REPORTS OF FINNISH ENVIRONMENT INSTITUTE 21 | 2008

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## Results of an international web survey

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Helsinki 2008

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REPORTS OF FINNISH ENVIRONMENT
INSTITUTE 21 | 2008
Finnish Environment Institute
Research Department

Page layout: Seija Turunen
Cover photo: Nora Tobiasson

The publication is available also on the Internet:
www.environment.fi/publications

This publication is printed on paper produced
in an environmentally friendly way.

ISBN 978-952-11-3165-3 (pbk.)
ISBN 978-952-11-3166-0 (PDF)
ISSN 1796-1718 (print)
ISSN 1796-1726 (online)

# Summary

This report provides an overview of the results from an international survey on the perceived significance of ecological thresholds in coastal areas. The purpose of the survey was to explore different framings and expert opinions concerning ecological thresholds and to highlight issues that may be of particular importance in developing policy relevant knowledge, especially from the point of view of coastal management.

The survey was distributed to over 1,000 researchers and stakeholders familiar with coastal management and/or ecological thresholds. The survey was based on an electronic web-based questionnaire.

This paper summarizes 320 responses received during spring 2008. The results reflect a wide array of expertise and experiences from 30 countries mainly from Europe and North America.

The results show that experts and stakeholders are concerned that current management structures are not capable of preventing the passing of many ecological thresholds. Especially effects of climate change are perceived to belong to this class of difficult problems.

The survey showed clearly that even though the concept of ecological threshold can be useful for coastal management, the use of the concept is complicated. Ecological thresholds related to different areas and environmental issues are perceived as highly variable. The policy implications depend on spatial, temporal and functional scales that should be taken into account.

Divided views were expressed about the state of the scientific knowledge. The complicated nature of thresholds was clearly acknowledged. For example, most respondents agreed that passing of threshold for one variable always triggers many changes in ecosystems and that the relations between key variables change radically in thresholds situations. However, a majority of respondents were critical towards often coined characterisations of ecological thresholds as being always rapidly occurring, irreversible or nearly impossible to detect in advance.

Due to great variation of natural conditions and human pressures it is difficult to make widely applicable generalizations about the characteristics of ecological thresholds. As respondents clearly agreed, large differences exist between different coastal areas and between different issues.

The results provide a reminder that the management of coastal areas is difficult because many fundamental concepts and issues are viewed and understood differently. The results suggest that there is a need to increase transparency and participatory approaches that can bring out different interpretations and facilitate social learning. Such learning processes will not create common understanding once and for all, but have to be maintained continuously in order to adapt to changing conditions.

The survey was a part of the research project Thresholds of Environmental Sustainability under EU FP6. Results presented here are preliminary. A more detailed analysis of the results will be published later in scientific paper.

## CONTENTS

# Introduction

This report summarizes preliminary results from an international on-line survey on the significance of ecological thresholds in coastal areas. The survey was a part of the EU FP6 project *Thresholds of Environmental Sustainability*, coordinated by the Instituto Mediterraneo de Estudios Avanzados (IMEDEA), Spain.[1] The survey was implemented by the Finnish Environment Institute (SYKE). The aim of this paper is to provide a timely overview and summary of the results. More detailed studies will be published in scientific papers.[2]

The purpose of the survey was to explore different framings and expert opinions considering ecological thresholds and to highlight issues that may be of particular relevance in developing policy relevant knowledge, especially from the point of view of coastal management.

The overall approach of the survey was explorative. The survey did not focus on any specific coastal area or environmental issue. Instead, it had a wide-angle focus on the expert views on relevance of thresholds, the nature and characteristics of thresholds and potential management implications of thresholds. The topics were chosen to reflect the overall objectives of the *Thresholds of Environmental Sustainability* project.[3]

The survey was directed at experts who have been involved in coastal management from different perspectives and backgrounds and who are therefore likely to represent different ways of framing the issues dealt within the survey. All respondent do, however, have a solid background in what broadly can be identified as coastal and marine issues. The survey was not directed at lay persons.

The survey was conducted by means of an electronic web-based questionnaire. The questionnaire techniques used included traditional Likert-type statements and more novel two-dimensional graph where respondents were asked to indicate their view on different topics.[4] Two such graphs were presented, one asking the respondent to indicate the probability that significant ecological thresholds related to certain issue exists vis-à-vis the capacity of present management and governance structures to prevent trespassing of ecological issue in question. Another graph asked the respondent to indicate his/her view on the current level of public acceptance of measures needed to take appropriate action to avoid passing ecological threshold vis-à-vis the level of current scientific knowledge needed to take appropriate action to avoid passing ecological thresholds. The issues included seven topics: Pollution by hazardous substances; Exploitation of fish stocks; Eutrophication; Effects of climate change on ecosystem functions; Effects of alien species on ecosystems; Physical alteration of ecosystems through building or construction; and General ecological status of aquatic ecosystems.

The Likert-type statements included different statements and claims related to the ecological thresholds. The respondents were asked to indicate how far they agree or disagree with 34 statements. The statements were ordered under three broad topics, including: Nature of ecological thresholds; Knowledge and ecological thresholds; and Management strategies for ecological thresholds.

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1 Thresholds of Environmental Sustainability: http://www.thresholds-eu.org/. Integrated project under EU FP6. Project contract no. 003933. Priority 1.1.6 "Sustainable Development, Global Change and Ecosystems" Sub-Priority 1.1.6.3 "Global Change and Ecosystems".

2 Please see our webpage for updates: http://www.ymparisto.fi/default.asp?contentid=254324&lan=fi&clan=en

3 http://www.thresholds-eu.org/index.html. See also Lyytimäki & Hildén 2007.

