular, coverage by HS was still dominated by views that were favourable to IPCC and other actors stressing the seriousness of climate change and general trustworthiness of climate science. For example, when reporting on the forthcoming review of the IPCC reports, HS (12 April 2010) mentioned the critique only briefly and gave most space to the UN Secretary-General Ban Ki-moon, who assured us that “Let me be clear - the threat posed by climate change is real ... None of the recent accusations or disclosures by the media alters the scientific consensus on climate change.” It should be noted that the critique towards IPCC and climate science was more strongly presented in the web debates on the HS Internet site (Lyytimäki 2010).

A clear peak of climate change coverage occurred simultaneously in several countries during November and December 2009 (Painter 2010, Boykoff and Mansfield 2011). HS coverage reached about the same level as January-February 2007 and January 2008. The cold and snowy winter weather in Southern Finland was a key factor that decreased the public’s interest in climate issues. Only one small news item (16 February 2010) noted that despite the cold weather in Europe and eastern parts of North America, global weather was exceptionally warm in January 2010 (see NOAA 2010). The hot summer of 2010 was record-breaking, with a prolonged heatwave in July, but this was not explicitly connected to climate change in the news by HS. November and December 2010 were unusually cold in Finland, which probably contributed to the low intensity of climate reporting.

Extreme weather events received surprisingly little attention in terms of headlines. Only slightly over one per cent (N=101) of the headlines mentioned storms or hurricanes, droughts, floods, heavy rain, heatwaves, or other extreme weather/climate events. Floods were the most commonly mentioned extreme weather-related event, with 61 headlines explicitly mentioning floods, followed by 39 news items mentioning storms. In comparison, a search using keywords “flood or flooding” (tulva or tulvia) resulted in 10,995 hits from the study period. A search with the keyword “heavy storm” (hirmumyrsky; a term used to describe all kinds of powerful storms as well as cyclones, hurricanes, tornados and typhoons) resulted in 1,624 hits. Hence, it appears that the news on extreme weather events are typically presented without an explicit connection to climate issues.

Climate coverage across newspaper sections

Climate coverage in different sections of HS is presented in Figure 4. The main news headlines are presented on the third page of the HS. This news front page contained 2.0% of all climate stories. The climate coverage was scattered and climate issues were only rarely mentioned before 2006. The emergence of climate issues as a hot news topic in 2007 is shown as a clear peak of coverage during January–February 2007 with 12 hits. These included the news en-
titled “Jorma Ollila demands strict emissions limits” (28 January 2007) and news describing EU energy and climate policies and their potential implications for the Finnish economy (see also Uusi-Rauva 2010). A smaller peak of coverage occurred in December 2009, when the Copenhagen COP15 meeting was highlighted by four news front page stories.

A section concentrating on science and environment/nature issues contained 6.1% of all climate stories. Between 1990 and 1997 almost one tenth (9.2%) of the climate articles were found in this section, but after 1998 the share dropped to 5.2%. Thus, in the 1990s in particular, climate issues featured relatively often in this section, which illustrates the science-driven origin of the climate debate. Because the share of climate news was already relatively high, there was only a modest increase in coverage after 2006. Furthermore, during the 2000s the research results were also increasingly featured in other sections. An example is local news entitled “Future brings storms, floods and bugs” (1 June 2007) describing various risks as described by climate scientists and thus painting a rather unpleasant picture of the future climate.

About one-quarter of all the newspaper items dealing with climate change were commentary material published in the Letters to the Editor (16.2%) or in the editorial section (9.8%). In

**Figure 4.** Coverage of climate change by newspaper section. Coverage is divided according the main phases of the debate. Local news includes the sections: Name of the Day, News from Helsinki, and Where to Go. Lifestyle includes the sections: Price & Quality, Leisure, Life & Health, Housing, Home & Style, Travel, Food & Drink, Cars, and Sport. (Source: Article II and updated data.)
addition to editorials by newspaper staff, articles written by external experts are published in the editorial section. Columns and other commentaries included in the other sections are not included in these figures. In recent years in particular, the share of columns by journalists and other commentary material has increased in HS and other Finnish media (Jokinen 2008).

Foreign news pages hold a share of 15.6% of all climate stories. The amount of coverage is more variable than in other sections, largely because of spikes in coverage caused by international climate summits and other events related to international climate policy. In particular, the Kyoto COP3, The Hague COP6 and the Copenhagen COP15 meetings and the EU Energy and Climate package were highlighted. Other key themes included different weather anomalies and potential effects of climate change in distant countries. For example, HS foreign news pages published a special reportage series labelled “Changing Climate” during the autumn of 2006, focusing on the effects of climate change on people and nature around the world. The drop in news coverage from 215 articles in 2009 to 94 in 2010 is partly explained by the low coverage given to the COP16 meeting in Cancún, Mexico, and a lack of other major international policy events.

Domestic news pages featured almost as many climate stories (14.7% of all climate stories) as foreign pages. However, the domestic news also had an international dimension on a number of occasions, such as implications of EU climate policies at the national level. Although climate change is a global issue par excellence, 8.3% of the news items appeared in sections focusing on local issues. These sections included “News from Helsinki”, “Where to Go” and “Name of the Day”. The dividing line between these sections and lifestyle issues is a vague one. Sections related to lifestyle issues account for 4.5% of all climate stories. Many of the hits under the lifestyle category were related to the social events such as exhibitions or demonstrations related to climate change. The decrease in coverage over the two last years of the study period was especially steep in the lifestyle section (from 60 news items in 2009 to 24 in 2010), possibly indicating that climate issues are not considered fashionable any more. On the other hand, the culture pages that present news items closely related to lifestyle issues presented a more modest decrease, from 52 news items in 2009 to 37 in 2010. Altogether, 3.2% of the climate stories were published in the culture pages. Sunday editions contain both lengthy reportages and shorter commentaries. The Sunday pages account for 3.0% of all climate stories.

The relatively high level of hits in TV and radio pages indicates that the climate issue was frequently presented in the broadcast media. 6.7% of all climate stories appeared in the TV and radio pages. Most of these hits were short descriptions of TV programmes. Based on the material, it remains unclear as to how many of these programmes concentrated on climate issues. Furthermore, this figure also includes critiques of and introductions to TV and radio programmes and columns dealing with media contents.

Almost one in ten (8.2%) climate stories appeared in the economy section. The negotiations around the Kyoto COP3 meeting were not intensively featured in the economy pages. The first clear peak in monthly coverage was in November 2000, caused by The Hague COP6 meeting and the simultaneous domestic debate over the costs of climate policy. The economy pages started to feature climate issues more often in early 2007, in the aftermath of the interview with Jorma Ollila and the Stern report.

During the 1990s, the share of hits with an unknown section was relatively high (5.7%) mostly because the information about all sections was not included into the database. The class “Unknown or other” as presented in Figure 4 also includes news items that appeared in the sections on Young People and Children, Crosswords or Weather. All together, these cover 1.7% of all climate stories. Despite the close connection between climate and weather, the weather pages did not include news material related to climate change but concentrated on weather forecasts and short-term weather statistics.
Mainstreaming of climate debate across topics

Based on the titles of the stories, over a quarter (27.0%) of all climate stories focused primarily on climate change or climate policy. Almost one-fifth (19.1%) of the titles concentrated on other environmental issues and mentioned climate issues in the main body. Energy issues were the main focus of less than a tenth (8.8%) of the titles. About a half (45.1%) of the titles described issues other than environmental or energy issues, e.g. economy, politics or lifestyle (Figure 5; Table 5).

Judging from the titles, the average annual share of climate news items actually focusing on climate issues was low (23.0%) between 1990 and 1996. Importantly, this period includes the economic recession in the early 1990s. The variation from year to year was high since this period included both the lowest (1992, 15.5%) and highest (1995, 39.2%) annual share of news articles focusing on climate issues. The high variation is partly explained by the relatively low total amount of news items. Environmental issues other than climate change were featured relatively often in the early 1990s, perhaps indicating the lack of one single dominant environmental issue during that time. However, one related key issue was the debate over nuclear power. This debate was intense, especially in 1993 when Parliament voted against the permit to build a fifth nuclear reactor in Finland (Litmanen and Kojo 2011). In the middle of the decade, the share of energy-related news was especially low.

During the period 1995–2005, the share of news focusing on climate issues increased to one-third of all climate stories (33.8%) and variation between the years was lower, ranging from a share of 28.2% (1999) to 38.1% (2001). Reporting concentrating on climate issues formed a background for the subsequent large-scale reporting. During the post-2006 period of heightened reporting, the share of news focusing on climate issues was again lower (25.6%), with a modest annual variation from 21.6% (2008) to 27.8% (2007). During the last year of the sample, the share declined to 21.2%.

An additional explanation for these changes can be found from the evolution of the concepts of the greenhouse effect and climate

![Figure 5. Development of the annual main focus of climate stories in HS. (Source: Articles II and III and updated data.)](image-url)
change (Figure 6). In the 1990s, terms related to “greenhouse effect” were more popular than the term “climate change”. The greenhouse effect was already a relatively familiar term that was commonly used in environmental reporting during the 1980s (Suhonen 1994). In the early 1990s, the concept of the greenhouse effect dominated the debate. During 1990–1991, almost two-thirds (60.8%) of all climate news mentioned terms related to the greenhouse effect but not the term climate change. During that time, the concept of climate change was typically connected with environmental issues. As the debate has evolved, the notion of climate change has become more widely used outside the environmental context. Especially in recent years, climate change has been mentioned relatively often in stories dealing with issues other than climate change or the environment. Almost a half (48.0%) of all climate stories mentioning climate change focused on other, non-environmental issues in 2008.

