# The Application of the Swedish Environmental Code's Regulations on Ecological Compensation in Sweden

*Tillämpningen av miljöbalkens bestämmelser om ekologisk kompensation i Sverige*

Lotta Sjöholm

Master's thesis in Environmental science • 30 credits
Swedish University of Agricultural Sciences, SLU
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# Abstract

Biodiversity loss is one of the greatest environmental challenges met on a global scale today. One approach developed to halt biodiversity loss is ecological compensation (EC), which means that damage to the natural environment caused by exploitation is compensated by the one who caused the damage. In 2015, the Swedish Environmental Protection Agency (Swedish EPA) published a report on EC, in which it was concluded that the application of EC varies between different case files and in different parts of Sweden. The following year the Swedish EPA published a handbook on EC to help increase the use of EC in Sweden and to provide a more uniform use of the regulations on EC in the Environmental Code.

The aim of this thesis is to: (1) Map the use of EC and the application of the regulations on EC in the Environmental Code in permits and exemptions regarding Species Protection, Protected Areas, and Habitat Protection Areas during the period 2015–2018, to (i) identify the extent to which EC is used, and (ii) examine if and how the application differs in different parts of Sweden (2) Identify differences in the application between the periods 2011–2014 and 2015–2018 (3) Discuss if the goals of the Swedish EPA's handbook on EC have been achieved.

This has been investigated by mapping more than 7,000 decisions from the period 2015–2018 and comparing the data with the mapping from 2015 (the period 2011–2014). Linear regression analysis has been used to analyse the proportion of approvals with demand on EC and the proportion of demands with reference to the regulations on EC in the Swedish Environmental Code during each period. In addition, Wilcoxon rank sum test has been performed for comparison between the forms of protection and the two periods. The results have been discussed from a policy implementation and policy evaluation perspective.

The conclusions from this thesis are: EC is only used to a limited extent and differs between different case files, regarding: to what extent EC is demanded, to what extent the Swedish Environmental Code is referred to, and to which section in the Swedish Environmental Code there is a reference. County Administrative Boards might demand EC to different extent. There are no differences between the two mappings (2011–2014 and 2015–2018) regarding to what extent EC is demanded. However, there are some uncertainties due to differences in the methods of the two mappings. Finally, the handbook on EC does not seem to have had the desired effect on the use of EC.



*Keywords*: Ecological compensation, Swedish Environmental Code, policy evaluation, policy implementation, permits, exemptions.

## Sammanfattning

Minskande biologisk mångfald är ett av dagens största globala miljöproblem. Ett av de verktyg som har tagits fram för att stoppa minskningen av biologisk mångfald är ekologisk kompensation (EK), som innebär att skada på naturmiljön som orsakas av exploatering kompenseras av den som orsakade skadan. År 2015 gav Naturvårdsverket ut en rapport om EK, där det konstaterades att tillämpningen av ekologisk kompensation varierar mellan olika ärenden och i olika delar av Sverige. Året därpå publicerade Naturvårdsverket en handbok om EK för att bidra till ökad användning av EK i Sverige samt för att ge en mer enhetlig tillämpning av miljöbalkens kompensationsbestämmelser.

Syftet med denna mastersuppsats är att: (1) Kartlägga användandet av EK och tillämpningen av miljöbalkens kompensationsbestämmelser i tillstånds- och dispensbeslut gällande artskydd, skyddade områden och biotopskyddsområden under perioden 2015–2018, för att: (i) identifiera i vilken utsträckning som EK används och (ii) undersöka om och hur användandet skiljer sig i olika delar av Sverige (2) Identifiera skillnader i tillämpningen mellan perioderna 2011–2014 och 2015–2018 (3) Diskutera om målen med Naturvårdsverkets handbok om EK har uppnåtts.

Detta har undersökts genom att kartlägga över 7 000 beslut från perioden 2015–2018 och jämföra dessa med kartläggningen från 2015 (perioden 2011–2014). Linjär regressionsanalys har använts för att analysera andelen bifall med krav på EK och andelen krav på EK med hänvisning till miljöbalkens kompensationsbestämmelser under varje period. Wilcoxon rank sum test har också utförts för att jämföra skyddsformerna och de två perioderna. Resultaten har diskuterats ur ett policy-implementerings- och policyutvärderingsperspektiv.

Slutsatserna från detta arbete är: EK används endast i begränsad omfattning och skiljer sig mellan olika samlingsärenden, vad gäller: i vilken omfattning som krav på EK ställs, i vilken omfattning som hänvisning till miljöbalken sker och till vilken paragraf i miljöbalken som hänvisningen sker. Länsstyrelserna verkar ställa krav på EK i olika omfattning. Det förekommer inga skillnader mellan de två kartläggningarna (2011–2014 och 2015–2018) gällande i vilken omfattning som krav på EK ställs. Det förekommer dock vissa osäkerheter på grund av skillnader i metoderna för de två kartläggningarna. Slutligen verkar Naturvårdsverkets handbok om EK inte ha haft den önskade effekten på användandet av EK.



*Nyckelord:* ekologisk kompensation, miljöbalken, policyutvärdering, policyimplementering, tillståndsbeslut, dispensbeslut.

# Preface

This master thesis within Environmental Science was written by Lotta Sjöholm at the Institution of Ecology, Swedish University of Agricultural Sciences (SLU, *Sveriges lantbruksuniversitet*), during the spring of 2019. Lina Widenfalk was the supervisor and Erik Öckinger the examiner at SLU.

The work was done in collaboration with the Swedish Environmental Protection Agency (*Naturvårdsverket*), where Jörgen Sundin and Hasse Berglund were the supervisors.

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# Abbreviations

| | |
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| BBOP | Business and Biodiversity Offsets Programme |
| CAB | County Administrative Board |
| EC | Ecological Compensation |
| EU | European Union |
| Swedish EPA | Swedish Environmental Protection Agency |

# Glossary

| | |
|---|---|
| Act (handling) | A piece of information handled by an authority, for example letters, e-mails, decisions, protocols, pictures, audio, and film recordings. |
| Approval (*bifall*) | When the application is approved by the reviewing authority, which means that the applicant may act accordingly. |
| Biodiversity offset | A term which is often used internationally. Although the term is commonly used interchangeably with ecological compensation, there are some differences between the two concepts. |
| Case file (*ärende*) | Collection of one or more acts, which form the basis for decisions or other measures. |
| Case file number (*ärende-nummer*) | Id-number of a specific case file. |
| County (*län*) | A division of Sweden into 21 counties. |
| County Administrative Board (*länsstyrelse*) | A regional governmental authority in charge of the governmental management in the county. |
| Decision (*beslut*) | A legal document of a decision made by an authority. In this case, a permit, or an exemption. |
| Dismissal (*avskrivning*) | When the application is dismissed by the reviewing authority because it does not contain enough information. |
| Ecological compensation (*ekologisk kompensation*) | Damage to the natural environment caused by exploitation is compensated by the one who caused the damage. |
| Modena | The Swedish EPA's case file management system (*ärendehanteringssystem*). |
| Municipality (*kommun*) | A division of Sweden into 290 local regions. |

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| Partial approval/rejection (*delvis bifall/avslag*) | When parts of the application are approved, and other parts are rejected by the reviewing authority. |
| Refusal (avvisning) | When the application is refused by the reviewing authority because no application is needed. In this case, no permit or exemption is needed. |
| Rejection (*avslag*) | When the application is rejected by the reviewing authority, which means that the applicant may not act accordingly. |
| The mitigation hierarchy (*skadelindringshierarkin*) | Describes the steps to be taken to minimize harm to environmental values caused by exploitation: 1) avoidance, 2) minimisation, 3) restoration, and 4) ecological compensation (biodiversity offset). |
| Swedish Species Observation System (*Artportalen*) | A website and tool for observations of plants, animals, and fungi in Sweden. |
| Swedish Species Protection Ordinance (*Artskydds-förordningen (2007:845)*) | Swedish legislation on protection of species. |
| The Swedish Environmental Code (*Miljöbalken (1998:808)*) | The central environmental legislation in Sweden. |
| The Swedish Environmental Protection Agency (*Naturvårdsverket*) | The national governmental agency for environmental issues in Sweden. |
| The Swedish Forest Agency (*Skogsstyrelsen*) | The governmental agency for forest-related issues in Sweden. |

# 1. Introduction

Biodiversity loss is one of the greatest environmental challenges met on a global scale today. During the past 50 years, changes in biodiversity have been faster than ever before in human history and biodiversity loss is predicted to continue, or even accelerate in the future (MEA, 2005). To halt biodiversity loss, different approaches have been developed. One such approach is ecological compensation (EC, *ekologisk kompensation*), which means that damage to the natural environment caused by exploitation is compensated by the one who caused the damage (Naturvårdsverket, 2016a).

The interest in EC has increased during the last years. In 2013, around 40 countries had laws or policies that regulated some form of compensation (OECD, 2013), a number which had increased to 69 countries in 2016 (Maron *et al.*, 2016). In Sweden, EC can be demanded based on several regulations in the Swedish Environmental Code (*Miljöbalken (1998:808)*). Among others, Chapter 7, section 7 and 29 contain compulsory demands on EC in nature reserves and Natura 2000-areas, and Chapter 16, section 9 contains a general regulation for demanding EC in cases of permits and exemptions. Ever since 1964, there has been provisions similar to today's regulations on EC. Still, EC has only been demanded to a limited extent during this period (Naturvårdsverket, 2016a).

In 2015, the Swedish Environmental Protection Agency (Swedish EPA, *Naturvårdsverket*) published a report on how the regulations on EC in the Environmental Code was applied during the period 2011–2014. It concluded that "the application of ecological compensation varies strongly between different case files and in different parts of Sweden" (translated from Kolb, 2015, p. 5). The following year the Swedish EPA published a handbook with the goal to help increase the use of EC in Sweden and to provide a more uniform use of the regulations on EC in the Environmental Code (Naturvårdsverket, 2016a).

Research on EC in Sweden is still sparse and few studies that evaluate EC from a policy perspective has been found, namely Rundcrantz (2006), Persson *et al.* (2015), and Koh *et al.* (2017). This indicates that there is a gap between implemented policies on EC and knowledge about their effects on the use of EC in Sweden. Thus, it seems highly relevant to evaluate if the application of the regulations on EC in the Environmental Code has changed since the publication of

the Swedish EPA's handbook, as well as if the goals of the handbook have been achieved.

## 1.1. Aim

The aim of this thesis is to:

1. Map the use of EC and the application of the regulations on EC in the Environmental Code in permits and exemptions regarding Species Protection (*artskydd*), Protected Areas (*skyddade områden*), and Habitat Protection Areas (*biotopskyddsområden*) during the period 2015–2018, to
    a. identify the extent to which EC is used, and
    b. examine if and how the application differs in different parts of Sweden.
2. Identify differences in the application between the periods 2011–2014 and 2015–2018.
3. Discuss if the goals of the Swedish EPA's handbook on EC have been achieved.

## 1.2. Hypotheses and research questions

Because the focus on EC from the authorities has increased, I expect that demands on EC have increased as well. Thus, I hypothesize that (1) the proportion of decisions with demand on EC has **increased** during the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively. For the same reason, I also hypothesize that (2) the proportion of decisions with demand on EC has **increased** for the period 2015–2018 compared to 2011–2014.