4 The survey method is explained in Assmuth et al. 2007.

# Recipients and respondents

The database of recipients identified for this survey consisted of 1076 e-mail addresses. This figure excludes the e-mail accounts identified as non-functional during sending of invitation e-mails. It is likely that some additional answers came from persons outside the sample identified by the survey organizers, because recipients that informed us to be unwilling or unable to fill in the questionnaire were encouraged to forward the invitation to a potentially interested colleague. Some of the respondents also informed that they have passed the invitation to participate to other persons.

Additionally, the invitation to participate to the survey was sent to the PRD-email list coordinated by the Resilience Alliance.[5] This list consists of about 320 members.

During March 26th and May 9th 2008, 321 responses were received. One answer containing no data was removed and thus the number of responses was 320. The response rate was 28 % (estimated based on the number of individual invitations sent but excluding 18 answers that were received through the link given in the invitation to PRD-list). This percentage can be considered satisfactory for an electronic survey. It must be noted that this response rate is estimation, because the exact number of recipients is not known. However, all answers were received via the individually numbered links given in the invitation mails, implicating that all of the respondents had received the invitation mail.

Responses were obtained from 30 countries. About half of the responses came from Europe. One fifth (N=62) of the answers came from the United States. Almost 30 responses were from the United Kingdom and also from Spain. Less than ten responses per country were recorded from 20 countries. 14 respondents did not provide information about their place of residence.

A majority of the respondents were male (58 % of those respondents specifying gender). Most of the respondents were middle-aged. Only six percent of the respondents were 29 years or under and 11 % were 60 years or above. A majority of respondents had over 10-years of professional working experience in coastal issues and 77 % had over six years of experience. A majority (58 %) had at least a PhD degree. Over half of the respondents were affiliated with research institutes or universities/colleges. The respondents' roles in coastal management ranged widely from research to implementation of policies. Most of the respondents (57 %) described their role to be mainly related to environmental management and 12 % with fisheries.

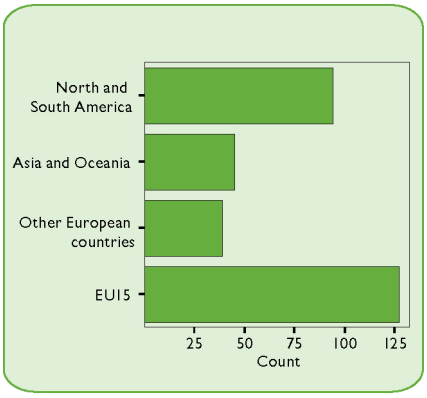


Figure 1. Origin of respondents (N=306; Answers with no data on this N=14).


Figure 2. Respondents role in coastal management (N=313; Answers with no data on this N=7).

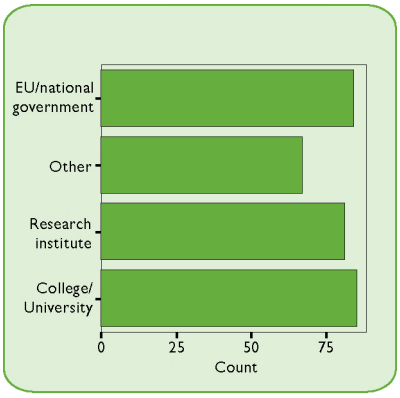


Figure 3. Organisation of the respondents (N=318; Answers with no data on this N=2)

[5] http://www.resalliance.org/2524.php

# Results

## The relevance of thresholds in coastal areas

Respondents were asked to indicate their views on a two-dimensional graph on the probability that significant ecological threshold related to certain issue exists vis-à-vis the capacity of present management and governance structures to prevent the breaching of the threshold. Overall the experts considered the probability of the existence of ecological thresholds to be greater than the capacity of current management and governance structures to prevent the potential passing of these thresholds (Figures 4 & 5).

Especially climate change was seen as an issue where the probability of the existence of thresholds was high compared to the society's management capacity. Physical alteration of coastal areas was the only exception where the capacity of present management and governance structures to prevent the crossing of thresholds was seen as slightly greater than the probability of thresholds effects.

The highest mean value given on the existence of thresholds was on the effects of the exploitation of fish stocks. On average, the respondents were rather pessimistic about the society's capacity to prevent crossing thresholds related to fishing, even though the variation of views was especially high on this issue. Overall, the variation was high on most issues and no easily observable differences were found between different groups of respondents.

## Dealing with thresholds: Knowledge and ecological thresholds

Respondents were asked to indicate their views on a two-dimensional graph on the current level of public acceptance of measures needed to take appropriate action to avoid passing ecological threshold vis-à-vis the level of current scientific knowledge needed to take appropriate action to avoid the passing of the threshold.

Based on the mean values calculated from the answers, the level of current scientific knowledge was considered to be lowest regarding thresholds related to climate change (see Figure 6). The perceived level of knowledge was low also regarding alien species and general state of aquatic environment.

The public acceptance of policy measures needed in order to avoid passing thresholds was considered to be greatest with the issues related to hazardous substances (Figure 7). This probably reflects the long history of public debates considering environmental pollutants, especially oil spills. Lowest acceptance was given to effects of alien species, perhaps reflecting the novelty of the issue. Especially respondents with expertise from fisheries considered that there is little public acceptance on measures aimed to prevent crossing the thresholds related the exploitation of fish stocks.

The indicative nature of these questions must be taken into account when interpreting the results. Many respondents commented that the two-dimensional graphs provided novel and interesting but challenging method to express their positions. Especially challenging was the statement considering the general status of aquatic ecosystem. However, despite the very general formulation of this statement, over 80 % of the respondents were able to provide an opinion.