The news front page was the only section in which the majority (57.6%) of the climate stories had a headline concentrating on climate issues. Because the space for text is very limited, only the key message of each news item is presented in this section. This means that if climate issues are mentioned, they are often the main topic of the news. The second highest proportion (44.3%) of titles focusing on climate issues was found in the foreign news section. This was as expected, because climate issues are often mentioned in the headlines describing international climate negotiations. The share was also high in the science section (39.9%), where the results of climate research are often presented.

The share of news items concentrating on issues other environmental than climate change was higher in the science section (28.4%) than in any other section. Here the implications of climate change for other environmental issues were often dealt with. As the climate debate has matured, the focus has shifted from describing the issue towards policy implications in the science section too. For example, a recent news item (14 September 2010) discussing the preparations for the new national strategy of the use of peatlands only mentions the warming of the climate and carbon emissions while focusing on describing various ecosystem services produced by the difficulties peatlands face in forming a common understanding about their use.

Energy issues reached their highest visibility in the economy section (23.7%), followed by
The environment in the headlines

The environment in the headlines

the Letters to the Editor (15.5%) and editorials (10.7%). It should be noted that the sample studied here covers the energy debate only partially. Luoma-Aho and Vos (2009) note that specifically as a result of the climate change discussion, nuclear energy was depicted as emission-free by Finnish newspapers in 2007. Other energy-related debates closely linked to climate change include the debate over carbon-based energy taxes in the 1990s (Vehmas 2002) as well as wind power (Varho 2007) and bioenergy (Kähkönen 2010) during the 2000s.

A high share of news concentrating on issues other than environmental or energy-related issues was found in the sections related to lifestyle (63.9%), culture pages (70.9%), Sunday pages (67.7%), and the sections related to local news (58.2%). The highest share (90.1%) was found from the news items that appeared in the TV and radio pages, largely because hits that gave only the name of the TV or radio channel as a title were coded to this class.

News items published as Letters to the Editor had a relatively even distribution between focus

**Table 5.** Cross tabulation of climate stories by newspaper section and main focus. Local news includes the sections: Name of the Day, News from Helsinki, and Where to Go. Lifestyle includes the sections: Price & Quality, Leisure, Life & Health, Housing, Home & Style, Travel, Food & Drink, Cars, and Sport. (Source: This research.)

<table>
<thead>
<tr>
<th>Focus of title</th>
<th>Climate</th>
<th>Environment</th>
<th>Energy</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>News front page</td>
<td>Count</td>
<td>99</td>
<td>23</td>
<td>17</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>1.1%</td>
<td>0.3%</td>
<td>0.2%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Editorial</td>
<td>Count</td>
<td>220</td>
<td>155</td>
<td>92</td>
<td>396</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>2.5%</td>
<td>1.8%</td>
<td>10%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Letters to Editor</td>
<td>Count</td>
<td>379</td>
<td>326</td>
<td>220</td>
<td>497</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>4.3%</td>
<td>3.7%</td>
<td>2.5%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Domestic news</td>
<td>Count</td>
<td>390</td>
<td>293</td>
<td>114</td>
<td>497</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>4.4%</td>
<td>3.3%</td>
<td>1.3%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Foreign news</td>
<td>Count</td>
<td>605</td>
<td>274</td>
<td>34</td>
<td>453</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>6.9%</td>
<td>3.1%</td>
<td>0.4%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Culture</td>
<td>Count</td>
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<td>44</td>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>0.3%</td>
<td>0.5%</td>
<td>0.1%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Sunday pages</td>
<td>Count</td>
<td>31</td>
<td>34</td>
<td>19</td>
<td>176</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Local news</td>
<td>Count</td>
<td>110</td>
<td>156</td>
<td>40</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>1.3%</td>
<td>1.8%</td>
<td>0.5%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Nature &amp; science</td>
<td>Count</td>
<td>197</td>
<td>152</td>
<td>25</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>2.2%</td>
<td>1.7%</td>
<td>0.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>TV, radio</td>
<td>Count</td>
<td>28</td>
<td>25</td>
<td>5</td>
<td>529</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.1%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Economy</td>
<td>Count</td>
<td>197</td>
<td>90</td>
<td>171</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>2.2%</td>
<td>1.0%</td>
<td>1.9%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Count</td>
<td>58</td>
<td>66</td>
<td>20</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.2%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Unknown or other</td>
<td>Count</td>
<td>24</td>
<td>39</td>
<td>6</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>0.3%</td>
<td>0.4%</td>
<td>0.1%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>2368</td>
<td>1677</td>
<td>771</td>
<td>3963</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>27.0%</td>
<td>19.1%</td>
<td>8.8%</td>
<td>45.1%</td>
</tr>
</tbody>
</table>
on climate issues (26.7%), other environmental issues (22.9%), energy issues (15.5%) and other issues (35.0%). Most of the news items published in the domestic news pages were focused on climate change (30.1%), other environmental issues (22.6%) and other issues (38.4%) while only 8.8% of the domestic news focused on energy issues. Foreign news emphasised climate issues (44.3%) over other environmental issues (20.1%) and other issues (33.2%).

According to Suhonen (1994), the economy pages of HS covered environmental issues relatively rarely until 1990. Four news items focusing on environmental issues appeared per month in the economy section during the 1970s, but the number dropped to two in the 1980s (Suhonen 1994, p. 91). The data from this research shows that during the period 1990–2006, the monthly average of news items mentioning climate issues in the economy section was 0.4. During 2007–2009 the average monthly number was 6.4 and in 2010 it dropped to 3.3. However, not all of these news items focused on climate issues. Before 2007, 37.0% of the climate articles appearing in the economy pages focused primarily on climate issues. During the climate hype of 2007–2009 the share was 27.6% and in 2010 this share was 25.6%.

Despite the relatively high overall amount of coverage in recent years, the coverage diminished temporarily during certain months. In April 2005, only 13 climate stories were published, of which only one focused on primarily climate issues. In August 2006, 26 stories were published and only four of them focused on climate issues. A sharp decrease also occurred between the periods of heightened coverage during the spring and summer of 2007. The 2009 peak in coverage was preceded by the minimum in the August. During this month, 59 stories mentioning climate change appeared, but only five of them focused on climate issues. In June 2010, only two news items out of 42 focused on climate issues, indicating that climate issues still remained a part of the presentations of other topics, even though they had largely lost their appeal as primary targets of news coverage.

4.2.3 Comparison of the coverage in Finland and other countries

The general trend of Finnish climate coverage largely followed the overall development of climate coverage in other industrialised countries, namely fluctuating coverage during the 1990s and early 2000s, a rapid increase around 2006 and subsequent levelling off and then a decrease in coverage (Boykoff 2009b, Holt and Barkemeyer 2010, Boykoff and Mansfield 2011, COMPON 2011).

Data from six Dutch newspapers shows that the annual number of climate change articles was low in the early 1990s, peaked around 1996 and decreased towards the end of the decade, increased to higher level around the millennium and started a rapid increase between 2003 and 2006 when the number of articles tripled (VROM-raad 2007). The climate coverage of Japan’s three major national newspapers from 1998–2007 show a slightly decreasing trend at the beginning of the period (after the Kyoto COP3 meeting), a peak during 2001, partly related to the COP6 meeting in Bonn after the US withdrawal from the Kyoto protocol, and an increase in coverage starting from 2005 which accelerated in 2007 (Sampei and Aoyagi-Usui 2009).

Climate coverage has been studied most widely in the United States and the United Kingdom (e.g. McComas and Shanahan 1999, Carvalho and Burgess 2005, Boykoff 2007, Jennings and Hulme 2010). In the UK, a sample of three national broadsheet newspapers from 1985–2003 indicated three phases of discussion (Carvalho and Burgess 2005). First, during 1985–1990 there was first a silence over climate issues that changed into the political construction of risk as shown by the increased news coverage. Second, during 1991–1996 the coverage initially declined, possibly because of editorial fatigue, and then increased again. Third, during 1997–2003 the coverage over climate change was characterised by a new sense of urgency. During the peak in the early 2000s the coverage almost doubled from the preceding peaks.

US press coverage of climate change shows a similar pattern of coverage, peaking during
the late 1980s and early 1990s, decreased reporting during the mid-1990s, a peak related to the Kyoto COP3 meeting and an increase during the early 2000s (Boykoff and Boykoff 2007). In both countries, the level of coverage remained relatively high during the 2000s. An increase began around 2006 and peak levels were reached during 2007. Most of the Western industrialised countries experienced a decrease in coverage in 2008, while coverage increased in Japan, South Korea and India (COMPON 2011). The Copenhagen COP15 meeting in 2009 resulted in the latest peak of coverage (Boykoff and Mansfield 2011).

Based on extensive newspaper data describing US, UK, French and German newspaper coverage on climate change (data from 1984–2007), Grundmann and Krishnamurthy (2010) report that while in all countries there was considerable growth in reporting after 2004, there was more growth in France and Germany compared to the US and the UK. The Finnish case appears to support their conclusion that more articles and more text on climate change appear in the countries from continental Europe when compared to what the Anglo-American world (see Brossard et al. 2004).

There are only a few studies focusing on the developing world (e.g. Adelekan 2009, Billett 2010). Studies focusing on non-English media coverage in developing countries are particularly rare (cf. Das et al. 2009, Gordon et al. 2010, Miah et al. 2011). Generally, climate coverage in the developing world has been relatively small (Boykoff and Mansfield 2011). For example, an analysis of the English-language Indian press from 2002–2007 showed a small peak at the beginning of the period, a bigger peak between 2005 and 2006 and an acceleration of coverage starting in 2007 (Billett 2010).