I also expect that EC is demanded more often in decisions based on Chapter 7, section 7 and 29 in the Environmental Code than decisions based on Chapter 16, section 9, since the two first regulations have a compulsory demand on EC. Thus, I hypothesize that (3) the proportion of decisions with demand on EC **differ** between cases of Species Protection, Protected Areas and Habitat Protection Areas, with the **largest** proportion in Protected Areas since these are based on Chapter 7.

Because the Swedish EPA published a handbook on EC, focusing on the application of the regulations on EC in Environmental Code, I expect that the reviewing authorities refer to the regulations more often after that. Thus, I hypothesize that (4) the proportion of decisions where the reviewing authority has referred to the legislations on EC in the Environmental Code has **increased** during

the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively.

I also wanted to investigate if the use of EC varies between different authorities, since that was one of the conclusions in the previous mapping (Kolb, 2015). However, due to limitations in time, I could only investigate this for some of the data. I chose to compare the application between County Administrative Boards (CABs, *länsstyrelser*) in decisions regarding Habitat Protection Areas during 2018. I will therefore try to answer the questions: Does the proportion of decisions regarding Habitat Protection Areas, where EC is demanded during 2018, differ between different CABs? If so, how? And what can be the explanation for this?

I also wanted to investigate if the goals of the Swedish EPA's handbook ("to help increase the use of EC in Sweden" and "to provide a more uniform use of the regulations on EC in the Environmental Code") have been achieved since the publication of the handbook in 2016. I chose to focus on the first goal of the handbook, since there were no previously collected data to evaluate the second goal. I will therefore try to answer the question: Has the goal "to help increase the use of EC in Sweden" of the Swedish EPA's handbook on EC been achieved?

## 1.3. Delimitations

This thesis is delimited to the use of EC in Sweden, and the application of the regulations on EC in the Environmental Code in permits and exemptions. Documents from other parts of the permit and exemption process, such as applications or appeals, are not included.

The mapping is limited to decisions regarding Species Protection, Protected Areas, and Habitat Protection Areas since these are some of the most common cases where EC can be demanded according to the Environmental Code. Only decisions from the period 2015–2018, which are available in the Swedish EPA's case management system, are included.

It will only be discussed whether the goals of the Swedish EPA's handbook on EC have been achieved. The content of the handbook will not be evaluated.

To limit the number of scientific theories applied to the discussion, only theories on policy implementation and policy evaluation will be used in this thesis.

# 2. Background

## 2.1. Ecological compensation

EC is an approach that has been developed to halt biodiversity loss (Naturvårdsverket, 2016a). Internationally, the term biodiversity offset is often used (BBOP, 2009), and even though the definition of the two terms are slightly different they are often used interchangeable (Koh *et al.*, 2019). In this thesis the term EC will be used, as this is the term used by the Swedish EPA (Naturvårdsverket, 2016a). In an Official Report of the Swedish Government, EC is defined as:

> Compensation for damage to the natural environment that constitutes public interests, such as species, habitats, ecosystem functions and experience values. The compensation should be done by the one who caused the damage, and it can be made either by adding new values or by securing existing values that would otherwise risk being lost (translated from Utredningen om ekologisk kompensation, 2017, p. 26).

EC is the last step in the *mitigation hierarchy*, which was developed by the Business and Biodiversity Offsets Programme (BBOP) to describe the steps to be taken to minimize harm to environmental values caused by exploitation. These include: 1) avoidance, 2) minimisation, 3) restoration, and 4) ecological compensation (biodiversity offset). This means that damage to the environment should first and foremost be avoided. Any damage that cannot be avoided, should be minimized, and damage that cannot be avoided or minimized should be restored. Finally, any damage that has occurred despite the previous three steps being taken should be compensated for (BBOP, 2012).

The goal of EC is to achieve no net loss of biodiversity, or even a net gain (BBOP, 2009). The Swedish EPA identifies four different types of compensation measures, including creation of new values, restoration and protection of existing values, and nature conservation. Which measure is most appropriate, depends on each case and should be assessed accordingly (Naturvårdsverket, 2016a).

The Swedish EPA's report on EC from 2015 aimed "to map in what extent and in which types of case files ecological compensation is used in Sweden today" and "to find examples of the application of ecological compensation that can be brought

forward as good examples" (translated from Kolb, 2015, p. 6). The mapping showed that out of the 10,000 decisions that were examined, only 1,137 had demands on EC. It was also found that the demand on EC varied between different case files. For example, large differences were seen between cases regarding Species Protection, Protected Areas and Habitat Protection Areas, where the proportion of approvals with demand on EC varied between 1–2% for Protected Areas, 4% for Species Protection and 82% for Habitat Protection Areas. The report also concluded that the application of EC varied between different parts of Sweden (Kolb, 2015). However, no further details were given on this matter.

Research on the implementation of EC in Sweden is very limited. In 2006, Rundcrantz showed that compensation was only used to a limited extent in several Swedish road projects. The first national inventory of the use of compensation in Sweden was conducted by Persson *et al.* (2015). They showed that CABs rarely demanded EC in road and railway projects from 1999–2012, even though legal support existed. They concluded that "the use of environmental compensation is neither well developed nor widespread" (p. 124) and identified a need for further policy development to increase the use of EC, both by stricter policy requirements and by creating incentives for voluntary compensation (Persson *et al.*, 2015). In 2017, Koh *et al.* concluded that EC cannot be the main approach to protect biodiversity. Instead, it should be a complement to other legal frameworks.

## 2.2. Policy and the policy cycle

The term *policy* can be defined as "a set of interrelated decisions […] concerning the selection of goals and the means of achieving them within a specified situation" (see Hill, 2005; Jenkins, 1978, p. 15). When on a governmental level, these are called *public policies* (Hill, 2005), which are developed by governmental bodies and officials (Anderson, 2010).

The process in which public policies are made is referred to as the policy process, which is often called the *policy cycle*, or *stages model* (Hill, 2005). According to Anderson (2010), the policy cycle includes five stages (*Figure 1*). In the first stage a public problem is identified and gains the attention of public officials. Then, alternatives on how to resolve the problem are proposed. In the third stage, one of these alternatives is chosen, and then the policy is carried out, i.e. implemented. In the fifth and final stage, the effect of the policy is evaluated. The focus of this thesis will be on the implementation and evaluation stages of the policy cycle.

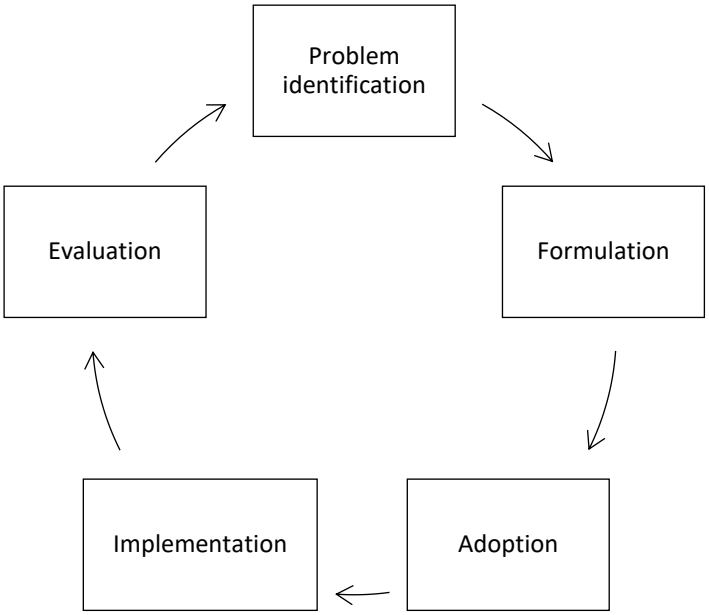


*Figure 1. The policy cycle, including 1) problem identification, 2) formulation, 3) adoption, 4) implementation, and 5) evaluation. Adopted from Anderson (2010).*

## 2.3. Forms of protection

In this section, the three forms of protection included in the thesis are described: Protected Areas, Habitat Protection Areas, and Species Protection.

### 2.3.1. Protected Areas

The concept of Protected Areas is used to refer to the following forms of protection in Swedish EPA's case management system Modena: national parks, nature reserves, nature conservation areas, culture reserves, natural monuments, and Natura 2000-areas.

- National park (*nationalpark*) is the strongest form of protection in Sweden (Naturvårdsverket, 2019c) and aims to preserve a large area of a certain landscape type.[1] As of today, there are 30 national parks in Sweden (Naturvårdsverket, 2019c).
- Nature reserve (*naturreservat*) is one of the most common forms of nature protection in Sweden with almost 5,000 reserves (Naturvårdsverket, 2019b). Nature reserves are formed to preserve biodiversity, to protect and preserve valuable natural environments, for recreational purposes, or to protect, restore or establish valuable natural environments or habitats for certain species.[2] Each nature reserve has its own regulations and therefore different rules apply for what is allowed within the reserve (Naturvårdsverket, 2019b).
- Nature conservation area (*naturvårdsområde*) is an older form of protection, which could be formed according to the Nature Protection Act (*Naturvårdslag (1964:822)*) until the introduction of the Environmental Code in 1999. When the Environmental Code is applied today, these areas are legally considered equal to nature reserves. There are 93 nature conservation areas in Sweden today (Naturvårdsverket, 2018a).
- Natural monuments (*naturminnen*) are certain natural objects, that needs special protection or care.[3] Common natural monuments include old trees and stone formations, such as potholes, and today more than 1,500 objects are protected in this way in Sweden (Naturvårdsverket, 2018b).
- Culture reserves (*kulturreservat*) are valuable cultural landscapes.[4] Examples of this is farmsteads and ancient monuments

[1] 7 kap. 2 § Miljöbalk (1998:808)
[2] 7 kap. 4 § Miljöbalk (1998:808)
[3] 7 kap. 10 § Miljöbalk (1998:808)
[4] 7 kap. 9 § Miljöbalk (1998:808)

(Riksantikvarieämbetet, 2017a). Currently, there are 44 culture reserves in Sweden (Riksantikvarieämbetet, 2017b).

- Natura 2000-areas (*Natura 2000-områden*) are areas with species or habitats, which are of special interest for the preservation of biodiversity within the European Union (EU). The areas are included in the EU network Natura 2000, and are appointed based on the Habitats Directive[5] and the Birds Directive[6] (European Commission, 2019). Today there are approximately 4,500 Natura 2000-areas in Sweden (Naturvårdsverket, 2018a).

### 2.3.2. Habitat Protection Areas

Small land and water areas that contain habitats for endangered animals and plants can be protected as habitat protection areas. These include two categories, a general protection of certain types of habitats, which are protected in the entire country, and protection of habitats in specific areas.[7] The first category includes 7 types of habitats: tree avenue, spring with surrounding wetland in agricultural land, cairn in agricultural land, willow avenue, small water and wetland in agricultural land, stone wall in agricultural land, and non-arable outcrop.[8] The second category includes 35 types of habitats[9] in forests and agricultural land (Naturvårdsverket, 2018a).

As of today, there are over 7,000 habitat protection areas in forests (Naturvårdsverket, 2018a), which can be designated by the Swedish Forest Agency (*Skogsstyrelsen*)[10] or a municipality.[11] Examples of this are forests that has been exposed to fire and alder swamps.[12] There are approximately 100 habitat protection areas in agricultural land (Naturvårdsverket, 2018a), which can be formed by a CAB,[13] or a municipality.[14] Examples of this are meadows and natural streams.[15]

[5] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

[6] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds

[7] 7 kap. 11 § Miljöbalk (1998:808)

[8] 5 § Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m. och bilaga 1 till förordningen

[9] Bilaga 2 och 3 till Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[10] 6 § Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[11] 7 a § Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[12] Bilaga 2 till Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[13] 7 § Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[14] 7 a § Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

[15] Bilaga 3 till Förordning (1998:1252) om områdesskydd enligt miljöbalken m.m.