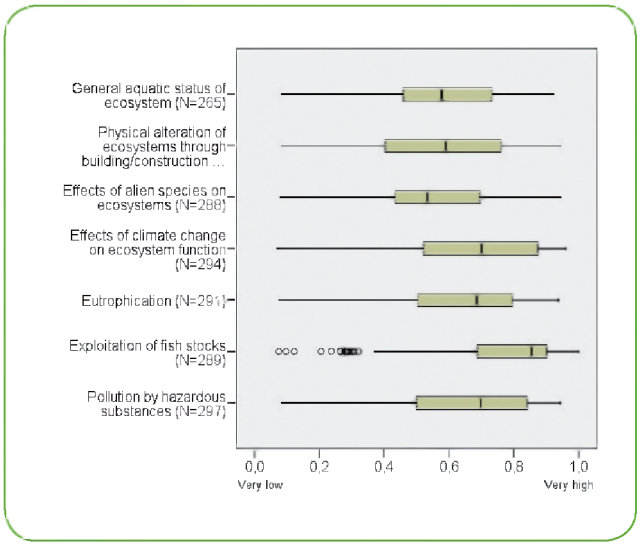


Figure 4. Views on the probability that significant ecological thresholds related to an issue exists. Boxplot indicates median, upper and lower quartiles and potential outliers.

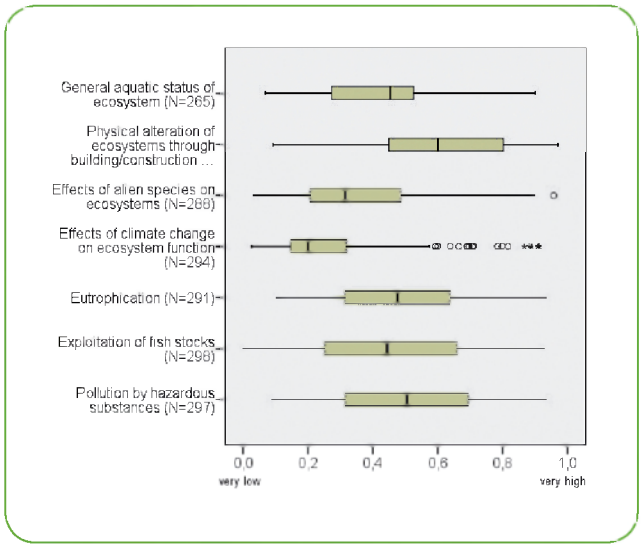


Figure 5. Views on the capacity of current management and governance structures to prevent the passing of an ecological threshold related to selected issues. Boxplot indicates median, upper and lower quartiles and potential outliers.

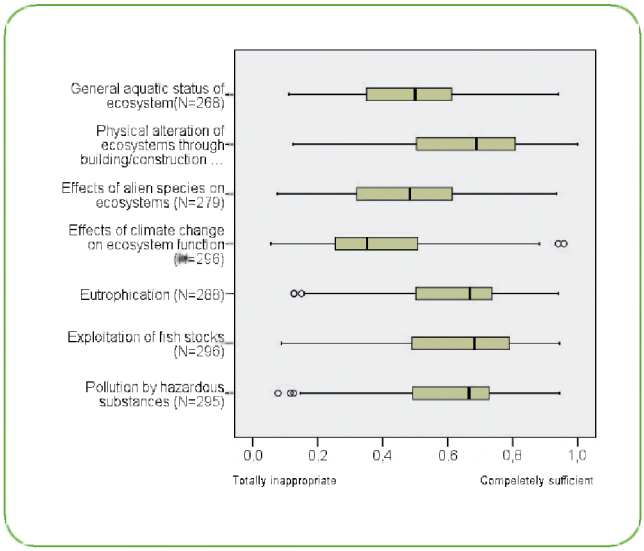


Figure 6. Views on the level of current scientific knowledge needed to take appropriate actions in order to avoid passing ecological thresholds related to selected issues. Boxplot indicates median value, upper and lower quartiles and potential outliers.

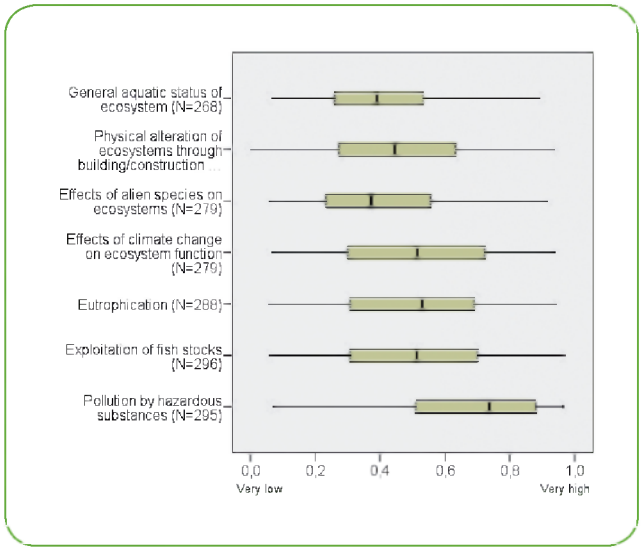


Figure 7. Views on the level of public acceptance of measures needed to take appropriate action to avoid passing ecological thresholds. Boxplot indicates median value, upper and lower quartiles and potential outliers.