To summarise, climate coverage in various countries is affected by the same cross-national news topics, especially the climate negotiations under the UNFCCC and the IPCC reviews on climate science. However, there are also variations related to national contexts. A key difference compared with southern countries is that in Finland the peaks in climate coverage are partly related to the mild winter weather, rather than heatwaves in summertime (Article II). The results support earlier observations suggesting that the European press has in general framed climate change as a proven fact, while the US press has given quite a lot of space to sceptical arguments (Grundmann 2007, Uusi-Rauva and Tienari 2010). Compared with the US climate coverage, the visibility of climate sceptics has been low in Finnish mainstream media (Honkonen 2010, p. 66, Lyytimäki 2012). News journalism still appears to reflect national priorities as emphasised by Herbert J. Gans already in 1979 (Gans 2005). Exploring these differences remains as one of the key tasks for environmental communication studies.

4.3 Newspaper coverage of eutrophication

4.3.1 Early debate on eutrophication in Finland

Finnish inland waters are typically small and shallow, and are thus susceptible to the effects of human activities. There are almost 190,000 lakes in Finland, although over 130,000 of them have an area of less than one hectare (Raatikainen and Kuusisto 1990; see also Article V). The low water volume makes many of the lakes susceptible to external loading from agriculture, industry and other sources of nutrients. During the wintertime, the lakes are covered by ice, which increases the risk of oxygen depletion (hypoxia) and loss of oxygen (anoxia), particularly in eutrophicated lakes. Lakes are also influenced by internal loading which can maintain eutrophication even after the external nutrient loading has reduced (Eloranta 2005).

The semi-enclosed, shallow and cold brackish-water Baltic Sea that surrounds Finland to the south and west is also considered to be ecologically highly vulnerable (HELCOM 2010). The sea is impacted by agriculture, industry, traffic and about 85 million people living within the drainage area of the sea. Ecological factors increasing the sensitivity of the sea to eutrophication include small water volume, slow renewal of water masses, strong stratification and relatively large river runoffs. In particular, the
shallow waters of Archipelago Sea and the Gulf of Finland are sensitive to eutrophication. As one indication of its vulnerability, the Baltic Sea area (excluding Russian waters) was approved as a Particularly Sensitive Sea Area (PSSA) by the International Maritime Organisation (IMO) in 2005. A PSSA is an area that needs special protection through action by the IMO because of its significance for recognised ecological, socio-economic or scientific attributes.

International negotiations related to the protection of the Baltic Sea were initiated relatively early. The Helsinki Convention (Convention on the Protection of the Marine Environment of the Baltic Sea Area) was the first international environmental agreement that made all the sources of pollution around an entire sea subject to a single convention. Finland took the initiative to host the negotiations since in the context of the Cold War, environmental issues provided a neutral topic under which Finland could build an improved international image as a sovereign actor independent of the Soviet Union (Räsänen and Laakkonen 2007). The convention was signed in 1974 by the then seven countries that had a Baltic coastline, and it entered into force in 1980. The convention was renewed in 1992.

The governing body of the Helsinki Convention is the Baltic Marine Environment Protection Commission – also known as Helsinki Commission or HELCOM. It has been a key organ that collects and synthesises monitoring data produced by other parties and compiles assessment reports on the state of the sea and activities affecting the sea (Lääne 2001).

Eutrophication of the Baltic Sea was recognised as a large-scale environmental problem in the late 1970s (Elmgren 2001), but local level debate related to coastal pollution emerged much earlier. Already a century ago, bitter complaints about the odours and unpleasant look of water bodies close to Finnish towns and cities were published in newspapers (Laakkonen et al. 1999). Based on coverage of the local newspapers of the coastal city of Turku, Lahtinen (2005) maintains that even in the late 19th and early 20th century, ordinary newspaper-reading urban dwellers were well aware of local environmental problems. Water pollution resulting from industrialisation, the growth of the towns and the building of water pipes and sewerage systems sparked public debate in other Finnish towns and cities, too (Laakkonen et al. 1999). Increasingly eutrophicated, pathogen polluted, murky and foul-smelling water bodies and urban shorelines covered with slime were concrete changes that were difficult to notice. One of the key concerns of the early debate was that valuable nutrients were wasted as human excrement was increasingly flushed from water closets to the nearby waters instead of the previous practice of transporting it to farm fields to be used as fertilizer (Laakkonen et al. 1999). However, the water closets provided a better level of hygiene and they soon become a symbol of progress and affluence.

Despite the concrete nuisance to local people, it was often difficult for local newspapers to criticise the polluting discharge originating from factories that were important to the local economy (Vepsäläinen 1999, Lahtinen 2005). Debates usually reflected the opinions of the middle-class and presented the views of well-educated professionals and officials (Lahtinen 2005). Partly due to political instability at the time, the amount of environmental coverage varied widely. Environmental issues often gave way to topics that were considered politically more important, especially during the social unrest related to the general strike of 1905 and the turmoil related to the declaration of independence from Russia in 1917 and the subsequent civil war. Early US environmental coverage shows a similar kind of pattern of relatively high but variable coverage of local level environmental issues (Knight 2010).

As a result of the concrete ecological changes and local level environmental controversies, the need for water protection was acknowledged and the first water treatment plants were installed in Finnish towns in 1910 (Katko and Lehtonen 1999). However, the civil war, the economic depression of the 1930s and especially the Second World War halted the progress of environmental protection for a long time (Laurila and Laakkonen 2007). Development of water protection continued in the early 1960s with the 1962 Water Act. As required by
the Water Act, wide-based monitoring of wastewater discharges and their impacts on surface waters was initiated. The Water Act also enhanced the development of environmental studies, related technology and policies. The main focus of water protection was first on curbing the oxygen depleting discharges, especially from forest industries. Later the focus turned to controlling nutrient discharges. In inland waters, phosphorus is generally the nutrient that limits the growth of phytoplankton (Niemi et al. 2004).

Both ecological and societal factors influenced the timing and tone of the debate over eutrophication and other water pollution. Despite the newly established legislation, critical voices towards the industries causing water pollution strengthened in the 1960s and 1970s, (e.g. Aho 1968, Dahlström 1969). The environmental measures required by legislation were largely ineffective and in most cases the water quality continued to deteriorate. Eutrophication caused by forest industries, other industrial plants and growing towns were in many cases accepted and tolerated as an unwanted but inevitable side-effect of economic progress (Massa 1994, Laine and Peltonen 2003). In some cases, the intense public critique started after the discharges from industry had already been curbed (Konttinen 1994).

One key socio-economic development influencing the debate over water pollution and eutrophication in particular is the increase in the amount of summer residences. The growth in their numbers has risen rapidly since the 1960s and currently there are almost 500,000 summer cottages or other buildings used as free time residences in Finland. Almost 80% of these are located within 200 metres of water bodies (Rehunen 2008). Furthermore, most Finnish cities and towns are located on seashores or nearby lakes or rivers. Thus, Finns have abundant opportunities to detect changes in water quality, especially during their leisure time.

A study based on the interviews of key Finnish decision-makers indicated that they personally notice changes in the environment primarily when they visit their summer cottages (Järvelä and Wilenius 1996, p. 125). Both the increased environmental awareness and the important role of the water environment for relaxation and leisure time has contributed to higher public expectations of water quality. For example, bitter criticism was directed towards a pulp factory that accidentally released oxygen-consuming substances into Lake Saimaa in 2003 (Korjonen-Kuusipuro et al. 2004).

Agriculture in Finland has been based on small-scale family farms and it has been largely considered as a traditional and “natural” sector of society contrasted with industry which causes environmental problems (Wahlström et al. 1996). However, the increase in nutrient discharges due to the intensification of agriculture since the 1960s, together with the decrease in point-source emissions from industry and municipalities since the 1970s, have gradually changed the interpretations. From the late 1980s onwards, agriculture has been identified as the most important source of polluting nutrients, but until 1987 the environmental effects of agriculture were a non-issue of environmental policy (Jokinen 2000). During the period 1988–1994, agriculture was treated more equally as a polluting sector of society, and after Finland’s accession to the EU in 1995, the environmental issues surrounding agriculture have been a part of the economic viability of agriculture as a result of agri-environmental subsidies from the EU (Jokinen 2000).

Harmful effects of forestry, peat production and aquaculture on water quality have raised some local level media debate. The debate over the effects of aquaculture has been extensively studied in the Archipelago Sea (south-western Finland) (Peuhkuri 2002, Peuhkuri 2004). Aquaculture was publicly referred to as a key cause of eutrophication of the Archipelago Sea after a relatively long period of incubation. In the 1970s, only a few local inhabitants and scientists paid attention to the harmful effects of aquaculture on water quality. The public debate peaked in the mid-1990s as a result of increased algal blooms in the Baltic, the expansion of aquaculture, the increased experiences of nuisance by people enjoying their free time, research results about the state of the Baltic Sea,
and individual expressions of concern by key stakeholders (Peuhkuri 2004).

Especially from the late 1990s onwards, eutrophication has been recognised as a key environmental problem by policy makers in Finland. Government programmes have repeatedly mentioned eutrophication, and the 1999 programme particularly highlighted the need to reduce nitrogen discharge to the Baltic Sea (Government 1999). Eutrophication was the key concern in the water protection targets for 2005 issued by the Finnish Council of State as a Decision-in-Principle in 1998 (MoE 1998) and in the Water Protection Policy Outlines to 2015 (MoE 2007). Following Finland’s accession to the EU, the national legislation has been largely based on EU directives. Key directives include the European Union Water Framework Directive (2000/60/EC) and the Marine Strategy Framework Directive (2008/56/EC).