### 2.3.3. Species Protection

Approximately 585 plant and animal species are protected in Sweden, because they are endangered or at risk of being plundered (Naturvårdsverket, 2019a). All protected species are listed in the Swedish Species Protection Ordinance (*Artskyddsförordningen (2007:845)*), which also states where they are protected.[16] Included are for example all orchids, amphibians, reptiles, bats and wild birds (Naturvårdsverket, 2019a). Different rules apply for different protected species. For example, it is not allowed to catch, kill or disturb animals, nor to collect or destroy eggs, nor to damage or destroy areas used for reproduction or resting.[17] Usually, it is not allowed to pick, dig, remove or harm protected plants.[18]

## 2.4. Regulations on EC in the Environmental Code

Regulations for EC are found in the Environmental Code, which is the central environmental legislation in Sweden and the main Swedish policy on EC. EC can be demanded based on several regulations in the Environmental Code. The regulations relevant to this thesis are: Chapter 7, section 7 and 29, and Chapter 16, section 9 (*Table 1*).

*Table 1. Summary of the three regulations on EC in the Environmental Code relevant to this thesis.*

| Regulation | Application areas | Legal strength |
|---|---|---|
| Chapter 7, section 7 | Decisions regarding Protected Areas (nature reserves, culture reserves, natural monuments, and nature conversation areas). | Compulsory |
| Chapter 7, section 29 | Decisions regarding Protected Areas (Natura 2000 areas). | Compulsory |
| Chapter 16, section 9 | Decisions regarding Species Protection, Protected Areas (nature reserves, culture reserves, natural monuments, nature conservation areas, and Natura 2000 areas), and Habitat Protection Areas. | Voluntary |

Chapter 7, section 7, paragraph 4 in the Environmental Code entail a compulsory requirement for EC in cases of withdrawal of protection or exemptions from regulations in nature reserves (Miljösamverkan Sverige, 2019). The regulation can

[16] Artskyddsförordning (2007:845)
[17] 4 § Artskyddsförordning (2007:845)
[18] 8–9 §§ Artskyddsförordning (2007:845)

also be applied to cultural reserves [19], natural monuments [20], and nature conservation areas[21]. This regulation is stronger than that of Chapter 16, section 9, but is only applicable when there is an encroachment on natural assets.[22]

Chapter 7, section 29, paragraph 1 part 3 in the Environmental Code entail a compulsory requirement for EC in cases of permits in Natura 2000-areas according to Chapter 7, section 28a in the Environmental Code (Miljösamverkan Sverige, 2019).

Chapter 16, section 9 in the Environmental Code, makes is possible to demand EC in cases of permits or exemptions, and withdrawal of permits or exemptions. Contrary to Chapter 7, section 7 and 29, Chapter 16, section 9 does not entail a compulsory demand on EC. This section applies to several forms of nature protection in the Environmental Code. Those relevant to this thesis are permits in nature reserves, culture reserves, natural monuments, and nature conservation areas (exemptions are covered by Chapter 7, section 7), as well as permits and exemptions regarding Species Protection and Habitat Protection Areas.

## 2.5. The permit and exemption process

Many activities and measures are subject to permit under the Environmental Code, which means that a permit or an exemption is needed before such activities or measures are initiated. The applicant, i.e. the person, operator, municipality, or other, that wishes to undertake such activities is responsible for applying to the right authority (Naturvårdsverket, 2017).[23] In cases of Species Protection, Protected Areas, and Habitat Protection Areas, the reviewing authority is either the CAB, the municipality or the Swedish Forest Agency.[24]

Once the reviewing authority receives the application, they decide on the matter (*Figure 2*). If the activity is deemed permissible according to the Environmental Code, the application is approved (*bifalles*), which means that the applicant may initiate the activities in the application according to the conditions of the decision. It is only when the application is approved, that the reviewing authority can demand EC, making it a two-parted reviewing process. If the activity is deemed not permissible according to the Environmental Code, the application is rejected (*avslås*), and the applicant may not initiate the activities in the application. If no permit or exemption under the Environmental Code is needed, there is no need to

[19] 7 kap. 9 § 2 stycket Miljöbalk (1998:808). From the English translation.
[20] 7 kap. 10 § 2 stycket Miljöbalk (1998:808). From the English translation.
[21] 9 § Lag (1998:811) om införande av miljöbalken.
[22] Prop. 1997/98:45, part 1, p. 315.
[23] Hasse Berglund, public officer, Swedish EPA, meeting, 2019-07-02.
[24] Hasse Berglund, public officer, Swedish EPA, meeting, 2019-07-02.

file an application and the application is refused (*avvisas*). However, there may still be a permit or exemption needed according to other regulations. If the application e.g. does not contain enough information or the handling fee is not paid, the application is dismissed (*avskrivs*), which means that the permit or exemption process is discontinued (Naturvårdsverket, 2017).[25]

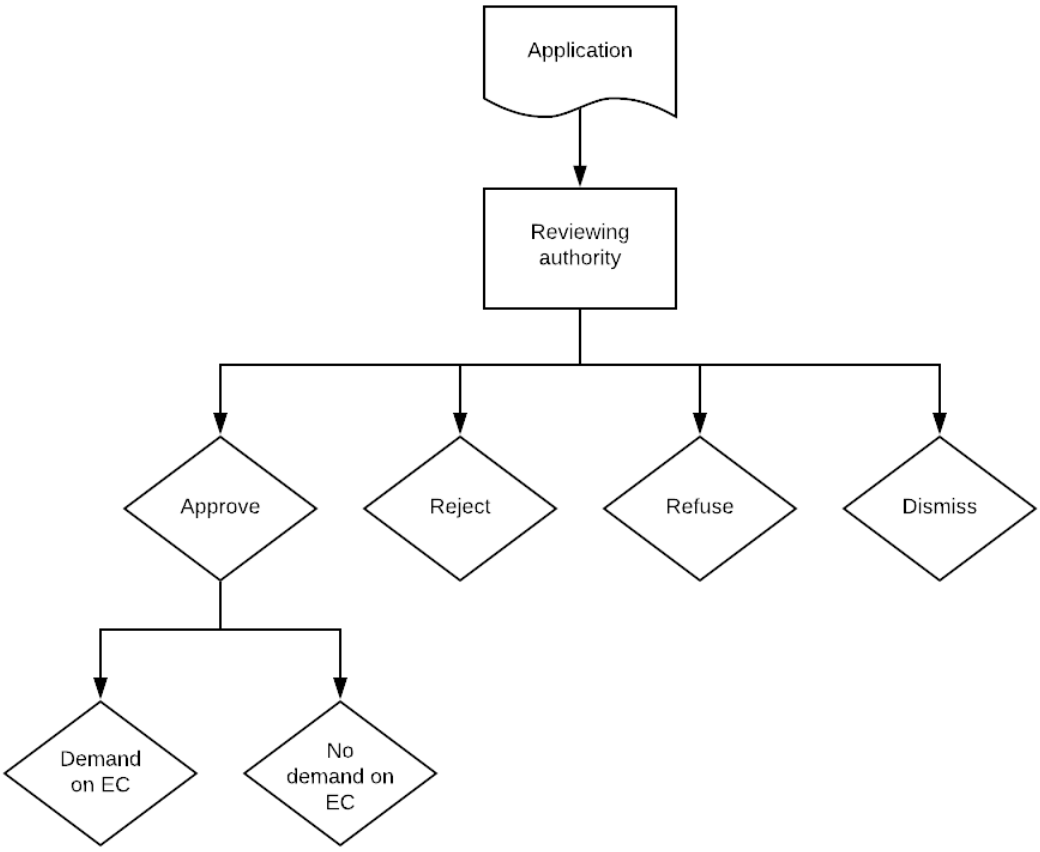


*Figure 2. Visualization over the permit and exemption process.*

Once the reviewing authority has made its decision, the decision is submitted to the Swedish EPA for attention. When the Swedish EPA receive the decision, the registration office place the document in an act in a case file in the case management system. Decisions regarding Species Protection, Protected Areas and Habitat Protection Areas, are filed in different case files and for each year a new case file is made.[26]

[25] Hasse Berglund, public officer, Swedish EPA, meeting, 2019-07-02.
[26] Hasse Berglund, public officer, Swedish EPA, meeting, 2019-07-02.

# 3. Method

A *systematic evaluation* (Anderson, 2010) was done to map the use of EC and the application of the regulations on EC in the Environmental Code. To discuss if the goals of the handbook have been achieved, a *before-and-after study* (Anderson, 2010) was done to compare the application before and after the publication of the Swedish EPA's handbook. Consequently, the method consisted of the following two parts: a mapping for the period 2015–2018 and a comparison with the first mapping (2011–2014).

In this section, the main parts of the method are described. For a more detailed description, see Appendix 4. Method.

## 3.1. Mapping 2015–2018

Data was collected from permits and exemptions in the case files Species Protection, Protected Areas, and Habitat Protection Areas for the period 2015-01-01 to 2018-12-31, which were available in the Swedish EPA's case file management system. The data collection can be summarized in the following steps:

1. Selection of documents for examination: Documents were selected from the case files. In the case files Species Protection and Protected Areas, the selection was made by searching for a series of words (e.g. "compensation") (see Appendix 4. Method). In the case files Habitat Protection Areas, all acts of the type "decision" was searched for. Out of these, 100 random decisions were selected per year for the years 2015–2017, and all decisions for the year 2018.
2. Examination of selected documents: The selected documents were examined manually, and the following data was collected:
    a. Decision (approval, rejection, or partial approval/rejection)
    b. Demand on EC ("yes" or "no")
    c. Reference to the regulations on EC in the Environmental Code ("yes" or "no")

    d. Reference to section in the Environmental Code (Chapter 7, section 7, Chapter 7, section 29 and/or Chapter 16, section 9)

3. Calculation of the total number of decisions: The total number of decisions in each case file was counted. In the case files Habitat Protection Areas, all documents that had been selected in step 1 were counted. For the case files Species Protection and Protected areas, on the other hand, all acts of the type "decision" was searched for in the case management system, and then counted manually.

4. Calculation of the number of rejections: The number of rejections in each case file was counted. In the case files Species Protection and Protected Areas, documents were selected by searching for a series of words (e.g. "rejection") (see Appendix 4. Method) and these were then examined manually to determine if they were rejections. In the case files Habitat Protection Areas, all documents were selected and examined manually. Then, the number of rejections were counted.

The collected data was used to calculate:

- The proportion of approvals with demand on EC
- The proportion of demands on EC with reference to the regulations on EC in the Environmental Code
- The proportion of demands on EC with reference to Chapter 7, section 7 and 29, and Chapter 16, section 9, in the Environmental Code

For formulas, see Appendix 4. Method and Appendix 5. Formulas.

The proportion of approvals with demand on EC was plotted against the year for all case files of the same type (Species Protection, Protected Areas, and Habitat Protection Areas). The same procedure was done for the proportion of demands on EC with reference to the regulations on EC in the Environmental Code.