## Characteristics of ecological thresholds

Majority of respondents were critical towards some often coined characterisations of ecological thresholds as being rapidly occurring, irreversible or nearly impossible to detect in advance (Figure 8). Less than a tenth of the respondents agreed strongly with the statement that the passing of an ecological threshold is always a sudden event. Another assumption that was generally rejected by the respondents was that breaching an ecological threshold always occurs without warning. Consistent with this, most respondents agreed that early warning systems can be developed for detecting thresholds (Figure 9).

Furthermore, over half of the respondents disagreed that passing a threshold is always an irreversible process. However, it might not be known how this recovery will happen, as indicated by the strong disagreement with the statement that ecosystem can return to its original state backtracking the original path of change.

The complicated nature of thresholds was clearly acknowledged, as most of the respondents agreed that passing of threshold for one variable always triggers many changes in ecosystems and that the relations between key variables change radically in thresholds situations. It was also agreed by most respondents that the range of variation changes for key variables after passing a threshold, even though several respondents chose to provide no opinion on this.

Half of the respondents agreed strongly or somewhat that passing an ecological threshold leads to sudden social and economic changes. The question about importance of indirect social and economic effects of passing a threshold compared to direct ones proved to be especially difficult to answer. The option "neutral" was selected by almost a third of the respondents and about one tenth choose to provide no opinion on this. A majority of those who expressed an opinion agreed partially or fully with the statement.

An overwhelming majority of respondents agreed that there are probably large differences between ecological thresholds of different areas. Only one percent of the respondents disagreed strongly with this. The importance of specific contexts was also emphasized in the comments that respondents were encouraged to provide at the end of the questionnaire.

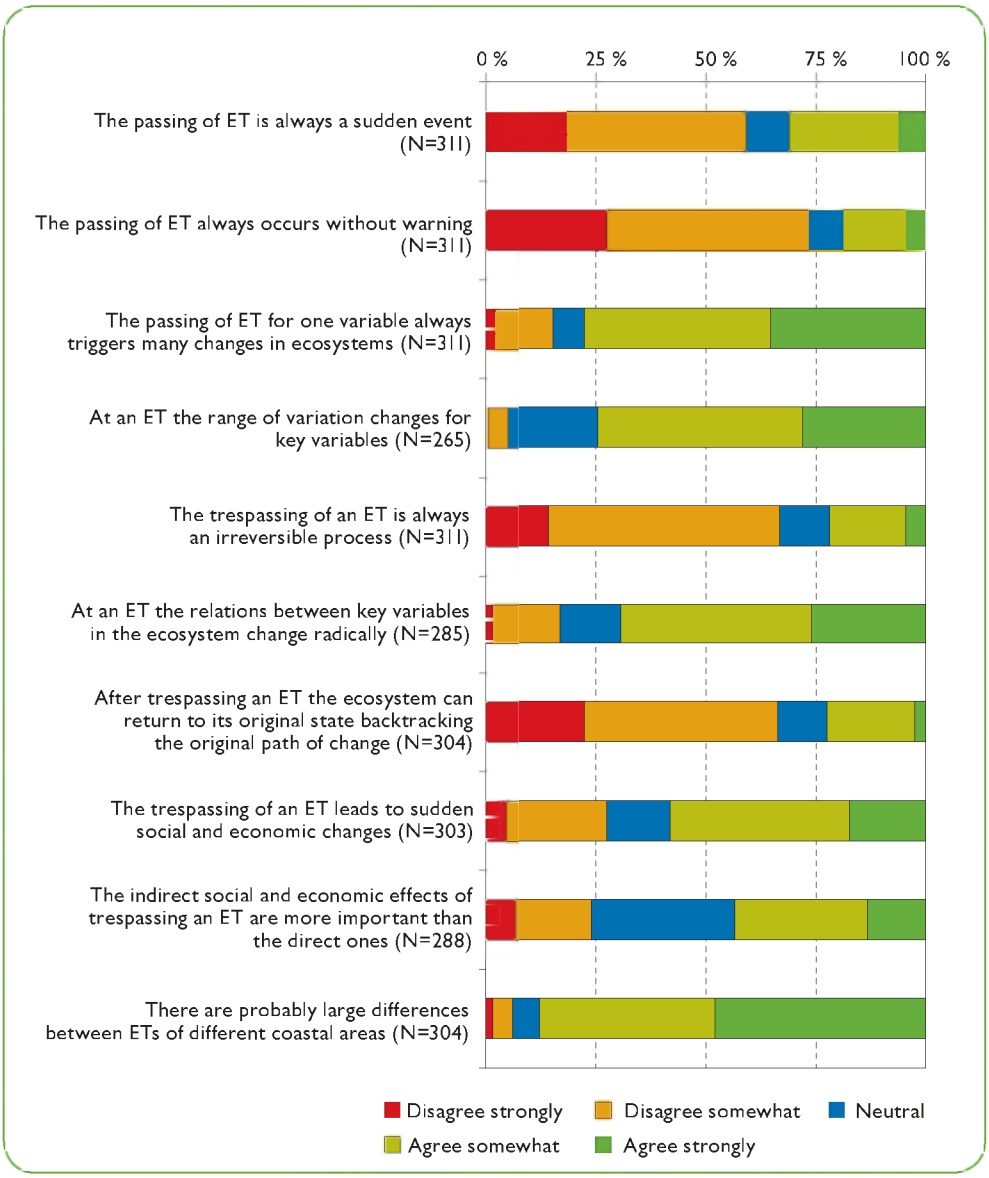


Figure 8. Views on selected claims considering the nature of ecological thresholds.

## State of the knowledge on ecological thresholds

Strongly divided views were expressed about the state of the scientific knowledge. Nearly half of the respondents agreed strongly or somewhat that researchers lack basic understanding of how coastal ecosystems change while almost the same share of the respondents think the opposite. Respondents affiliated with national governments seem to have high confidence on the adequacy of the knowledge. An overwhelming majority of the respondents agreed at least partially that there is a lack of monitoring that is frequent enough and a lack of long enough time series of key variables to detect ecological thresholds.