Recent main topics of Finnish debate concerning eutrophication have been related to agriculture, nitrogen removal from urban wastewater and the treatment of wastewater in dispersed settlements (Pihlajamäki and Tynkkynen 2011). The government Onsite Waste Water System Decree (542/2003), setting the minimum reduction targets for households and summer cottages not connected to the wastewater treatment network, entered into force in 2004. Because of substantial costs, demanding nutrient reduction targets and rigid implementation rules, it received considerable public critique that led to alterations to the decree in 2011 (Pihlajamäki 2011).

4.3.2 Coverage of eutrophication in HS between 1990–2010

During 1990–2010, a total of 2,162 news stories mentioning eutrophication or blue-green algae (hereafter: eutrophication stories) appeared. The coverage of eutrophication was relatively stable during the first half of the 1990s, except for the peak in July and August 1990 related mainly to the potential risks of blue-green algae (Figure 7). Interest towards blue-green algae was increased because of research results suggesting potential health hazards related to the toxins produced by some blue-green algae (Cyanobacteria) species. Finnish researchers initiated the studies on the subject in the 1980s and the first results were published in the early 1990s (Sivonen 2004). Since then, risks related to toxins produced by cyanobacteria species have been frequently brought up in news coverage describing the algal situation.

![Figure 7. Monthly number of news articles mentioning eutrophication or blue-green algae by HS.](Source: modified from Article V.)
Potential health hazards related to the toxins produced by blue-green algae are easy to connect to everyday behaviour, but it remains challenging to assess the exposure to and effects of toxins potentially released in individual cases (Sivonen 2004). Consequently, the potential health risks remain largely unknown. For example, news articles commonly warned people against swimming or using water in their daily activities. A Finnish speciality is the warnings against using water containing algae in sauna stoves (e.g. 18 July 2002). Small amounts of water thrown on the sauna stove are used to create steam in the sauna and potential toxins in the water may be inhaled as the water is vaporised. These warnings highlight the culturally determined importance of water.

The coverage has been concentrated on summertime, especially since 1997. The monthly average number of all news articles mentioning eutrophication or blue-green algae was 8.6, which was less than a half of the monthly average of July–August (20.5). The monthly average number of all eutrophication stories was 6.0 during 1990–1996 and 9.9 during 1997–2010. The higher level of news during the latter period is explained by the increased news coverage in summertime. The monthly average number of news items published in July–August increased from 11.2 during the period 1990–1996 to 25.2 during 1997–2010. Coverage during wintertime remained low throughout the study period, including three months with no eutrophication news.

The share of eutrophication stories published during July–August reached 63.6% of the annual coverage in 1997. During other years of the sample, the share of the July–August coverage from the total annual coverage varied between 23.9%–50.5%. Other studies have indicated that the news related to eutrophication or water quality is concentrated in the summertime (Bruun 1998, Leivonen 1999, Peuhkuri 2004, Lyytimäki 2006a). For example, nearly a half (43%) of the articles describing eutrophication published by the 20 national and regional Finnish newspapers in 1998 appeared in July (Välimäki 2000).

The focus on the summertime can be explained by four key factors. First, the ecological changes caused by eutrophication are easily observable during the summer months as the occurrences of blue-green algae in Finland are usually most abundant in July–August (Lepistö 1999). Second, July is the typical holiday season for Finns. Thus, many Finns spend their leisure time on the beaches or summer residences close to water bodies, and because of this, they have a personal interest in the algae situation. This also creates demand for news coverage about the water environment. Third, because July is a common holiday period in Finland, there is a relatively short supply of other domestic news issues. Fourth, since 1998 there has been an increased supply of material for the press provided by the national algal monitoring and communication system (see below). Most of this material is published during the summer months (Article IV).

**1997 as a turning point**

During the summer of 1997, massive algal occurrences developed in the Gulf of Finland. These were highlighted by HS, as exemplified by the front page news (11 July 1997) entitled “Green algal mats swim in the Gulf of Finland”. Local news pages highlighted that the algal situation was the worst it had been for over a decade. However, as the interviewed beach user optimistically stated, “the algae are not disturbing us as long as the sun shines” (27 July 1997). The occurrence of blue-green algae was also intensive in inland waters, although the main focus of the news published by HS was on the algal situation on the seashores near the Helsinki metropolitan area.

During the study period, the annual amount of news items mentioning eutrophication was relatively stable. The number of news items varied between 44 and 70, except for in 1998, when 95 news items mentioning eutrophication were published. The amount of news items mentioning blue-green algae showed a rapid increase from 16 to 80 in 1997 (Figure 8). Leivonen (1999) has collected a time series of the news by HS focusing on algal situation and water
pollution during 1960–1999. This data is based on a two-week sample consisting of the last week of July and the second week of August. It shows that the number of news items focusing specifically on blue-green algae was between 0–6 for all other years except for 1997 when the number increased to 20 (Leivonen 1999).

The easily observable algal occurrences of summer 1997 and the subsequent extensive news coverage induced demands for detailed and timely public information about the algal situation and the risks related to swimming, fishing and other uses of water. For example, an interview with the research director of the Finnish Environment Institute was published in the domestic news pages (25 July 1997) and he was critically questioned about the lack of timely local level information on the algal situation. The journalist suspected that the authorities were not able to adequately disseminate the information that was available from the databases. Regarding the algal situation in the sea areas, the press officers from the Finnish Marine Institute responded with a Letter to the Editor (30 July 1997), maintaining that all possible efforts are carried out and information collected from various sources is synthesised and provided through a special Internet site. However, this information concerned mainly the open sea areas and they admitted that the authorities were not fully aware of the rapidly changing algal situation in coastal areas.

Partly because of the wide-based debate and critique, a need for additional communication was recognised by the authorities. In order to improve the situation, the national algal monitoring and communication system was established in 1998 by various environmental authorities (Lepistö et al. 1998). The increased supply of information largely explains why the highest annual number of eutrophication stories (N=170) was found from 1998. Since then, the general trend of coverage on blue-green algae has been decreasing (Figure 8).

The algal monitoring and communication system has been based on collaboration between the national, regional and local level authorities, national research organisations and individual citizens voluntarily participating in information collection. Information on the algal situation has been delivered through press releases and maps depicting the algal situation. Furthermore, information has been provided via interviews, brochures, reports and books. For example, a guidebook answering one hundred common questions related to the algae was

![Figure 8](image-url)  
**Figure 8.** Development of share of news items mentioning eutrophication or blue-green algae in HS. Note: the news on eutrophication may also mention blue-green algae. A maximum of 165 such news items exist. (Source: modified from Article V.)
The environment in the headlines

published in 1999 (Rissanen 1999). A special telephone service focusing on inland waters and coastal areas was initiated. On average, about 350 telephone calls to the freshwater telephone service have been received per year, but during the hot and dry summer of 2002 over 670 calls were received (Rapala et al. 2005). The importance of Internet has increased and nowadays web pages can be considered as the main channel of dissemination. A special web portal concentrating on the Baltic Sea was established in 2002. It was first coordinated by the Finnish Marine Institute and then by the Finnish Environment Institute after the merging of these two institutions in 2009. The information pages on the algal situation regarding inland waters have been coordinated by the Finnish Environment Institute.

The need for a national communication system was discussed back in 1990, when domestic news pages published an interview with a researcher who suggested that the authorities should inform people about the algal situation just like people are informed about high pollen concentrations (5 November 1990). However, after the communication system was established, another researcher initiated the discussion by suggesting that providing information focusing too much on algal occurrences creates inaction and shifts attention and resources from remedial activities (4 August 2002).

Massive algal occurrences largely explain the high level of coverage during the summer of 2002. As the domestic news pages published on 5 September summarises, the algal situation in 2002 was the worst since 1997. However, the headline of the news erroneously stated that 2002 was “the worst summer for blue-green algae since 1977”. No correction to this headline was published, indicating how easily incorrect impressions about past states of ecological systems can be created.

The level of news coverage was relatively high in the summer of 2003 when, despite the warmer than average weather, algal occurrences remained moderate. The situation resembled that of summer 1998 when the massive algal blooms of the preceding summer were well remembered and the public anticipated another summer of intensive algal occurrences, as exemplified by the news headline “A fierce algal summer predicted by nutrient amounts” (6 June 1998).

The news made a strong connection between the algal occurrences and sunny and warm weather (Article IV). Typical headlines described how sunny weather increases the amount blue-green algae. The sunny weather was presented both as a risk factor increasing the likelihood of algal occurrences in the near future and as an ecological factor that caused the current ecological change. Typical examples of the former are front page news stating that “Heat wave drastically increased the amount of blue-green algae” (16 July 2003) or “Heat wave drastically increased the amount of blue-green algae in sea and inland waters” (9 August 2007). A typical example of the latter is domestic news from autumn 1998 proposing that “Sunny weather may increase blue-green algae in the Gulf of Finland” (4 September 1998). At a more general level, algal nuisances were connected with summertime, as lamented by the local news in 1998: “Blue-green algae will emerge again as a summertime nuisance” (27 May 1998), or domestic news ten years later “The summer will bring moderate amounts of blue-green algae” (3 June 2008).

In addition, the windless weather was presented as a factor increasing the probability of algal blooms, as stated in the domestic news section (10 August 1998) “Blue-green algae problem can evolve in the sea when the weather calms down”. A combination of sunny and windless weather was presented as especially risky, even outside the warm summer months. A domestic news article published in spring 1998 stated that “Calm and warm weather lifted algal mats to the surface” (1 May 1998). The expert interviewed in this news assured readers that the question was not about blue-green algae occurrences but normal spring bloom of other algae species.