To investigate whether the proportion of decisions with demand on EC had increased during the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively (hypothesis 1), linear regression analysis was performed for each form of protection. Linear regression analysis was also performed for each form of protection to investigate if the proportion of decisions where the reviewing authority had referred to the legislations on EC in the Environmental Code had increased during the period 2015–2018 (hypothesis 4). This was done even though there were only one data point per year, i.e. four data points in total (see Discussion).

To investigate if the proportion of decisions with demand on EC differed between cases of Species Protection, Protected Areas and Habitat Protection Areas (hypothesis 3), a Wilcoxon rank sum test was performed between each pair. The same procedure was done for the proportion of demands on EC with reference to the regulations on EC in the Environmental Code.

The proportion of approvals with demand on EC for the case file Habitat Protection Areas for 2018 was plotted against CAB to investigate if the application of the regulations on EC in the Environmental Code varied between different authorities (the first research question). The CABs were ordered from north to south to investigate if there were any north-south gradient. The proportion of approvals with demand on EC was also plotted against the area of agricultural land in each county to investigate if there were any correlation between the amount of agricultural land in each county and to what extent EC is demanded.

## 3.2. Comparison between 2011–2014 and 2015–2018

Data from the first mapping (2011–2014) was compared to the collected data from the mapping in this thesis (2015–2018). Since the first mapping only included decisions until the 5th of October 2014, the periods 2011-01-01 to 2014-10-05 and 2015-01-01 to 2018-10-05 were compared, to make the comparison as accurate as possible.

The collected data and the data from the first mapping were used to calculate the proportion of approvals with demand on EC for each year. For formulas, see Appendix 4. Method and Appendix 5. Formulas. The formulas were adjusted compared to the mapping 2015–2018 to better match the method used in the mapping of 2011–2014.

For each period (2011–2014 and 2015–2018) the proportion of approvals with demand on EC was plotted against the year for all case files of the same type (Species Protection, Protected Areas, and Habitat Protection Areas).

To investigate if the proportion of decisions with demand on EC had increased for the period 2015–2018 compared to 2011–2014 (hypothesis 2), Wilcoxon rank sum test was performed for each form of protection. In addition, linear regression analysis was performed for Species Protection, Protected Areas, and Habitat Protection Areas respectively during each mapping to give a better understanding of the proportion of decisions with demand on EC for each form of protection.

# 4. Results

In this section, the results from the mapping during the period 2015–2018 and the comparison between the periods 2011–2014 and 2015–2018 are presented.

## 4.1. Mapping 2015–2018

The proportion of approvals with demand on EC and the proportion of demands on EC with reference to the regulations on EC in the Environmental Code are presented for Species Protection, Protected Areas and Habitat Protection Areas separately (section 4.1.1–4.1.3) and then compared to each other (section 0).

### 4.1.1. Species Protection

The total number of decisions in the case files Species Protection varied between 143 and 196 decisions per year during the period 2015–2018. Many of these were approved, whereas a smaller number were rejected (*Table 2*). The proportion of approvals with demand on EC was also small, ranging from 3.6–4.9% (mean value 4.1%). There was no trend between the years (linear regression: $R^2 = 0.24$, $p = 0.51$) (*Figure 3*). Of the approvals with demand on EC, 1–3 (11–60%) had reference to the regulations on EC in the Environmental Code (mean value 39%) and there was no trend between the years (linear regression: $R^2 = 0.12$, $p = 0.66$) (*Figure 4*). 89% of these had reference to Chapter 16, section 9 for the entire period 2015–2018. During the same period, 11% had reference to Chapter 7, section 7, whereas none had reference to Chapter 7, section 29.

*Table 2. Data for permits and exemptions in the case files Species Protection for the period 2015-01-01 to 2018-12-31.*

| | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Total number of decisions | 196 | 143 | 167 | 154 |
| Number of rejections | 11 | 8 | 1 | 10 |
| Number of approvals | 185 | 135 | 166 | 144 |
| Number of approvals with demand on EC | 9 | 5 | 6 | 6 |
| Proportion of approvals with demand on EC (%) | 4.9 | 3.7 | 3.6 | 4.2 |
| Number of demands on EC with reference to the regulations on EC in the Environmental Code | 1 | 3 | 3 | 2 |
| Proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) | 11 | 60 | 50 | 33 |

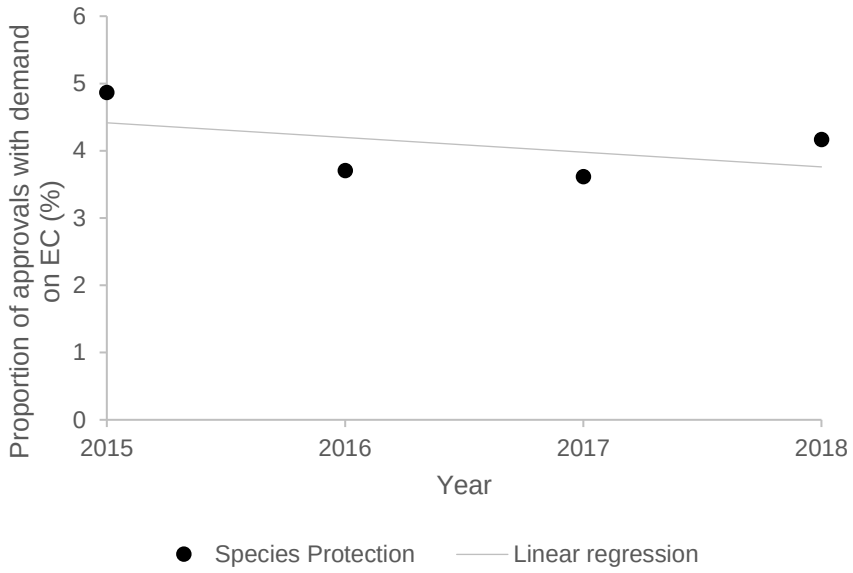


*Figure 3. The proportion of approvals with demand on EC (%) in the case files Species Protection for each year during the period 2015–2018 (R2 = 0.24, p = 0.51).*

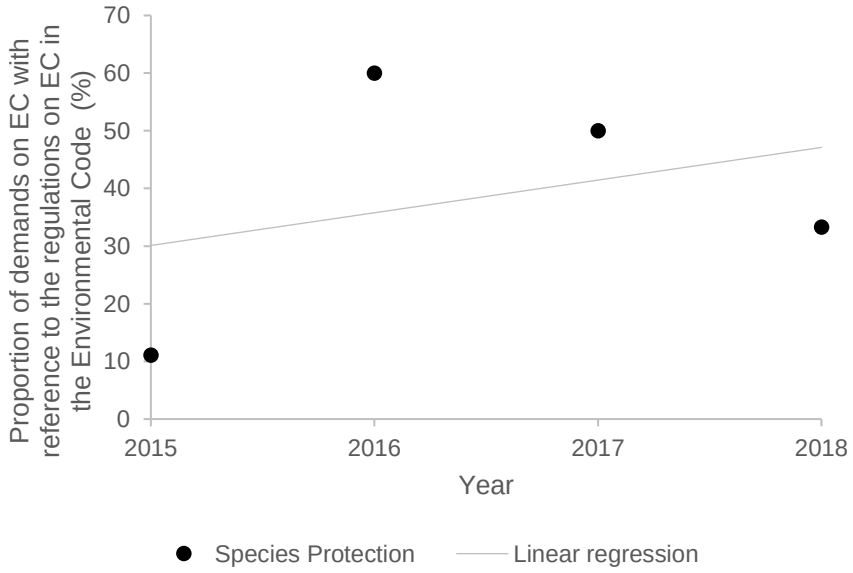


*Figure 4. The proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) in the case files Species Protection for each year during the period 2015–2018 ($R^2$ = 0.12, p = 0.66).*

### 4.1.2. Protected Areas

The total number of decisions in the case files Protected Areas varied between 941 and 1114 decisions per year during the period 2015–2018. Many of these were approved, whereas a smaller number were rejected (*Table 3*). The proportion of approvals with demand on EC was small, ranging from 1.4–3.8% (mean value 2.9%). There was no trend between the years (linear regression: $R^2$ = 0.00, p = 0.96)

(*Figure 5*). Of the approvals with demand on EC, 66–87% had reference to the regulations on EC in the Environmental Code (mean value 75%) and there was no trend between the years (linear regression: $R^2 = 0.06$, $p = 0.76$) (*Figure 6*). 90% of these had reference to Chapter 7, section 7 for the entire period 2015–2018. During the same period, 29% had reference to Chapter 16, section 9, whereas none had reference to Chapter 7, section 29.

*Table 3. Data for permits and exemptions in the case files Protected Areas for the period 2015-01-01 to 2018-12-31.*

| | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Total number of decisions | 941 | 1037 | 1086 | 1114 |
| Number of rejections | 14 | 39 | 35 | 48 |
| Number of approvals | 927 | 998 | 1051 | 1066 |
| Number of approvals with demand on EC | 33 | 26 | 15 | 41 |
| Proportion of approvals with demand on EC (%) | 3.6 | 2.6 | 1.4 | 3.8 |
| Number of demands on EC with reference to the regulations on EC in the Environmental Code | 25 | 19 | 13 | 27 |
| Proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) | 76 | 73 | 87 | 66 |

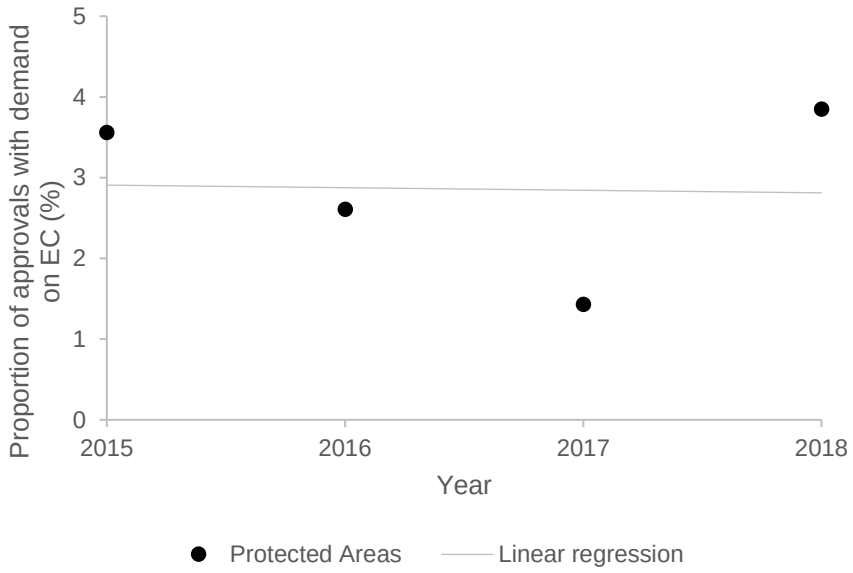


*Figure 5. The proportion of approvals with demand on EC (%) in the case files Protected Areas for each year during the period 2015–2018 (R2 = 0.00, p = 0.96).*