Most respondents agreed that researchers have presented convincing evidence about the existence of ecological thresholds in coastal areas. There are still many uncertainties and unresolved questions, since a majority also agreed that researchers should more critically assess claims related to thresholds.

The media is sometimes accused of exaggerating risk related to thresholds. Over ten percent of the respondents agreed strongly that this is indeed the case. However, some disagree strongly and many disagree somewhat. Most respondents believed in the power of detailed information and agreed that news media should provide more detailed information to the public. Also analogues seem to provide a promising tool to enhance the communication, since a majority of respondents agreed that characteristics of ecological thresholds can be easily illustrated with analogues to everyday phenomena.

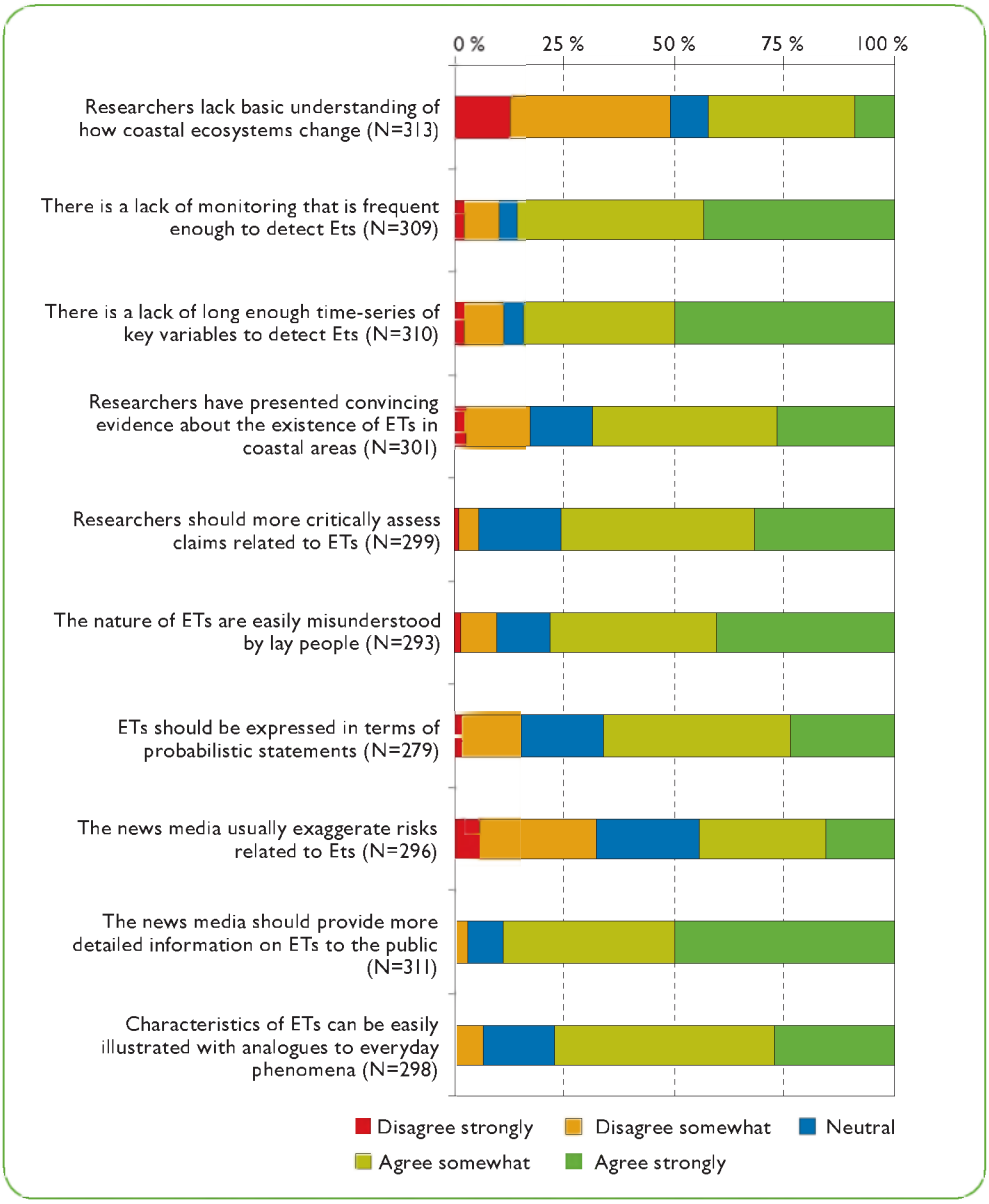


Figure 9. Views on selected claims considering the level and types of knowledge on ecological thresholds.

## Management options for ecological thresholds

From the management point of view it is interesting that almost all respondents agreed that a clear typology of ecological thresholds would be highly useful for coastal management (Figure 10). A majority of respondents also agreed that ecological thresholds should be clearly defined in environmental legislation. These observations illustrate some of the key difficulties for management: there is a strong demand to make the issues manageable and controllable by standardizing and introducing typologies that can be used in legislation, while there is at the same time a wide spread recognition of the context specificity of the problems. There are obvious dangers in fixing standards across systems and contexts. A majority of respondents have recognized this and think that adaptive management is the key to successfully deal with thresholds, but making the adaptive management operational is not easy, as illustrated by the strong views that present management is generally considered unable to deal with ecological thresholds (see Fig. 5). One way out of this dilemma is the precautionary principle and polluter pays principle, which most respondent consider important in management. However, both of these statements lead to new questions that are difficult in an adaptive context.