On the other hand, cold and windy weather was presented as a reason for the lack of algal blooms and a key factor contributing to the dis-
solution of algal occurrences (Article V). For example, domestic news from summer 2002 included headlines like “Unstable weather has forestalled the formation of algal mats” (5 July 2002) and “Wind has dissolved biggest algal mats” (20 July 2002).

In reality, calm, warm weather alone is not sufficient to induce massive algal blooms (Lepistö 1999). Finland’s hot summer of 2010 was record-breaking, but the algal situation in sea areas remained average while the situation in inland waters remained better than average. Local news warned at the start of the summer that the “Risk of blue-green algae is considerable this summer” (6 June 2010). Later the news stated that “Hot weather increases the amount of blue-green algae in surface waters” (12 July 2010). However, the year could be summed up (23 October 2010) with a positive conclusion: “Water remained clean for swimmers in Helsinki last summer”.

Coverage of eutrophication across newspaper sections

Eutrophication is predominantly represented as a domestic issue since 41.0% of news items were published in the domestic section and 24.9% in the local news section (Figure 9). Both the local and domestic news faced a rapid increase during 1996–1998. Local news reached its peak in 1998 (59 news items) after which the coverage decreased. Coverage on the domestic news page remained at a high level and reached its peak in 2002 (76 news items). Foreign news pages addressed eutrophication only rarely (1.2% of all eutrophication news). This was largely because the state of the Baltic Sea was addressed under local or national level news. For example, the Russian city of St. Petersburg, located at the eastern tip of the Gulf of Finland, was mentioned in 20 news headlines but none of these articles appeared in the foreign news section. Sixteen of these news items appeared as domestic news, including one front page news article, and two as local news. The section of one news item remained unknown and one appeared as an editorial.
The distribution of news articles published in the science/nature pages remained at a relatively constant level (3–10 news items annually) throughout the study period. In total, 5.6% of all eutrophication news articles were published in the science section. Research results related to blue-green algae were the most prominent single topic of the science pages. *Cyanobacteria* species were framed as a source of health risk but also as a fascinating and resilient life form that has survived for billions of years: “Blue-green algae could grow on the Moon” (18 March 2008).

Letters to the editor held a share of 8.3% of all news and the annual number of opinion pieces fluctuated between 1 and 21. The most intense debate occurred during 2007–2008, largely related to the criticism directed to the implementation of Onsite Waste Water System Decree, requiring purification of wastewater in settlements outside the sewage network. However, a major share of this debate remained outside the sample. A search from 2007–2008 with keyword “waste water decree” (jätevesiasetus) found nine news items related to eutrophication, which can be considered a low number (cf. Pihlajamäki 2011). Only one of these news items was included in the sample studies here.

Critique was presented particularly because expensive investments were required from households, although the share of dispersed settlements of all discharges is small (see Pihlajamäki 2011). Criticism was expected since new regulations framed the owners and users of summer residences as polluters. Some Letters to the Editor maintained that people living in the areas of scattered settlements are used as scapegoats (e.g. 8 May 2008). Debate over dispersed settlements shifted attention away from agriculture, which remains the biggest anthropogenic source of nutrient discharge (Putkuri *et al.* 2009) or from municipal waste treatment that may provide more cost-efficient means of reducing nitrogen discharge. The low number of eutrophication stories in the economy section is noteworthy.

The highest number of front page news articles was found in 1997, when ten such articles appeared. Most of these news items were related to the intensive occurrences of blue-green algae. Seven front page news articles related to eutrophication were published both in 2002 and 2008. In 2002, the algal situation of the shores of the Gulf of Finland and especially around the swimming beaches of Helsinki dominated the front page news. In 2008, the majority of front page news related to eutrophication dealt with the Baltic Sea. Topics included projections of the algal situation for the coming summer, current ecological state and future of the sea, public opinion about the state of the Baltic Sea, and policy measures related to emission targets.

![Figure 10. Coverage of news on eutrophication by main topic. (Source: modified from Article V.)](image-url)
Mainstreaming of eutrophication debate across topics

The shares of the news focusing on eutrophication, other environmental issues and non-environmental issues remained relatively stable. Eutrophication was typically represented as an environmental issue not connected to other issues. However, 1997 was the only year when over a half (55.0%) of the news items mentioning eutrophication or blue-green algae concentrated specifically on eutrophication (Figure 10, Table 6). The smallest share of news focusing on eutrophication (27.7%) was found in 1993 and 2008. On average, 39.9% of the stories focused specifically on eutrophication.

A slightly higher share of the news (41.7%) focused on some other environmental issue or discussed eutrophication under general notions of the state of the water, emissions into water, water pollution, or equivalent. The largest share (65.1%) of news focusing on other environmental issues was found in 1993 and 2008.

Table 6. Cross tabulation of climate stories by newspaper section and main focus. Local news includes the sections: Name of the Day, News from Helsinki, and Where to Go. Lifestyle includes the sections: Price & Quality, Leisure, Life & Health, Housing, Home & Style, Travel, Food & Drink, Cars, and Sport. (Source: this research.)

<table>
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<tr>
<th>Focus of title</th>
<th>Eutrophication</th>
<th>Other environmental issue</th>
<th>Other issue</th>
<th>Total</th>
</tr>
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<td>26</td>
<td>3</td>
</tr>
<tr>
<td>% of Total</td>
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<td>1.2%</td>
<td>0.1%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Editorial</td>
<td>Count</td>
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<td>70</td>
<td>21</td>
</tr>
<tr>
<td>% of Total</td>
<td>1.2%</td>
<td>3.2%</td>
<td>1.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Letters to Editor</td>
<td>Count</td>
<td>32</td>
<td>114</td>
<td>34</td>
</tr>
<tr>
<td>% of Total</td>
<td>1.5%</td>
<td>5.3%</td>
<td>1.6%</td>
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</tr>
<tr>
<td>Domestic news</td>
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<td>91</td>
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<td>% of Total</td>
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</tr>
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<td>% of Total</td>
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<td>0.9%</td>
<td>0.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Culture</td>
<td>Count</td>
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<td>4</td>
<td>8</td>
</tr>
<tr>
<td>% of Total</td>
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<td>0.2%</td>
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<td>19</td>
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<tr>
<td>% of Total</td>
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<td>0.5%</td>
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<td>1.5%</td>
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<tr>
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<td>4.9%</td>
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<tr>
<td>Nature &amp; science</td>
<td>Count</td>
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<td>28</td>
</tr>
<tr>
<td>% of Total</td>
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<td>2.0%</td>
<td>1.3%</td>
<td>5.6%</td>
</tr>
<tr>
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</tr>
<tr>
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<td>0.0%</td>
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<td>4</td>
</tr>
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<tr>
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<td>34</td>
</tr>
<tr>
<td>% of Total</td>
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<td>1.4%</td>
<td>1.6%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Unknown or other</td>
<td>Count</td>
<td>8</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>% of Total</td>
<td>0.4%</td>
<td>1.0%</td>
<td>0.5%</td>
<td>1.8%</td>
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<tr>
<td>Total</td>
<td>Count</td>
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<td>902</td>
<td>397</td>
</tr>
<tr>
<td>% of Total</td>
<td>39.9%</td>
<td>41.7%</td>
<td>18.4%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The environment in the headlines

The environment in the headlines was from 1993. This was not caused by any single news topic but several reports related to water quality or discharge and other environmental issues. The share was at its lowest in 1997 when about a quarter (26.4%) of the eutrophication news focused on other environmental issues. The number of these news items dropped from 60 to 33 during 2008–2009. The heightened climate debate of the late 2000s was reflected only with few individual news titles such as “Climate change threatens the Baltic Sea” (16 May 2007).

Less than a fifth (18.4%) of all news items mentioned eutrophication or blue-green algae but focused on issues other than environmental ones. The share of these varied between 7.2% in 1993 and 28.3% in 1999. The topics varied, including issues such as fishing, agriculture, land use and planning, research and recreation.

4.3.3 Comparison of the coverage in Finland and other countries

Only a few studies focusing on media coverage of eutrophication can be found from international (English-language) literature. Jönsson (2011) presents an analysis of media representations of environmental risks related to the Baltic Sea. The analysis is based on the data from a Swedish broadsheet newspaper Dagens Nyheter from 1992–2009. According to the results, the Baltic Sea was more visible in the news in the 1990s than in the 2000s. This is partially explained by political initiatives concerning the Baltic Sea environment, such as a new HELCOM convention (1992), and the Baltic 21 initiative (1996). The Baltic Sea was commonly framed as an area suffering from environmental problems since generally between 25% and 35% of the news articles concerning the Baltic Sea addressed environmental issues in some way. Although many newspaper articles acknowledged several environmental risks, eutrophication received the most attention and was considered to be the biggest threat. Eutrophication was not framed in terms of uncertainty concerning risks and consequences, but rather in terms of main causes. Agriculture and its use of phosphorus and nitrogen was presented as the main cause of harmful changes and political restrictions on agriculture were presented as a key solution (Jönsson 2011).

Eutrophication of the Baltic Sea has been one key topic of the environmental coverage in Finland and Sweden but the situation in other countries surrounding the Baltic Sea may be very different. Environmental coverage in the Lithuanian press has been studied in a Master’s thesis focusing on one national and one regional newspaper from the period of six months (January–June 2000) (Maceviciute 2000). During that period, eutrophication was not mentioned, even though almost a fifth of the environmental coverage of the national newspaper dealt with water pollution. A relatively high share of environmental news related to oil spills in the Baltic Sea. The main focus of the Lithuanian press was on local issues such as wastewater releases, while large-scale effects of this pollution were not dealt with.