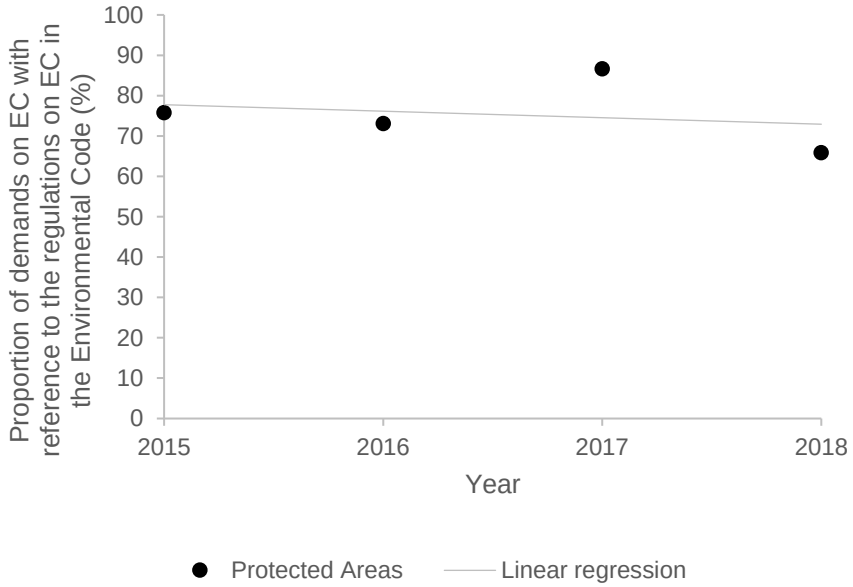


*Figure 6. The proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) in the case files Protected Areas for each year during the period 2015–2018 (R2 = 0.06, p = 0.76).*

### 4.1.3. Habitat Protection Areas

The total number of decisions in the case files Habitat Protection Areas varied between 529 and 764 decisions per year during the period 2015–2018. Many of these were approved, whereas a smaller number were rejected (*Table 4*). The proportion of approvals with demand on EC was large, ranging from 60–88% (mean value 73%). There was no trend between the years (linear regression: $R^2 = 0.39$, p

= 0.37) (*Figure 7*). Of the approvals with demand on EC, 36–57% had reference to the regulations on EC in the Environmental Code (mean value 46%) and there was no trend between the years (linear regression: $R^2 = 0.50$, $p = 0.29$) (*Figure 8*). More than 99% of these had reference to Chapter 16, section 9 for the entire period 2015–2018, 9 decisions (< 1%) had reference to Chapter 7, section 7, whereas none had reference to Chapter 7, section 29.

*Table 4. Data for permits and exemptions in the case files Habitat Protection Areas for the period 2015-01-01 to 2018-12-31. For the years 2015–2017, the numbers are calculated from a random selection of approx. 100 decisions per year and case file, whereas for 2018, the numbers are based on all decisions in the case file.*

| | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Total number of decisions | 529 | 544 | 571 | 764 |
| Number of rejections | 33 | 60 | 58 | 59 |
| Number of approvals | 496 | 484 | 513 | 705 |
| Number of approvals with demand on EC | 295 | 343 | 448 | 511 |
| Proportion of approvals with demand on EC (%) | 60 | 71 | 88 | 72 |
| Number of demands on EC with reference to the regulations on EC in the Environmental Code | 167 | 158 | 163 | 228 |
| Proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) | 57 | 46 | 36 | 45 |

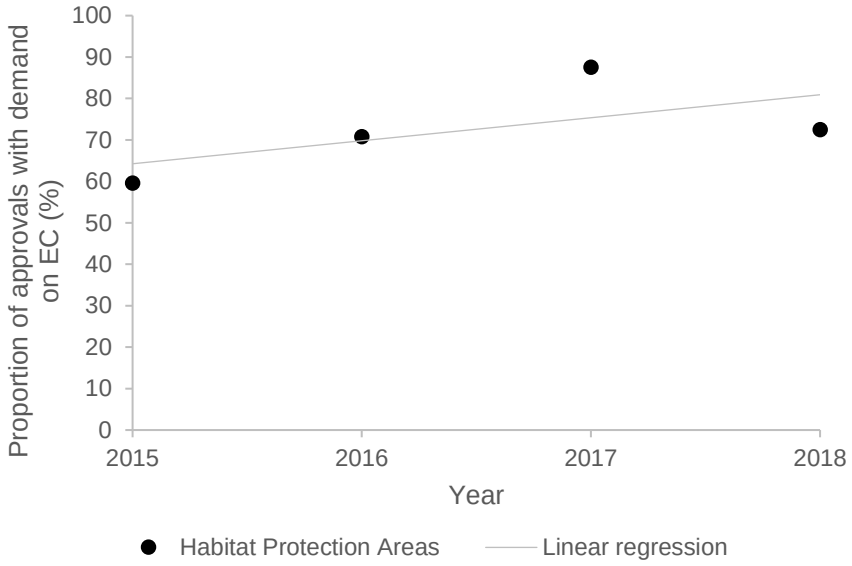


*Figure 7. The proportion of approvals with demand on EC (%) in the case files Habitat Protection Areas for each year during the period 2015–2018 (R2 = 0.39, p = 0.37). For the years 2015–2017, the numbers are calculated from a random selection of approx. 100 decisions per year and case file, whereas for 2018, the numbers are based on all decisions in the case file.*

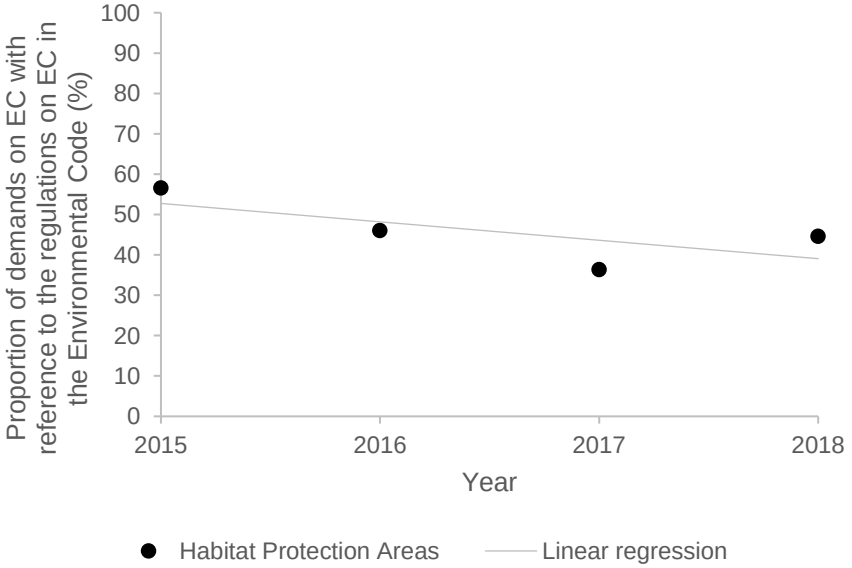


*Figure 8. The proportion of demands on EC with reference to the regulations on EC in the Environmental Code (%) in the case files Habitat Protection Areas for each year during the period 2015–2018 (R2 = 0.50, p = 0.29). For the years 2015–2017, the numbers are calculated from a random selection of approx. 100 decisions per year and case file, whereas for 2018, the numbers are based on all decisions in the case file.*

### 4.1.4. Comparisons between the forms of protection

The proportion of approvals with demand on EC differed between the three forms of protection, with 1.4–3.8% (mean value 2.9%) for Protected Areas, 3.6–4.9% (mean value 4.1%) for Species Protection, and 60–88% (mean value 73%) for Habitat Protection Areas. Habitat Protection Areas had a larger proportion of approvals with demand on EC than both Protected Areas (Wilcoxon: $W = 0$, $p = 0.03$) and Species Protection (Wilcoxon: $W = 16$, $p = 0.03$). However, there was no difference between the proportion of approvals with demand on EC for Species Protection and Protected Areas (Wilcoxon: $W = 14$, $p = 0.11$).

The proportion of demands on EC with reference to the regulations on EC in the Environmental Code also differed between the three forms of protection, with 11–60% (mean value 39%) for Species Protection, 36–57% (mean value 46%) for Habitat Protection Areas, and 66–87% (mean value 75%) for Protected Areas. Protected Areas had a larger proportion of demands on EC with reference to the regulations on EC in the Environmental Code than both Species Protection (Wilcoxon: $W = 0$, $p = 0.03$), and Habitat Protection Areas (Wilcoxon: $W = 16$, $p = 0.03$). However, there was no difference between the proportion of demands on EC with reference to the regulations on EC in the Environmental Code for Species Protection and Habitat Protection Areas (Wilcoxon: $W = 9$, $p = 0.89$).

The sections in the Environmental Code were referred to different extent for the three forms of protection. Chapter 7, section 7 was referred much more often for Protected Areas (90%) than for both Species Protection and Habitat Protection Areas (11% respectively < 1%). Meanwhile, there was no reference to Chapter 7, section 29 in any decision. Chapter 16, section 9 was referred to more often for Habitat Protection Areas and Species Protection (99% respectively 89%) than for Protected Areas (29%).

### 4.1.5. Differences between County Administrative Boards

The total number of decisions in the case files Habitat Protection Areas for 2018, varied from 0 to 135 decisions between the different CABs (*Table 5*). In most cases, a large proportion of these were approved (mean value 92%). The proportion of approvals with demand on EC also varied, between 25 and 100% (mean value 73%). No apparent trend in a north-south direction or trend related to area of agricultural land (Statistiska centralbyrån, 2019) could be seen by visual inspection (*Figure 9*).

*Table 5. Data for permits and exemptions in the case file Habitat Protection Area from 2018 for the 21 CABs in Sweden. Since there were no decisions for the CAB of Västerbotten, the proportion of approvals and the proportion of approvals with demand on EC could not be calculated.*

| CAB | Total number of decisions | Number of approvals | Proportion of approvals (%) | Number of approvals with demand on EC | Proportion of approvals with demand on EC (%) | Area of agricultural land (ha) |
|---|---|---|---|---|---|---|
| Blekinge | 12 | 11 | 92 | 8 | 73 | 41,607 |
| Dalarna | 40 | 39 | 98 | 33 | 85 | 70,847 |
| Gotland | 31 | 27 | 87 | 21 | 78 | 111,580 |
| Gävleborg | 31 | 28 | 90 | 14 | 50 | 72,393 |
| Halland | 37 | 36 | 97 | 32 | 89 | 124,926 |
| Jämtland | 11 | 7 | 64 | 5 | 71 | 51,821 |
| Jönköping | 36 | 35 | 97 | 30 | 86 | 127,112 |
| Kalmar | 49 | 44 | 90 | 25 | 57 | 193,602 |
| Kronoberg | 35 | 33 | 94 | 24 | 73 | 68,044 |
| Norrbotten | 5 | 5 | 100 | 5 | 100 | 35,716 |
| Skåne | 77 | 67 | 87 | 42 | 63 | 498,640 |
| Stockholm | 63 | 63 | 100 | 45 | 71 | 92,567 |
| Södermanland | 4 | 4 | 100 | 1 | 25 | 142,316 |
| Uppsala | 47 | 41 | 87 | 26 | 63 | 181,425 |
| Värmland | 34 | 34 | 100 | 25 | 74 | 113,677 |
| Västerbotten | 0 | 0 | N/A | 0 | N/A | 71,497 |
| Västernorrland | 6 | 6 | 100 | 4 | 67 | 50,461 |
| Västmanland | 24 | 24 | 100 | 14 | 58 | 108,425 |
| Västra Götaland | 135 | 124 | 92 | 97 | 78 | 527,049 |
| Örebro | 28 | 27 | 96 | 18 | 67 | 113,166 |
| Östergötland | 54 | 46 | 85 | 40 | 87 | 243,023 |