Questions asking the respondents' views on the willingness of different groups do not reveal any facts about the actual preferences of these groups (Figure 11). Instead, these responses tell about assumptions that experts hold towards other groups. It seems that experts have quite divided views about the willingness of politicians and users of natural resources to take into account the idea of ecological thresholds. Experts seem also to have little trust that lay people should take the idea of thresholds seriously before such thresholds are breached.

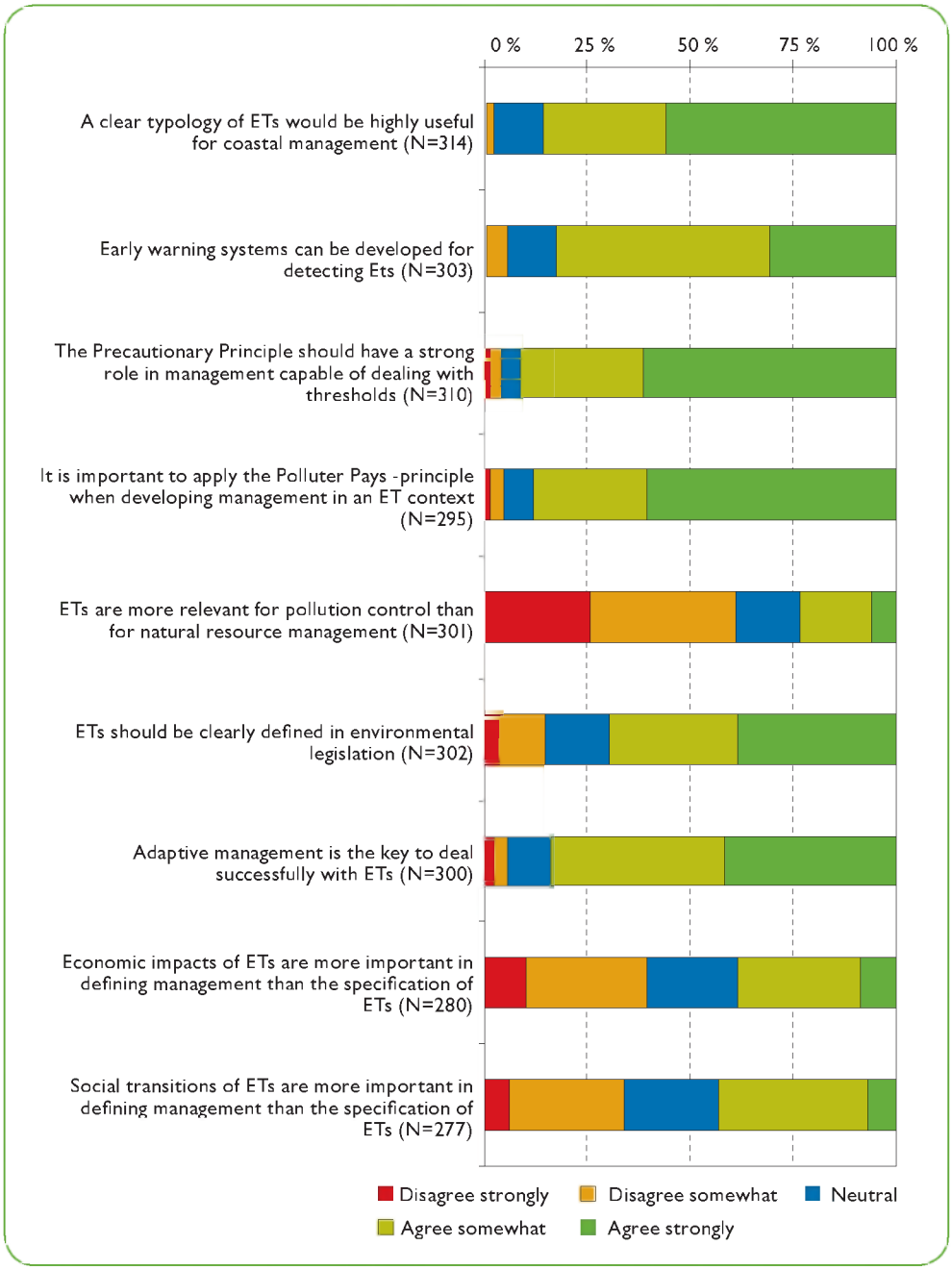


Figure 10. Views on selected claims considering the management strategies for ecological thresholds.


Figure 11. Views on selected claims considering other group's attitudes on ecological thresholds.

# Tentative conclusions

One characteristic feature of the responses to the survey is a significant variation. This is not surprising in itself as the survey reached a wide group of people with different backgrounds, positions and occupations. What is more interesting is that large variation can also be observed within fairly narrowly specified groups of experts. The results provide a reminder that the management of coastal areas is difficult because many fundamental concepts and issues are viewed and understood differently. The differences in the ways issues and problems are framed are likely to hamper management actions and create confusion, thus creating the conditions that most regard as unacceptable, i.e. the inability of societies to avoid the unwanted passing of ecological thresholds.

The differences in views cannot be eradicated by standardization or by decrees setting fixed limit values for emissions or for the state of the environment. One way to reduce their unwanted consequences is to increase transparency and participatory approaches that can bring out different interpretations and understandings thereby facilitating social learning. Such learning processes will not solve the problems once and for all, but have to be maintained continuously in order to adapt to changing conditions and shifting threshold levels.