4.4 Comparison of eutrophication and climate change coverage

The rapid increase in the coverage of climate issues since 2006 was an extraordinary event, but the annual share of climate stories still remained less than two per cent of all news coverage (Figure 11). The annual share of news items focusing on climate change remained less than 0.5% of all news. Only one per cent of all news mentioned climate issues during 2010.

The monthly share of climate news of all news reached 2.0% in January 2007 and 2.4% in February 2007. During the Copenhagen COP15 meeting, the share increased to 2.4% in November 2009 and 2.5% in December 2009. Partly due to the mild winter, the monthly share was also high in December 2007 (2.5%) and February 2008 (2.3%).

The international climate meetings showed up as distinctive peaks. The greatest shares of news specifically focusing on climate issues were found from November 2009 (1.0%) and December 2009 (0.9%), at the time of the Copenhagen COP15 meeting. The peaks of two preceding winters were lower. The share of 0.8% was reached during February 2007 and
December 2007. The peaks related to the Kyoto COP3 meeting December 1997 (0.4%) and The Hague meeting November 2000 (0.6%) also gained relatively high shares of all news.

Eutrophication news as a share of all news remained relatively low, reaching a peak of 0.2% in 1998. The shares calculated on a monthly basis were considerably higher, due to the concentration of coverage in the summertime. The highest monthly share of eutrophication news of all news (0.7%) was reached in July 2003, when the hot and sunny summer weather triggered abundant algal occurrences. Almost the same level of eutrophication news (0.6%) was reached in July 1997, July 1998, August 2002 and July 2005.

The annual share of news items focusing specifically on eutrophication remained below 0.1% of all news, reaching 0.09% in 1998 and 0.08% in 2002. These news articles were concentrated on the summer months, following the pattern of all news mentioning eutrophication or blue-green algae. The highest monthly share (0.4%) was reached in July 2005, followed by July 2003 (0.4%), August 2002 (0.4%), July 1997 (0.4%) and July 1998 (0.3%).

Even though the overall number of climate news surpassed the number of eutrophication news during the whole study period, articles focusing specifically on eutrophication were published almost as often as news focusing specifically on climate issues throughout most of the 1990s. However, the amount of stories mentioning climate issues as a part of other topics was higher throughout the study period. The wider treatment of climate issues probably paved the way to the high amount and wide scope of coverage during the last years of the sample.

The results indicate that climate change has been represented by HS as an issue widely connected to other issues, while eutrophication has been represented more in isolation from other issues (Figure 12). Eutrophication was only rarely addressed in the culture pages or the economy pages and it was not seen as an international issue to be dealt with in foreign news. Especially regarding the Baltic Sea, eutrophication reporting tends to localise a cross-national issue. Climate reporting, on the other hand, has brought a global level change into local contexts.

In their study focusing on the role of science in Finnish Baltic Sea eutrophication governance, Pihlajamäki and Tynkkynen (2011, p. 194) briefly note that “a rising topic of discussion, although not yet highly popularised, is the impact of climate change on eutrophication.” The data here supports this notion, although the data allows systematic analysis only at a level
of headlines. However, somewhat surprisingly, headlines for eutrophication stories only rarely made an explicit connection between climate change and heatwaves causing algal blooms. Only nine of the headlines for eutrophication stories mention climate change or the greenhouse effect. Climate news includes eight headlines that mention eutrophication or blue-green algae. Since the titles usually focus on only a few issues, these numbers greatly underestimate the interactions that are built between these issues by the news texts. For example, an article entitled “The state of water courses is slowly improving” (17 September 2007) presented climate change as a risk factor threatening the positive development of water quality.

Importantly, an indirect and partly implicit connection between these issues was created by the eutrophication news that represented the sunny and warm summer weather as an ecological factor regulating algal blooms. So far, warm summer weathers have been typically presented in connection with leisure time and relaxation. Due to the relatively cold climate conditions

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**Figure 12.** A comparison of the coverage by section of the paper Local news includes the sections: Name of the Day, News from Helsinki, and Where to Go. Lifestyle includes the sections: Price & Quality, Leisure, Life & Health, Housing, Home & Style, Travel, Food & Drink, Cars, and Sport. (Source: this research.)
in Finland, summer heatwaves have been generally welcomed and algal blooms have been perceived as a nuisance prohibiting the use of water during comfortably warm periods. If Finland is to be increasingly faced with unpleasantly warm summer weather (Jylhä et al. 2004), this framing is likely to shift towards a framing of warm weather an environmental problem.

5 Discussion: reaching behind the headlines

This chapter discusses the key factors influencing newspaper coverage of climate change and eutrophication and re-evaluates the models aimed to explain the development of the coverage. Finally, potential avenues for further research are scoped.

5.1 Factors explaining the changes of the coverage

The results show how the amount of press coverage describing individual environmental problems fluctuates, especially in the short-term. No single dominant factor capable of explaining the evolution of newspaper coverage of environmental issues was found. Instead, the coverage of eutrophication and climate change has been influenced by several factors with varying importance between the cases and points in time.

Generally, the results confirm that the amount of environmental coverage is not principally determined by the anthropogenic driving forces of environmental changes. The level of emissions of carbon dioxide or other greenhouse gases appears to have only minor – if any – influence on climate reporting (Article II). Likewise, the amount of news coverage of eutrophication does not follow the level of nutrient discharges. The debate over eutrophication was intensive at the end of the 1990s, although the discharges from industry and other major point-sources continued to decrease (Kauppila et al. 2004, Niemi et al. 2004, Putkuri et al. 2009). Generally, the water quality near cities and industrial plants had already improved before 1990 and during the 1990s the amount of blue-green algae decreased, especially in the most eutrophicated lakes (Lepistö 1999, Niemi et al. 2004), but the amount of algal occurrences increased in sea areas near the coast (Kauppila et al. 2004). Thus, many of the ecological impacts of eutrophication had already passed when the intense debate was initiated during the late 1990s.

Ecological changes appear to have more influence on the coverage, but this influence is also partial and affected by several confounding factors. Variability of the state of the environment across time and space are important factors. During the late 1990s, eutrophication was highlighted as a key environmental problem, partly because of concrete ecological impacts resulting from decades of nutrient discharges into sensitive ecosystems (Articles I and IV). The weather conditions, especially in the summer of 1997, allowed exceptionally abundant algal occurrences. Eutrophication was highlighted by the press that summer, but the coverage also remained high during subsequent summers, sometimes even when the algal occurrences were below the long-term average levels.

Public interest towards eutrophication was amplified due to several factors. Social factors included the increased free time habitation along seashores and close to lakes, which increased public interest in water quality, together with increasing environmental awareness. The reduced economic importance of sectors causing water pollution gave more opportunities for presenting public critique towards the polluting sectors. Research results related to the risks of toxic blue-green algae occurrences were highlighted by the media representations.

Environmental problems related to the eutrophication of inland waters and seashores have been covered by the Finnish press for a long time when compared with coverage of climate change. This can be partly explained by the combination of ecological factors related to these environmental problems and the economic and social development patterns in Finland. Eutrophication is predominantly a local level environmental problem characterised by easily observable ecological changes caused by the anthropogenic nutrient discharges to vulnerable
ecosystems (Articles I and IV). Human impacts such as nuisances to beach users or decreases in property values because of algal occurrences can be connected in a straightforward manner to the ecological changes and nutrient discharges. Climate change, on the other hand, is a global level environmental problem that has to be characterised by science before it can enter into public debate (Weart 2008). Concrete weather events can be a substantial part of the media coverage of climate change, but only after the initial science-based problem definition identifying key causal relationships has been set out.

Overall, the press coverage of eutrophication news has centred on ecological events rather than on the long-term eutrophication process, while the coverage of climate change has highlighted social events related to international climate policies. Climate news highlighted connections to international and EU-level policy processes, while the eutrophication news focused primarily on the state of the environment at a local level.

It’s about weather

Weather conditions are an important part of both eutrophication and climate debate in Finland, but in different ways. The results show the importance of winter weather for climate reporting (Article II) and the importance of summer weather for eutrophication reporting (Article IV). Weather anomalies have been intensively dealt with in climate news by the press in various countries, even though establishing a causal link between certain weather anomalies and climate change is difficult, and potential risks primarily determined by socio-economic factors (IPCC 2011). Various weather anomalies that are often connected with climate change include forest fires and heatwaves in Southern Europe, droughts in Australia, hurricanes in the US and melting glaciers in mountainous regions (Ashlin and Ladle 2007, O’Donnell and Rice 2008, Masco 2010). In Finland, the visibility of extreme weather events in climate coverage appears to be limited. Overall, it appears that the weather anomalies are represented by the Finnish media as natural phenomena rather than as a consequence of climate change.

Weather conditions are an important part of the news coverage of eutrophication as well. Weather conditions partially explain the annual patterns of the climate and eutrophication news. The coverage of eutrophication is concentrated in July–August, mainly because of the combined effect of ecological factors, i.e. occurrences of blue-green algae, and social factors, i.e. the supply of news material by national algal monitoring and communication system (Articles IV and V). Sunny and windless weather is commonly presented as the reason for the algal occurrences by the press. This connection is also emphasised in the press releases published by the national algal monitoring and communication programme (Lyytimäki 2006a; Article IV). If weather is presented as the key factor regulating the occurrences of algal nuisances, nutrient discharges are easily left with little attention. This can be understood as a case of innocent omission of knowledge (Article VI).

It’s about time

Both eutrophication and climate change are environmental problems caused by driving forces and pressures working within different timescales. In such situations, the press seems to be largely unable to highlight a problem until
evidence appears in the form of a symptom that is easy to dramatize (Article IV). Both issues are also characterised by periods of ecological latencies, with the impacts of causes working invisibly until they materialise as effects. Furthermore, the effects of corrective measures are often delayed and they may induce unintended effects, both positive and negative.