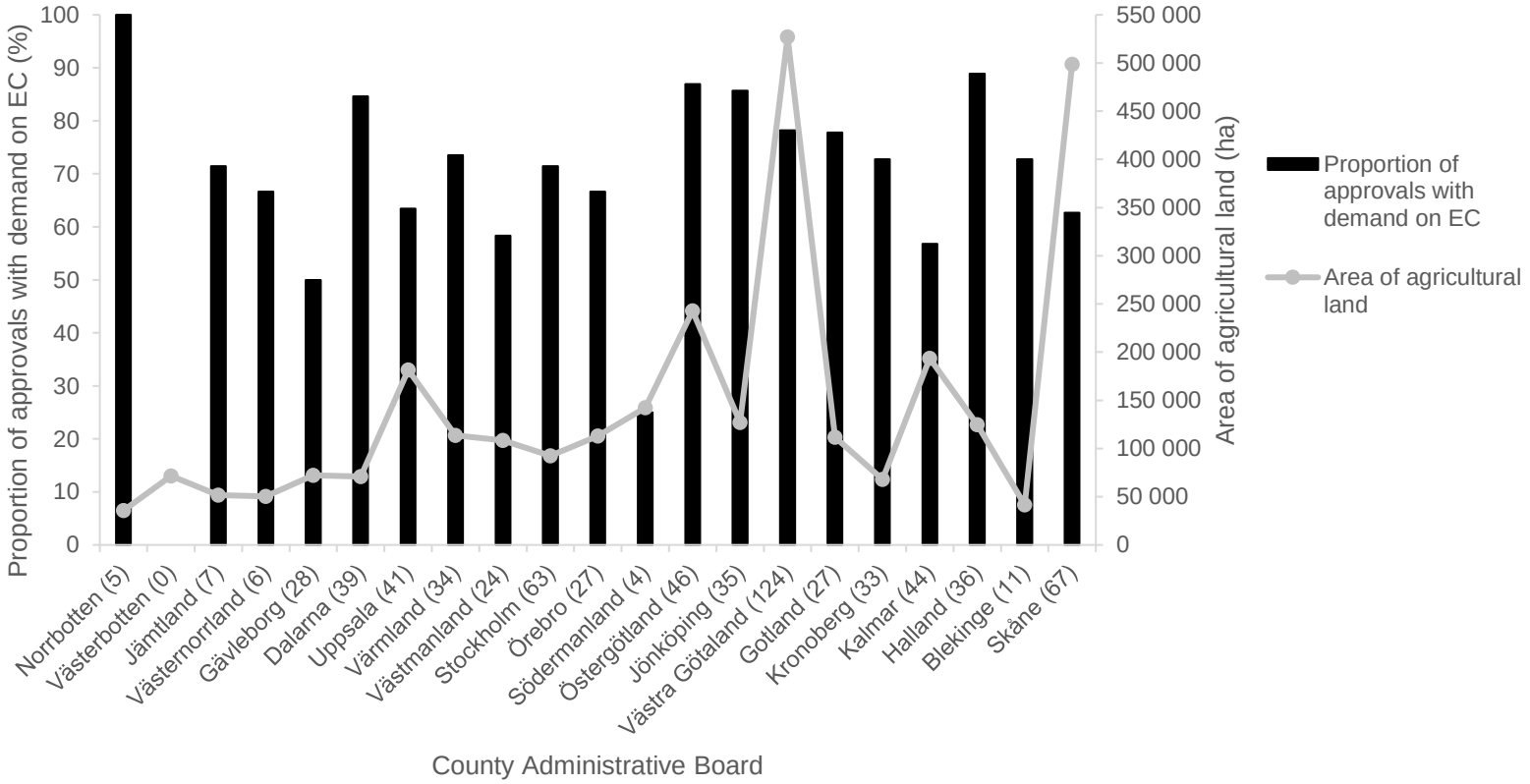


*Figure 9. The proportion of approvals with demand on EC (%) in the case file Habitat Protection Areas from 2018 for the 21 CABs, ordered from north to south based on the location of the county town, as well as the area of agricultural land (ha) in each county (Statistiska centralbyrån, 2019). The number of approvals is given in brackets after the name of each CAB. Since there were no decisions for the CAB of Västerbotten, the proportion of approvals with demand on EC could not be calculated.*

## 4.2. Comparison between 2011–2014 and 2015–2018

The proportion of approvals with demand on EC are presented for Species Protection, Protected Areas and Habitat Protection Areas separately and compared between the periods 2011–2014 and 2015–2018 (section 4.2.1–4.2.3).

### 4.2.1. Species Protection

The total number of decisions in the case files Species Protection varied between 93 and 155 decisions per year during the period January 2011–October 2014 and between 130 and 196 decisions per year during the period January 2015–October 2018. Only a few of the approvals for each period had demand on EC, between 2 and 10 for the period January 2011–October 2014 and between 5 and 9 for the period January 2015–October 2018 (*Table 6*).

The proportion of approvals with demand on EC varied between 1.9 and 7.5% during the period January 2011–October 2014 (mean value of 4.9%). There was an increasing trend for the period (linear regression: $R^2 = 0.98$, $p = 0.01$) (*Figure 10* (a)). During the period January 2015–October 2018, the proportion of approvals with demand on EC varied between 3.5 and 4.6% (mean value 4.1%). However, there was no trend for this period (linear regression: $R^2 = 0.00$, $p = 0.96$) (*Figure 10* (b)). There was no significant difference between the two periods (Wilcoxon: $W = 6$, $p = 0.69$).

*Table 6. Comparison between data for permits and exemptions in the case files Species Protection for the periods 2011-01-01 to 2014-10-15 (Kolb, 2015) and 2015-01-01 to 2018-10-05.*

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Total number of decisions | 104 | 134 | 155 | 93 | 196 | 143 | 167 | 130 |
| Number of approvals with demand on EC | 2 | 5 | 10 | 7 | 9 | 5 | 6 | 6 |
| Proportion of approvals with demand on EC (%) | 1.9 | 3.7 | 6.5 | 7.5 | 4.6 | 3.5 | 3.6 | 4.6 |

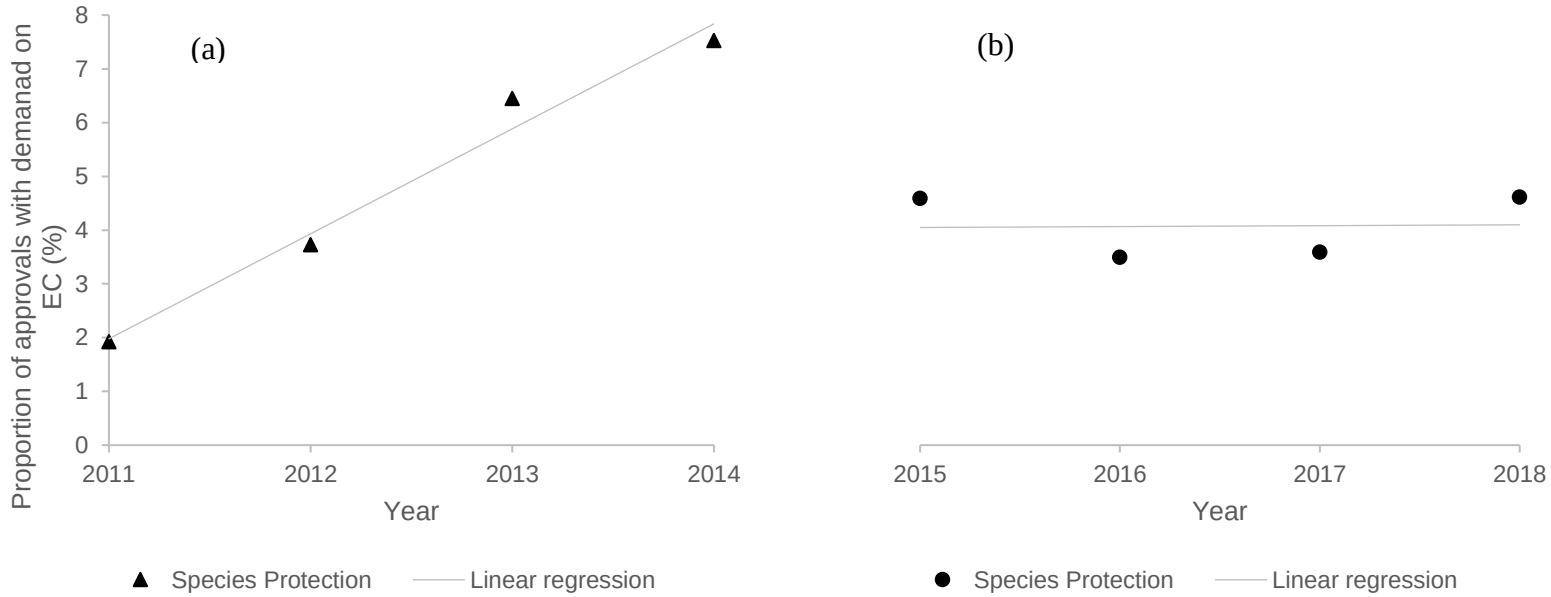


*Figure 10. The proportion of approvals with demand on EC (%) in the case files Species Protection for each year from (a) 2011-01-01 to 2015-10-05 (Kolb, 2015) ($R^2$ = 0.98, p = 0.01) and (b) 2015-01-01 to 2018-10-05 ($R^2$ = 0.00, p = 0.96).*

### 4.2.2. Protected Areas

The total number of decisions in the case files Protected Areas varied between 707 and 961 decisions per year during the period January 2011–October 2014 and between 904 and 1086 decisions per year during the period January 2015–October 2018 (*Table 7*).

The proportion of approvals with demand on EC varied between 1.3 and 1.8% during the period January 2011–October 2014 (mean value 1.5%). There was no trend for the period (linear regression: $R^2 = 0.20$, $p = 0.55$) (*Figure 11* (a)). During the period January 2015–October 2018, the proportion of approvals with demand on EC varied between 1.4 and 4.0% (mean value 2.9%). There was no trend for this period either (linear regression: $R^2 = 0.00$, $p = 0.97$) (*Figure 11* (b)). There was no significant difference between the two periods (Wilcoxon: $W = 14$, $p = 0.11$).