Creating adaptive and transparent management approaches for dealing with thresholds in coastal areas is a major challenge due to the multitude of stakeholders and the complexity of the issues at hand.[6] This survey has illustrated a number of the general issues. For any specific area or problem one can design more specific surveys that can help in identifying some of the issues on which there are major divergences of views, and specific knowledge needs. A survey is, however, always limited in scope and cannot replace two way communication and actual participation that can advance the understanding of research results and their implications.

[6] See e.g. Groffman et al. 2006; Lindenmayer & Luck 2005; Scheffer et al. 2001.

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## DOCUMENTATION PAGE

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|---|---|---|---|---|
| *Publisher* | Finnish Environment Institute SYKE | | | *Date*<br>June 2008 |
| *Author(s)* | Jari Lyytimäki, Mikael Hildén, Zelealem Aberra and Matti Lindholm | | | |
| *Title of publication* | **The significance of ecological thresholds in coastal areas. Results of an international web survey** | | | |
| *Publication series and number* | Reports of Finnish Environment Institute | | | |
| *Theme of publication* | | | | |
| *Parts of publication/ other project publications* | The publication is available also on the internet: www.environment.fi/publications | | | |
| *Abstract* | This report presents results from a web-based survey on the perceived importance of ecological thresholds in coastal areas. The survey was a part of the EU-funded project Thresholds of Environmental Sustainability. The objective of the survey was to explore different framings and expert opinions considering ecological thresholds and to highlight issues that may be of particular importance in developing policy relevant knowledge, especially from the point of view of coastal management. The survey was distributed to over 1,000 researchers and stakeholders familiar with coastal management and/or ecological thresholds. It was conducted by means of an electronic web-based questionnaire. This report summarizes 320 responses received during spring 2008. The results reflect a wide array of expertise and experiences from 30 countries mainly from Europe and North America. The results show that experts think that current management structures are not capable of preventing the trespassing of many ecological thresholds. The results also show that even though the concept of ecological threshold can be useful for coastal management, it's use is complicated. Due to great variation of natural conditions and human pressures it is difficult to make widely applicable generalizations about the characteristics of ecological thresholds. The results also highlight that one of the difficulties in the management of coastal areas is the fact that many fundamental concepts and issues are viewed and understood differently. | | | |
| *Keywords* | Coastal areas, ecological thresholds, experts, survey | | | |
| *Financier/ commissioner* | Thresholds of Environmental Sustainability: http://www.thresholds-eu.org/. Integrated project under EU FP6. Project contract no. 003933. Priority 1.1.6 "Sustainable Development, Global Change and Ecosystems" Sub-Priority 1.1.6.3 "Global Change and Ecosystems". | | | |
| | ISBN<br>978-952-11-3165-3 (pbk.) | ISBN<br>978-952-11-3166-0 (PDF) | ISSN<br>ISSN 1796-1718 (print) | ISSN<br>ISSN 1796-1726 (online) |
| | *No. of pages*<br>21 | *Language*<br>English | *Restrictions*<br>Public | *Price (incl. tax 8 %)* |
| *For sale at/ distributor* | Finnish Environment Institute (SYKE), P.O.Box 140, FI-00251 Helsinki, Finland<br>Phone +358 20 490 123, Fax +358 20 490 2190<br>Email: neuvonta.syke@ymparisto.fi, www.environment.fi/syke | | | |
| *Financier of publication* | Finnish Environment Institute (SYKE), P.O.Box 140, FI-00251 Helsinki, Finland<br>Phone +358 20 490 123, Fax +358 20 490 2190<br>Email: neuvonta.syke@ymparisto.fi, www.environment.fi/syke | | | |
| *Printing place and year* | | | | |

## KUVAILULEHTI

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|---|---|---|---|---|
| *Julkaisija* | Suomen ympäristökeskus SYKE | | | *Julkaisuaika*<br>Kesäkuu 2008 |
| *Tekijä(t)* | Jari Lyytimäki, Mikael Hildén, Zelealem Aberra ja Matti Lindholm | | | |
| *Julkaisun nimi* | **The significance of ecological thresholds in coastal areas. Results of an international web survey**<br>(Ekologisten kynnysarvojen merkitys rannikkoalueilla. Kansainvälisen verkkokyselyn tuloksia) | | | |
| *Julkaisusarjan nimi ja numero* | Reports of Finnish Environment Institute | | | |
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| *Tiivistelmä* | Tässä raportissa esitellään tuloksia verkkokyselystä, jossa selvitettiin näkemyksiä rannikkoalueiden ekologisista kynnysarvoista. Kysely oli osa EU-rahoitteista hanketta Thresholds of Environmental Sustainability. Kyselyn tarkoituksena oli tarkastella asiantuntijoiden hahmottamia erilaisia rajauksia ja näkemyksiä ekologisista kynnysarvoista sekä tuoda esiin aihepiirejä, jotka voivat olla erityisen tärkeitä kehitettäessä ympäristöpolitiikan kannalta käyttökelpoista tietoa erityisesti rannikkoalueiden käyttöön liittyen. Kysely lähetettiin yli tuhannelle tutkijalle ja muulle rannikkoalueiden käytön ja/tai ekologisten kynnysarvojen asiantuntijalle ja siinä käytettiin internetpohjaista sähköistä kyselylomaketta. Tämä raportti vetää yhteen 320 vastausta, jotka saatiin kevään 2008 aikana. Vastaukset ilmentävät laajaa asiantuntijuuden ja kokemusten kirjoa 30:stä maasta, erityisesti Euroopasta ja Pohjois-Amerikasta. Asiantuntijat ovat tulosten perusteella sitä mieltä, että nykyiset ympäristöpolitiikan rakenteet eivät ole riittäviä estämään monien ekologisten kynnysarvojen ylittymistä. Ekologisen kynnysarvon käsite voi olla käyttökelpoinen rannikkoalueiden hoidossa, mutta käsitteen hyödyntäminen on monimutkaista. Luonnonolojen ja ympäristökuormituksen suuren vaihtelun takia on vaikeaa löytää yleistettävissä olevia ekologisten kynnysarvojen ominaispiirteitä. Tulokset toimivat myös muistutuksena siitä, että rannikkoalueiden hoito on vaikeaa, koska näkemykset monista perustavan laatuisista käsitteistä vaihtelevat ja koska eri aihepiirejä tarkastellaan ja ymmärretään eri tavoin. | | | |
| *Asiasanat* | Asiantuntijat, ekologiset kynnysarvot, kysely, rannikkoalueet | | | |
| *Rahoittaja/ toimeksiantaja* | Thresholds of Environmental Sustainability: http://www.thresholds-eu.org/. Integrated project under EU FP6. Project contract no. 003933. Priority 1.1.6 "Sustainable Development, Global Change and Ecosystems" Sub-Priority 1.1.6.3 "Global Change and Ecosystems". | | | |
| | ISBN<br>978-952-11-3165-3 (nid.) | ISBN<br>978-952-11-3166-0 (PDF) | ISSN<br>1796-1718 (pain.) | ISSN<br>1796-1726 (verkkoj.) |
| | *Sivuja*<br>21 | *Kieli*<br>Englanti | *Luottamuksellisuus*<br>Julkinen | *Hinta (sis.alv 8 %)* |
| *Julkaisun myynti/ jakaja* | Suomen ympäristökeskus (SYKE), asiakaspalvelu, PL 140, 00251 Helsinki<br>Puh. 020 690 183, faksi 020 490 2190<br>Sähköposti: neuvonta.syke@ymparisto.fi | | | |
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## PRESENTATIONSBLAD