The algal occurrences are relatively easy to detect without any technical measurement tools. However, processes that lead to abundant algal occurrences may have thresholds under which the changes are not easily observed (Article I). Nutrient discharges can continue for decades without any easily observable changes in water quality. These delays easily remain unnoticed in the press coverage focusing on the present situation or the near past or future events (Article IV).

In addition, climate coverage tends to omit long-term effects by focusing mainly on the near term implications and potential effects. If compared with eutrophication, the time lags related to climate change are generally considerably longer. Many of the ecological changes related to climate change unfold during time-scales measuring from centuries to millennia. Therefore, despite the high volume of outputs of greenhouse gases into the atmosphere since the Second World War, most of the ecological changes are yet to be seen, and they also hold a risk of crossing unwanted ecological thresholds that accelerate the changes (Lenton et al. 2008).

The long temporal and wide geographical scale of change makes the climate debate fundamentally dependent on scientific theories, analyses and projections. This also challenges scientists to present the findings describing changes that transpire over hundreds or thousands of years in a way that can be addressed by the media focusing predominantly on current concerns.

**It's about sources**

The activity of news sources is one key factor determining the ups and downs of environmental coverage (Suhonen 1994, Hannigan 2006). A recent study suggested that over a fifth of all news material published by HS is based solely or mainly on press releases or other PR-material (Juntunen 2011). The role of communication by the authorities differed substantially across the cases analysed here. Regarding the case of eutrophication in particular, the role of information provided by the environmental authorities proved to be the key factor (Article IV, Lyytimäki 2006a). The permanent national algal monitoring and communication system has served as a key news source for eutrophication news in Finland for over a decade. No such dominant national level news source exists for climate news. During the study period, there were EU-level and national campaigns aimed at increasing public awareness of climate change. The direct impact of the Finnish Climate Change Communication Programme (FCCCP 2011) on climate coverage in HS was negligible, since no headlines mentioning the programme were found. Likewise, the direct visibility of the climate communication campaign organised by the European Union was low, although the campaign was noticed by HS (6 July 2006).

 Sources for climate reporting are more variable, including national and international research, and global, EU-level and national policy processes. The climate coverage highlighted the importance of cross-national political processes that are coupled with national level processes, whereas a cross-national policy perspective was largely missing from the eutrophication news. The press occasionally pointed out the importance of emissions from Russia, especially St. Petersburg, in terms of the eutrophication of the Gulf of Finland, but this information was presented in a context of ecological changes rather than in the context of policy processes aimed to mitigate the problem.

The IPCC has often been mentioned as the key actor in the climate change debate (Agrawala 1999, Weart 2008). The direct visibility of the IPCC in the Finnish press is relatively low and restricted mainly to the assessment reports published every four or five years. However, the IPCC has considerable indirect influence on the press news. The results indicate, for example, that the IPCC-based general level consensus
on climate change has been widely accepted by the Finnish mainstream media. International climate research served as an important source of information for climate news, whereas eutrophication news highlighted national research and monitoring results. HELCOM has provided cross-national information from the Baltic Sea area, but this regional level perspective was narrowed and represented largely through the national and local perspective that dominates the press representations of eutrophication.

It's about the economy

The recent decline in climate coverage can be understood as a “climate fatigue” caused by several intertwined factors creating positive feedback loops. As the media coverage of climate issues dwindled and the two snowy winters suggested no warming, citizens probably felt it was easy to forget about global climate change. Importantly, the economic crisis was perceived as a more serious and immediate problem. Furthermore, compared to the preceding period of climate hype, scepticism towards climate science was presented more publicly, even though scepticism remained relatively rare in mainstream media. Instead of climate science, the critique was directed mainly at certain measures of climate policies that were considered too costly or inefficient, such as the use of biofuels as a way of abating greenhouse gas emissions.

Overall, the post-2009 situation of climate debate bears some resemblance to the situation of the environmental debate in the early 1990s. Then, Finland was hit by a severe economic depression, which decreased the interest in environmental issues. Väliverronen (1997) suggested that environmental problems lost much of their symbolic power and ability to speak to the people as they were seen as everyday phenomena in the early 1990s. The relatively wide media attention created an impression that environmental problems were taken into account by almost everyone, which decreased the motivation to act and make personal sacrifices.

Public criticism was also presented against the measures directed to combat eutrophication. During the last few years, residents of sparsely habituated areas in particular have opposed the costs caused by the implementation of the government’s Onsite Waste Water System Decree (Pihlajamäki 2011). This critique was directed mainly at the implementation of the decree that was widely considered unfair and expensive. However, as indicated by the recent news coverage, eutrophication remained a widely acknowledged environmental problem and the need for measures to mitigate it remained widely accepted at a general level.

5.2 The models explaining dynamics of the environmental coverage

The results of this study support the initial suggestion (see Chapter 2.2) that no single model is able to take into account all relevant factors influencing the environmental coverage, while at the same being coherent and parsimonious enough to be used as an analytical research tool. Instead of aiming for one universal model, various models taking into account different factors should be used simultaneously in order to acquire as realistic an interpretation of the complex functioning of the socio-ecological system as possible.

The results only partially support the Issue-Attention Model (IAM), suggesting a development of phases of media coverage for an environmental issue (Downs 1972). Instead of such phases, the coverage of eutrophication indicated continuous annual oscillation. On a decadal scale, the coverage of climate change showed a pattern that could be interpreted as following the phases of IAM, namely a relatively long pre-problem stage, alarmed public discovery and subsequent realisation of costs and decline of coverage. However, the monthly data showed a more variable fluctuation. Furthermore, at the start of the study period (in the early 1990s) both climate issues and eutrophication had already been discussed by the Finnish press (Suhonen 1994).

The IAM was developed and introduced during the early days of modern environmental concern, and it predominantly focused on
the emergence of issues. Hence, it appears that it is better suited to describe novel environmental issues when they first emerge into the public arena. It has less explanatory power to describe the continuous dynamics of issues that re-emerge after a period of relative absence (cf. Article VI).

The Public Arenas Model (PAM) focusing on the competition between actors pursuing different agendas (Hilgartner and Bosk 1988) does not adequately explain the dynamics between environmental issues such as eutrophication and climate change. Rather than competing for social attention, these environmental issues are mutually reinforcing. This is partially explained by the Finnish context, where the peaks of climate coverage have occurred mainly during wintertime and eutrophication is predominantly featured during summertime. Another explanation for the lack of competition between these issues is that climate news is often published in the foreign news section, whereas eutrophication is featured typically as local or domestic news. Furthermore, a wide-based issue such as climate change serves as a “bandwagon” that may give justification for the treatment of related issues, such as eutrophication. All in all, the PAM appears to serve better as a tool to understand the competition between environmental issues and other issues for social attention, as indicated by the recent decrease in climate news that is likely explained by increased coverage given to economic issues (Article II).

The suggestion of evolving cultural circuits by the Circuit of Culture Model (CCM) (Carvalho and Burgess 2005) gained partial support from the climate case, especially through the increased concern publicly expressed by key Finnish businessmen and politicians from 2007 onwards. However, the CCM is a less suitable model for interpreting the evolution of eutrophication news. Instead of changing cultural-political circuits that are assumed to be largely shaped by values and ideological cultures (Carvalho and Burgess 2005, p. 1467), the coverage was shaped by a rather technical issue: the improved and continuous flow of press releases and other information produced by the national monitoring and communication system. The news focused mainly on the algal situation and key topics remained largely constant throughout the study period. The shift in values and ideological cultures especially towards agriculture as a pollution source had already occurred earlier (Jokinen 2000, Peuhkuri 2004). This, in turn, contributed to a shortage of information and a need for communication that was fulfilled after the triggering event of summer 1997 (Article V).

The Quantity of Coverage Theory (QCT) suggests that the major news organisations play a key role in the formation of the public agenda (Mazur 1998, 2006). This study was also based on the assumption of the dominant position of a major news organisation – the newspaper HS – in Finnish society. The longitudinal data on climate coverage shows that the coverage of climate issues in other newspapers largely follows the pattern of HS coverage (Article III). This may indicate both the dominant position of HS but, more likely, it indicates that other newspapers rely on the same news sources and follow the same logic of news production as HS. The comparison of eutrophication news in several newspapers indicated rather uniform reporting, the main differences being the location of the water area that was described (Article IV). The key position of the national algal monitoring and communication system for eutrophication news illustrated that a focus only on the news organisations is inadequate. Furthermore, the social media and the Internet are challenging the key position of news organisations.

The QCT maintains that any publicity denoting risk increases the public’s uncertainty and sense of danger (Mazur 2006). It is likely that this is what happens with news items focusing on climate issues, since the risks related to climate change are typically represented as obscure, intangible collective level hazards. On the other hand, the eutrophication news focuses more on personal level health risks. Eutrophication news related to the algal toxins presents concrete advice on how to avoid the harmful health effects. Confirming whether this increases or decreases public concern is however beyond the scope of content analysis as carried out in this study.
On a general level, the Punctuated Equilibria Model (PEM) (Holt and Barkemeyer 2010) provides a description of major shifts in coverage, but it does not help to understand the small-scale changes or the nuances of the coverage that may be socially and politically relevant. While ecological changes have formed a central part of the punctuation points, or critical discourse moments, of the eutrophication debate, social events dominated the climate debate. Punctuation points of climate coverage include events related to international negotiations, namely the Kyoto COP3 and Copenhagen COP15 meetings. Political or socio-cultural events were not a key determinant for media attention of eutrophication. Instead, ecological events provide a seemingly convenient explanation for the major change of the eutrophication coverage. Algal blooms in the summer of 1997, especially in the Gulf of Finland, can be interpreted as a symptom of crossing ecological thresholds of eutrophication. However, the processes involving such non-linear changes are complex, and information remains inadequate in scientifically assessing whether or not ecological thresholds are involved in specific cases of algal occurrences (Article I).