*Table 7. Comparison between data for permits and exemptions in the case files Protected Areas for the periods 2011-01-01 to 2014-10-15 (Kolb, 2015) and 2015-01-01 to 2018-10-05.*

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Total number of decisions | 933 | 961 | 908 | 707 | 945 | 1047 | 1086 | 904 |
| Number of rejections | 32 | 14 | 14 | 7 | 14 | 39 | 35 | 36 |
| Number of approvals | 901 | 947 | 894 | 700 | 931 | 1008 | 1051 | 868 |
| Number of approvals with demand on EC | 12 | 12 | 16 | 10 | 33 | 26 | 15 | 35 |
| Proportion of approvals with demand on EC (%) | 1.3 | 1.3 | 1.8 | 1.4 | 3.5 | 2.6 | 1.4 | 4.0 |

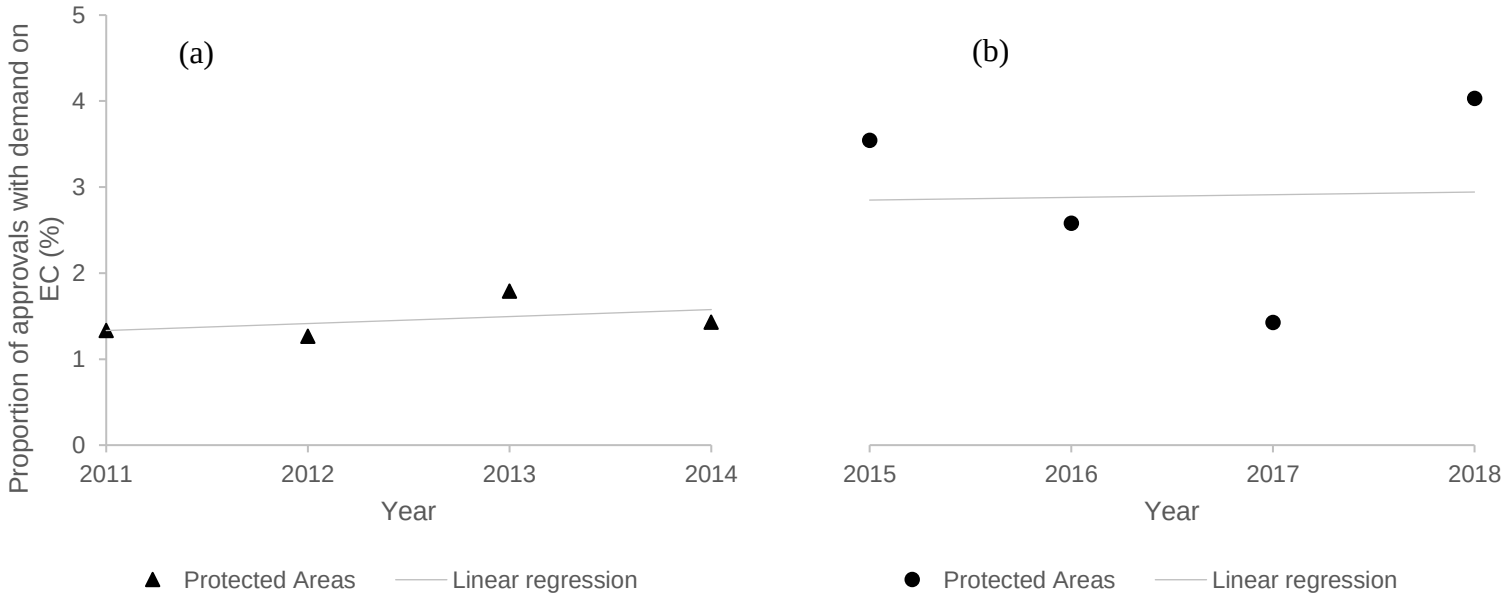


*Figure 11. The proportion of approvals with demand on EC (%) in the case files Protected Areas for each year from (a) 2011-01-01 to 2015-10-05 (Kolb, 2015) ($R^2$ = 0.20, p = 0.55) and (b) 2015-01-01 to 2018-10-05 ($R^2$ = 0.00, p = 0.97).*

### 4.2.3. Habitat Protection Areas

The total number of decisions in the case files Habitat Protection Areas varied between 221 and 399 decisions per year during the period January 2011–October 2014 and between 557 and 629 decisions per year during the period January 2015–October 2018 (*Table 8*).

The proportion of approvals with demand on EC varied between 74 and 90% during the period January 2011–October 2014 (mean value 83%). There was no trend for the period (linear regression: $R^2 = 0.62$, $p = 0.21$) (*Figure 12* (a)). During the period January 2015–October 2018, the proportion of approvals with demand on EC was somewhat lower and varied between 60 and 88% (mean value 73%). There was no trend for this period either (linear regression: $R^2 = 0.38$, $p = 0.39$) (*Figure 12* (b)). There was no significant difference between the two periods (Wilcoxon: $W = 3.0$, $p = 0.2$).

*Table 8. Comparison between data for permits and exemptions in the case files Habitat Protection Areas for the periods 2011-01-01 to 2014-10-15 (Kolb, 2015) and 2015-01-01 to 2018-10-05. In the original table from Kolb (2015) the two numbers indicated by 1 and 2 had accidently switched places, which has been corrected in this table. For the years 2015–2017, the numbers are calculated from a random selection of approx. 100 decisions per year and case file, whereas for 2018, the numbers are based on all decisions in the case file.*

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Total number of decisions | 221 | 272 | 399 [1] | 337 | 557 | 578 | 629 | 566 |
| Number of rejections | 26 | 19 | 13 | 16 | 35 | 64 | 64 | 41 |
| Number of approvals | 195 | 253 | 386 | 321 | 522 | 514 | 565 | 525 |
| Number of approvals with demand on EC | 144 | 211 | 349 [2] | 275 | 311 | 364 | 494 | 379 |
| Proportion of approvals with demand on EC (%) | 74 | 83 | 90 | 86 | 60 | 71 | 88 | 72 |

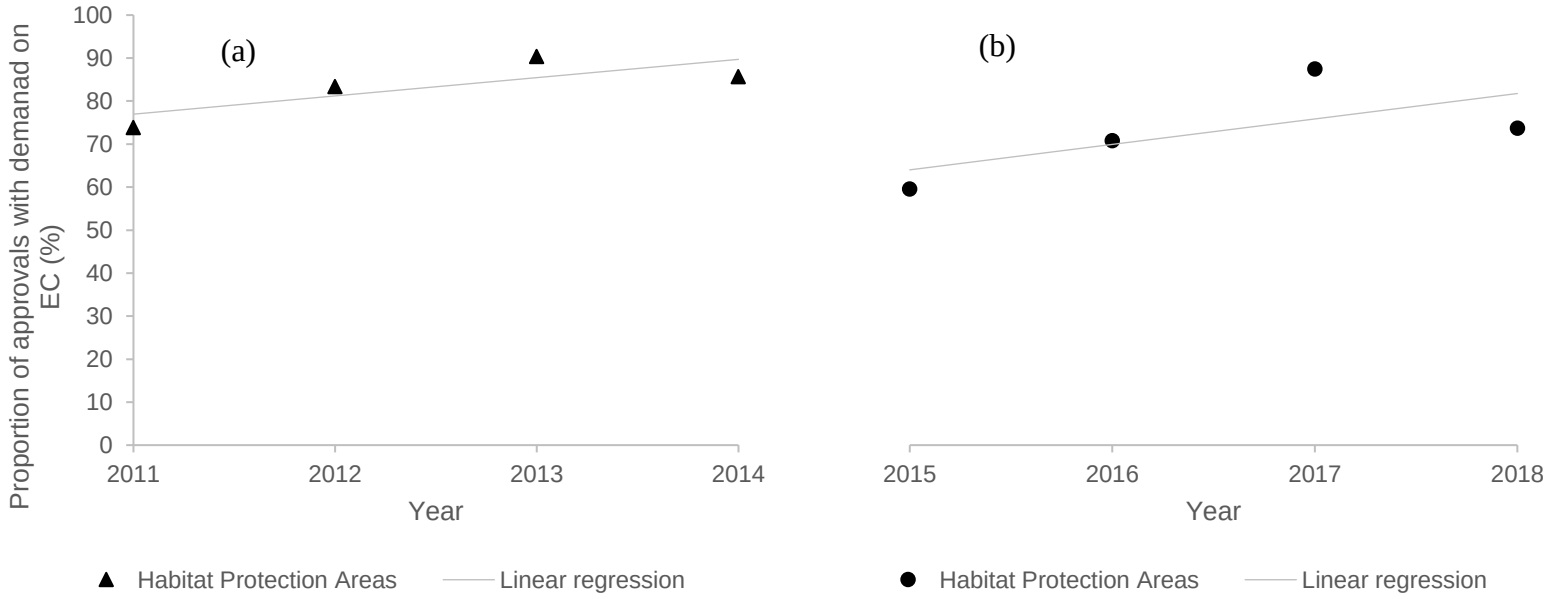


*Figure 12. The proportion of approvals with demand on EC (%) in the case files Habitat Protection Areas for each year from (a) 2011-01-01 to 2015-10-05 (Kolb, 2015) ($R^2$ = 0.62, p = 0.21) and (b) 2015-01-01 to 2018-10-05 ($R^2$ = 0.38, p = 0.39). For the years 2015–2017, the numbers are calculated from a random selection of approx. 100 decisions per year and case file, whereas for 2018, the numbers are based on all decisions in the case file.*

# 5. Discussion

In this section, I discuss the results from this mapping (2015–2018) and the comparison with the first mapping (2011–2014). I also discuss if the goals of the Swedish EPA's handbook on EC has been reached, the method, and the need for future research. The validation of Kolb's method is discussed in Appendix 3.

## 5.1. Mapping 2015–2018

During the mapping for the period 2015–2018, the proportion of approvals with demand on EC, the proportion of demands on EC with reference to the Environmental Code, reference to regulations in the Environmental Code, and differences between the CABs were investigated. I discuss these in section 5.1.1–5.1.8 below.

### 5.1.1. Approvals with demand on EC

I expected that the demands on EC would increase during the period 2015–2018 due to the increased focus on EC from the authorities. However, the proportion of approvals with demand on EC showed no trend for any of the three forms of protection during this period (section 4.1.1–4.1.3). Thus, the first hypothesis "the proportion of decisions with demand on EC has increased during the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively" is not supported.

The results suggest that the handbook on EC has not had an effect on the extent to which compensation is demanded. One explanation for this, could be insufficient communication of the handbook from the Swedish EPA. According to Vries (2020), communication is important for the effectiveness of environmental policies. Until recently, the handbook was the only policy on EC written as a guidance for the CABs, making it an important tool for communicating the use of EC and the application of the regulations on EC. In an online survey from 2016, which was sent out approximately nine months after the publication of the handbook, one of the weaknesses mentioned by the respondents, was that it had not reached those who work with EC. In fact, several respondents answered that they found the

handbook by coincidence (Naturvårdsverket, 2016b). This supports the claim that the handbook was insufficiently communicated.

Another explanation to why the handbook does not seem to have had an effect on the extent to which compensation is demanded, could be a lacking possibility to participate in the development of the handbook, affecting how well anchored the handbook is among the CABs. Within policy literature, the processes in which "individuals, groups, and organizations have the opportunity to participate in making decisions that affect them, or in which they have an interest" (Smith, 2003, p. 5) is referred to as *public participation*. According to Eden (1996), the implementation of a policy depends on public participation, i.e. how well the policy is anchored among those concerned with the policy. In the survey from 2016, some of the respondents were unsatisfied with the possibility to participate in the development of the handbook (Naturvårdsverket, 2016b), which might have affected the use of the handbook among some of the users. However, a majority of the respondents were satisfied with the possibility to participate (Naturvårdsverket, 2016b). Altogether, it is difficult to say if the participation has affected the effectiveness of the handbook.

Other weaknesses mentioned in the survey, was that the handbook contained too few practical examples on EC, which several respondents wanted more of, and that the handbook was considered bureaucratic and difficult to read (Naturvårdsverket, 2016b). These could be other reasons to why the handbook has not had an effect on the extent to which EC is demanded.

Another important aspect to consider is the time frame. The handbook on EC was published in 2016, whereas the mapping included decisions from the years 2015–2018. According to Mickwitz (2003), the time it takes to implement an environmental policy is usually very long, due to the complexity of environmental problems. Hence, it might be too soon to even evaluate if the handbook has had an effect on the use of EC in Sweden.