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<tr><td>Publikationens titel</td><td colspan="3">The significance of ecological thresholds in coastal areas. Results of an international web survey<br>(Ekologiska tröskelvärdens betydelse i kustområden. Resultat från en internationell web-enkät.)</td></tr>
<tr><td>Publikationsserie och nummer</td><td colspan="3">Reports of Finnish Environment Institute</td></tr>
<tr><td>Publikationens tema</td><td colspan="3"></td></tr>
<tr><td>Publikationens delar/ andra publikationer inom samma projekt</td><td colspan="3">Publikationen finns tillgänglig också på internet: www.environment.fi/publications</td></tr>
<tr><td>Sammandrag</td><td colspan="3">Rapporten presenterar resultat från en web-baserad enkät om hur ekologiska tröskelvärden uppfattas bland experter på skötseln av kustområden. Enkäten förverkligades som en del av det EU-finansierade projektet Thresholds of Sustainability. Enkätens målsättning var att undersöka hur experter uppfattar ekologiska tröskelvärden i olika sammanhang och identifiera frågeställningar som kan vara särskilt viktiga så man strävar till att utveckla information för miljö- och resurspolitik, speciellt då det gäller förvaltning av kustområder. Enkäten sändes ut till över tusen forskare och experter på ekologisk tröskevärden och/eller kustområden. Enkäten byggde på ett elektronisk Internet-baserat frågeformulär. Rapporten summerar de 320 svar som enkäten gav under våren 2008. Experter med olika bakgrund från 30 olika länder, främst Europa och Nordamerika svarade på enkäten. Enkäten visade att experter betvivlar att de nuvarande förvaltningssystemen kan hindra att ekologiska tröskelvärden överskrids. Resultaten visar också att även om tröskelvärden kan vara ett användbart begrepp i kustförvaltning så är användningen komplicerad. Den stora variation i naturförhållanden och i mänsklig belastning gör det svårt att generalisera vad ekologiska tröskelvärden innebär. Resultaten visar också att en av svårigheterna i kustförvaltning ligger i att många centrala begrepp och frågeställningar uppfattas och tolkas olika.</td></tr>
<tr><td>Nyckelord</td><td colspan="3">Enkät, experter, ekologiska tröskelvärden, kustområden</td></tr>
<tr><td>Finansiär/ uppdragsgivare</td><td colspan="3">Thresholds of Environmental Sustainability: http://www.thresholds-eu.org/. Integrated project under EU FP6. Project contract no. 003933. Priority 1.1.6 ”Sustainable Development, Global Change and Ecosystems” Sub-Priority 1.1.6.3 “Global Change and Ecosystems”.</td></tr>
<tr><td rowspan="2"></td><td>ISBN<br>978-952-11-3165-3 (hft.)</td><td>ISBN<br>978-952-11-3166-0 (PDF)</td><td>ISSN<br>1796-1718 (print)</td><td>ISSN<br>1796-1726 (online)</td></tr>
<tr><td>Sidantal<br>21</td><td>Språk<br>Engelska</td><td>Offentlighet<br>Offentlig</td><td>Pris (inneh. moms 8 %)</td></tr>
<tr><td>Beställningar/ distribution</td><td colspan="3">Finlands miljöcentral (SYKE), kundservice, PB 140, 00251 Helsingfors<br>Tel. +358 20 690 183, Fax +358 20 490 2190<br>Epost: neuvonta@ymparisto.fi</td></tr>
<tr><td>Förläggare</td><td colspan="3">Finlands miljöcentral (SYKE), PB 140, 00251 Helsingfors<br>Tel. +358 20 490 123<br>Epost: neuvonta@ymparisto.fi, www.miljo.fi/syke</td></tr>
<tr><td>Tryckeri/tryckningsort och -år</td><td colspan="3"></td></tr>
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