The notion of the Piercing Effect (PE) suggests that environmental concerns are increasingly imported to other domains during and after the period of intense media coverage emerged based on climate reporting (Article II). The more wide-based presentation of climate issues can be promising for climate policy, where incorporating climate targets in all sectors of society is a prerequisite to making successful adaptation and mitigation efforts (Mickwitz et al. 2009). However, it is also possible that this wide-based coverage will be quickly surpassed, purposefully neglected or incidentally omitted (Article VI). It also may only contribute to increased worry and uncertainty, as the QCT suggests.

Despite the increased coverage from 1997 onwards, there has not been a piercing effect for eutrophication. The eutrophication debate has been confined to domestic and local news, while the treatment of eutrophication in the foreign news, economy and lifestyle sections is scarce. This is partly explained by the strong position of the nationwide algal communication system that provides information suitable for domestic and local news.

In the long-term, environmental coverage seems to be increasing, even though it is possible that the peak(s) of climate coverage showed the limits of quantity of coverage for an individual environmental issue. Based on the notion of the Piercing Effect (Article II), it can be postulated that a saturation point was reached for climate news in local, domestic and foreign news, as well as in the science section, after which the coverage does not grow but shifts into other arenas, such as the culture or economy sections. The results of this study further suggest that these saturation points for environmental issues are relatively low. When compared with earlier environmental coverage, the peaks of coverage of climate change were high during 2007–2009, but the monthly share of news items focusing on climate issues only reached about 0.6% of all coverage. From the agenda setting perspective, this share is small, especially if contrasted against the scientific evaluations of the importance of climate change for long-term human well-being (Stern 2007, IPCC 2008).

An important question is what happens when the media coverage focusing on a certain environmental issue decreases (Article VI). From the perspective of the QCT, Mazur (2009), in his analysis of a generation of environmental coverage by the US media, lamented that if past patterns continue, the post 2006-peak of news coverage will abate even as climate change worsens. The results presented here show that this is largely what is happening. Although recent scientific results indicate even gloomier perspectives than those presented by the IPCC reviews (Füssel 2009), the press coverage of climate news has declined. However, the decline is not likely to be permanent but a part of continuous fluctuations and it is also affected by the piercing effect (Articles II and III).
5.3 Implications for future research

Media should not be seen as something separate from the ecological realm, but as increasingly important lenses through which we perceive our world (Allenby 2008). There is a clear need for additional interdisciplinary research integrating media coverage analysis with management studies and natural science-oriented studies. While the relationship between public awareness and environmental coverage has been widely studied, there is a lack of research focusing on the various relationships between the state of the environment and media representations. The possibility of the existence of thresholds in socio-ecological systems and their media representations poses a particularly key challenge for research and management (Article I).

In some cases, reviews aimed at being comprehensive presentations of the management of eutrophication focus solely on natural science (Ansari et al. 2011). Studies focusing on the management of aquatic resources may mention mass media as one factor influencing the socio-ecological system, but they do not analyse the media in more detail (Iwasa et al. 2007). More surprisingly, studies specifically focusing on questions related to processing and disseminating data on the aquatic environment typically acknowledge the importance of public outreach, but they do not assess the actual media treatment or public visibility of the data (e.g. Seager 2001, Vascetta et al. 2008, McQuatters-Gollop et al. 2009). So far, only a few attempts have been made to specifically assess the media contents of eutrophication (e.g. Peuhkuri 2004, Zubrycki 2010, Jönsson 2011, Article IV). These offer only meagre source material for comparative synthesis.

Generally, research into media representations of eutrophication is scarce when compared with literature on media representations of climate change. It is likely that the media treatment of eutrophication is more variable between countries than the media coverage of climate change. This is because of the variance of local-level ecological conditions and the lack of commonly shared international-level news sources. The Baltic Sea region provides an interesting case for comparative studies. The management of the cross-national environmental problems related to the sea gives a common context, binding together ecologically, politically, socially and economically disparate countries surrounding the sea.

Climate change is largely defined at a supranational level and hence one key research topic is the domestication of climate issues to national and local levels. In communication studies, this stream of research has so far focused on short-term media coverage describing momentary issues such as international climate meetings (e.g. Kunelius and Eide 2012). One potentially fruitful topic for further studies is the long-term domestication of global environmental issues.

Despite the relatively high number of studies addressing the media coverage of climate change, studies comparing climate change with other environmental issues are scarce (cf. Mazur 1998, Ashlin and Ladle 2007, Masco 2010). For example, studies comparing the coverage given to climate issues with the coverage of biodiversity issues could provide interesting results. One particularly interesting question is the public visibility and potential impact of the concept of ecosystem services (MEA 2005). Comparative research is needed, regarding not only media coverage between different environmental issues, but also in terms of environmental and other issues. This is especially important in connection with the mainstreaming of environmental concerns to other policy areas. Such comparative studies would be especially valuable in order to understand the functioning of socio-ecological systems characterised by dynamics of different issues operating simultaneously.

An interdisciplinary approach is important, not only in terms of understanding the dynamics of socio-ecological systems, but also to understand the multiple factors which affect the way the press and other media reports on environmental matters. Here the focus has been on the long-term development of press content. Studies focusing only on newspaper content...
The environment in the headlines may continue to give relevant insights, but studies focusing more widely on different forms of communication, including interactive social media, are needed.

The analysis presented here aims to give an overall picture of the key features of the press coverage of two environmental problems. In the future, the data can be employed in more detailed case studies and comparative research. The material opens up possibilities for further studies utilising more detailed quantitative coding schemes, and qualitative studies based on samples of full contents of news stories, not only the titles. Such studies would give systematic insights into the dominant actors and framings of the full news contents, for example. The material gathered here can serve as a seed for studies employing statistical approaches such as time series analyses that may disentangle the potential relationships between media contents, and indicators describing ecological changes and social responses (Yanovitzky and Van Lear 2008).

Analysing the factors leading to the emergence of new issues or perspectives on the public agenda remains an important topic for environmental communication studies. However, it seems that it is also important to investigate the reasons that lead to the absence of certain information from public debate (Article VI). A particularly promising research area might be the implications of the treatment of environmental issues as a part of other issues, outside the bold headlines and core environmental debate.

6 A concluding remark

“For many people, science leads not to enlightenment and empowerment, but to existential angst and the absurdity of human insignificance in an incomprehensibly vast universe.”

John D. Sterman, 2006

The grim statement of John D. Sterman (2006) overestimates the ability of science to depress people. Even though science is in many cases the core source of complex and potentially discouraging environmental information, hardly anybody starts their day with a cup of coffee and a refereed scientific report about the deteriorating state of the environment, as noted by Boykoff (2009a). Instead, people often start their day with a fair dose of media exposure provided by newspapers and other media. In other words, the potentially worrying results of environmental science are brought to the public and policy agenda largely through the media that often emphasises the bad news. Coverage of environmental problems increasingly suggest that we are living in the Anthropocene characterised by human dominance over (other) natural forces. This is both scary and motivating, since this coverage reminds us both about risks to our well-being through continuing environmental degradation, but also about the potential for various mitigation and adaptation measures from the personal to the global scale.

In Finland, newspapers have been a key source of environmental information and they continue to play a major role, despite the increasing importance of other media. The results describing the contents of the Helsingin Sanomat newspaper show that a good deal of information on eutrophication and climate change has been publicly available over the last two decades. The absolute amount of coverage has been characterised by considerable variations caused by a variety of intertwined factors. The results show that during the short-term peaks of the coverage in particular, these topics have gained considerable visibility in Finland. However, even though the absolute number of these environmental stories has increased, their average share from all news content has remained relatively low.

The evolution of environmental coverage is more than just a sporadic fluctuation of different environmental issues. As the notion of the Piercing Effect of climate change coverage suggests, an issue once elevated high on the media agenda may continue to influence the debate even when it is not frequently featured as front page news any more. This kind of less visible but large-scale media treatment may be the key for building a policy and public agenda favourable for seeking new solutions and helping to
overcome the personal and institutional impediments of effective climate change mitigation and adaptation.

The notion of the Piercing Effect suggests that despite the fluctuations and recent decrease in climate coverage, this issue will not entirely abate from the view of newspaper readers. Only some of the environmental issues are likely to become a major issue in the mass media and a subject of the Piercing Effect. The eutrophication of water provides an example of a narrower environmental debate, where active and continuous communication by stakeholders such as the authorities can play an important role. It also provides a warning against the generation of potentially one-sided framings by actors capable of dominating the debate. Even well-meaning communication can lead to non-recognition of other relevant viewpoints or issues.

The media is not only a source of bad environmental news. Media contents are one important part of the functioning of socio-ecological systems. Recognising the role of the media is required in order to build a public and policy agenda favourable for mainstreaming the environmental concerns into all key actions of society. The ability of press publicity to set an agenda that facilitates the implementation of the long-term environmental policy measures is decreased because there is a tendency in the press to focus on immediate concerns and omit long-term ecological, structural or institutional driving forces and pressures. The ultimate question is whether and how the environmental coverage helps to avoid the crossing of potential undesirable ecological thresholds that typically occur at timescales far beyond 24 hour news production cycles or policy and management perspectives focusing on a few years. There probably is no comprehensive answer to this question, but fostering a critical yet constructive public debate is surely one part of the answer.

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