### 5.1.2. Demands on EC with reference to the regulations on EC in the Environmental Code

I also expected that the reviewing authorities would refer to the regulations on EC in the Environmental Code more often after the publication of the handbook, since it focuses on the application of these regulations. However, the proportion of demands on EC with reference to the regulations on EC in the Environmental Code showed no trend during the period 2015–2018 for any of the three forms of protection (section 4.1.1–4.1.3). Thus, the fourth hypothesis "the proportion of decisions where the reviewing authority has referred to the legislations on EC in the Environmental Code has increased during the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively" is not supported.

When visually examining the results for Species Protection, there seems to be an increase of the proportion of decisions where the reviewing authority has referred to the legislations between 2015 and 2016 (11% respectively 60%), which coincide with the publication of the handbook in 2016. However, since these proportions are based on very few decisions (1 of 9 approvals with demand on EC had reference to the Environmental Code in 2015) this is likely due to chance and should not be interpreted as an effect of the handbook. Also, if the handbook had affected the extent to which the regulations on EC is referred, I would expect to see a similar increase between 2015 and 2016 for Protected Areas and Habitat Protection Areas.

The results suggest that the handbook has not had an effect on the extent to which the regulations on EC in the Environmental Code is referred. In section 5.1.1, I mentioned some explanations to why the handbook does not seem to have had an effect on the demand on EC: insufficient communication of the handbook (Vries, 2020), lacking possibility to participate in the development of the handbook (Eden, 1996), and too few practical examples. All these might also explain why the handbook has not had an effect on the extent to which the regulations on EC in the Environmental Code is referred. For example, the lack of practical examples is supported by the survey from 2016, where it is mentioned that there were too few concrete situations when compensation should be demanded according to Chapter 16, section 9 in the Environmental Code (Naturvårdsverket, 2016b). In section 5.1.1, I also mentioned that it might be too soon to even evaluate if the handbook has had an effect on the use of EC in Sweden and this aspect is equally relevant here.

The results also showed that far from all approvals with demand on EC had reference to the regulations on EC in the Environmental Code. That the reviewing authorities had not referred to the regulations in these cases is troublesome, since authorities must refer to the regulations which the decision is based on.[27] However, it was not until 2018 this was added in Förvaltningslagen, following an investigation in 2010 (Förvaltningslagsutredningen). The previous law from 1986 did not include this formulation.[28]

### 5.1.3. Reference to section in the Environmental Code

Which section in the Environmental Code that was referred to differed between the three case files, which is discussed in section 5.1.7. It is difficult to say if the handbook has influenced which regulation on EC in the Environmental Code the reviewing authorities refer to. For example, it might be easier to find information

[27] 32 § första stycket Förvaltningslag (2017:900).
[28] 20 § första stycket Förvaltningslag (1986:223).

regarding which section in the Environmental Code to refer to in the handbook, than in the Environmental Code, as the application is described more in depth in the handbook, as well as includes practical examples of the application. However, one might also argue that the public officers at the CABs and municipalities working with permits and exemption should have knowledge of how to use the regulations on EC in the Environmental Code. Nevertheless, if that was the case, there would not have been a need to develop the handbook.

The handbook addresses the application of all the three regulations included in this thesis. For example, all the regulations were mentioned in the summarizing table of regulations which can be used to demand EC (table 2) and they were all described separately. Notably, the main description of Chapter 16, section 9 was longer (3.5 pages), than Chapter 7, section 29 (almost 1.5 page) and Chapter 7, section 7 (1 page). The longer explanation might have provided a more in-depth description of Chapter 16, section 9 and made it easier for the CABs to refer to this regulation than the others. However, this has not been investigated any further.

### 5.1.4. Comparison between the forms of protection

The proportion of approvals with demand on EC, the proportion of demands on EC with reference to the Environmental Code and reference to regulations in the Environmental Code were compared between the three forms of protection. I discuss these in section 5.1.5–5.1.7 below.

### 5.1.5. Approvals with demand on EC

I expected that EC would be demanded more often in decisions based on Chapter 7, section 7 and 29 in the Environmental Code than decisions based on Chapter 16, section 9, since the two former regulations have a compulsory demand on EC. The proportion of approvals with demand on EC did differ between the three forms of protection, but the largest proportion was not seen in Protected Areas. Instead, Protected Areas had the smallest proportion, whereas Habitat Protection Areas had the largest (section 0). Thus, only parts of the third hypothesis “the proportion of decisions with demand on EC differ between cases of Species Protection, Protected Areas and Habitat Protection Areas, with the largest proportion in Protected Areas” is supported.

There are several possible explanations to why there are differences between the three forms protection. One explanation to why the smallest proportion was seen in Protected Areas might be that a large proportion (approximately 75%) of these decisions were concerned with nature reserves. In nature reserves, a permit is needed for all measures that violate the rules issued for the reserve, including

smaller intrusions.[29] If a large proportion of the applications regarded smaller intrusion, for which EC is likely not demanded, Protected Areas would get a lower proportion of decisions with demands on EC than the other forms of protection. However, it is difficult to say how many of the applications regarded smaller intrusions, since it was not investigated in this thesis. I did observe that in approximately 45 cases, the authority motivated that no compensation was needed since the intrusion in the nature reserve was so small. In another 35 cases, approximately, the authority motivated that no compensation was needed because it deemed no damage would be caused to the natural environment due to the intrusion. However, this only explains why some of the decisions regarding Protected Areas did not have a demand on EC. I also noticed that the reviewing authority sometimes mentioned other reasons why they did not demand EC, for example that the intrusion was only temporary. Still, many decisions remain which lacked motivation for why EC was not demanded.

The differences between the three forms of protection might also be linked to how easy or difficult it is to compensate the damaged values. In habitat protection areas, there is usually only one value being damaged due to exploitation, and therefore only one value to compensate for if the principle of "like-for-like" is applied. According to this principle, damaged values should be compensated by similar values (BBOP, 2009), something which is often desired (Naturvårdsverket, 2016a). When examining the data, I saw that damaged values in habitat protection areas often were compensated by similar values. For example, tree avenues were often compensated by planting a new tree, and stone walls were often compensated by building new stone walls. Hence, the simplicity of the compensation measure might explain why the largest proportion was seen in Habitat Protection Areas. However, with the same reasoning, I would also expect to see a similar pattern for Species Protection, for which often also only one value is damaged as well. Nevertheless, there was no difference between the proportion of approvals with demand on EC for Species Protection and Protected Areas.

As mentioned above, a large proportion of the decisions for Protected Areas were concerned with nature reserves. Nature reserves may contain several different environmental values that might be damaged due to exploitation, making it harder to compensate than values in habitat protection areas. Unfortunately, I have not investigated which values were damaged in Protected Areas, and which compensation measures were demanded, which would provide valuable information to further investigate this.

The results suggest that the possibility to find an appropriate compensation measure affects the extent to which EC is demanded. This indicates that the two-parted reviewing process (Naturvårdsverket, 2016a; Miljösamverkan Sverige,

[29] 7 kap. 7 § andra stycket Miljöbalk (1998:808)

2019), which the Swedish EPA finds important (Naturvårdsverket, 2016a), has failed.

### 5.1.6. Demands on EC with reference to the regulations on EC in the Environmental Code

The proportion of demands on EC with reference to the regulations on EC in the Environmental Code differed between the three forms of protection. Protected Areas had a larger proportion than both Species Protection and Habitat Protection Areas, whereas there was no difference between Species Protection and Habitat Protection Areas. The differences might be explained by the strength of the regulations applicable for the three forms of protection.

That the regulations were referred to more often for Protected Areas than for Species Protection and Habitat Protection Areas, might be explained by the stronger legal status of Chapter 7, section 7 and 29 than of Chapter 16, section 9. Chapter 7, section 7 and 29, which are only applicable for decisions regarding Protected Areas, have a compulsory demand on EC. Chapter 16, section 9, which is applicable for Species Protection and Habitat Protection Areas (as well as Protected Areas), is voluntary. It seems that the reviewing authority were more prone to refer to the regulations on EC in the Environmental Code when the regulation had a stronger legal status. The reason for this, might be that a compulsory demand on EC has a greater weight to it, than when demand on EC is voluntary. However, this does not explain why the stronger legal status of Chapter 7, section 7 and 29 did not result in a larger proportion of approvals with demand on EC (section 5.1.1).

That there was no difference between Species Protection and Habitat Protection Areas, might be explained by that the same regulation is applicable in both cases, namely Chapter 16, section 9.

### 5.1.7. Reference to section in the Environmental Code

As mentioned in section 5.1.3, which section in the Environmental Code that was referred to differed between the three case files. This was expected since the regulations on EC in the Environmental Code is applicable in different cases.

For Protected Areas, reference to Chapter 7, section 7 was most common. This was expected, since many of these decisions were exemptions from regulations in nature reserves, where Chapter 7, section 7 is applicable. Some of the decisions had reference to Chapter 16, section 9, which also is not surprising since some of the decisions regarded permits in nature reserves. However, I was surprised that there was no reference to Chapter 7, section 29, even though there were many decisions concerning Natura 2000-areas. One possible explanation for this is that the measure in the application in many cases was not regarded to have a considerable effect on the Natura 2000-area and that a permit according to Chapter 7, section 28a was not

needed. However, there were cases where EC had been demanded, but the reviewing authority had not referred to Chapter 7, section 29, even though authorities must refer to the regulations which the decision is based on.[30]

For Species Protection and Habitat Protection Areas, it was most common with reference to Chapter 16, section 9. This was also expected since these case files mainly contains exemptions from habitat protection areas and exemptions from prohibitions in the Swedish Species Protection Ordinance, where this section is applicable. Some of the decisions in the case files Species Protection had reference to Chapter 7, section 7, which could be explained by the fact that some of the decisions were exemptions from rules in nature reserves. The same reasoning could also explain why a couple of the decisions in the case files Habitat Protection Areas had reference to Chapter 7, section 7.

### 5.1.8. Differences between County Administrative Boards

I wanted to investigate if the use of EC varied between different authorities, since that was one of the conclusions in the previous mapping (Kolb, 2015). I chose to compare the application between CABs in decisions regarding Habitat Protection Areas during 2018. Therefore, I wanted to answer the questions: Does the proportion of decisions regarding Habitat Protection Areas, where EC is demanded during 2018, differ between different CABs? If so, how? And what can be the explanation for this?

The proportion of approvals with demand on EC did differ between the CABs (section 4.1.5), but no pattern could not be seen. I expected there to be a geographical difference between the CABs, due to diffusion (Jordan & Huitema, 2014b) of knowledge between them. I thought that CABs geographically close to each other would work more together and learn from each other, resulting in higher demands on EC in some areas than others. However, this way of diffusion has been challenged (Jordan & Huitema, 2014a), and might explain why no pattern was seen regarding geographical proximity.

Instead, the literature suggests that policies culturally close to the policy makers are more likely to be successful (Jordan & Huitema, 2014b), meaning that there could be other explanations to the differences between the CABs. For example, counties with a longer history of nature conservation might demand EC to a larger extent. As mentioned in the method, I choose to investigate the difference between the CABs by ordering them from north to south in the plot. This was a simple way to investigate if CABs close to each other had similar proportion of approvals with demand on EC. Other approaches could also have been used, for example the CABs could have been grouped in clusters, or it could have been investigated which CABs

[30] 32 § första stycket Förvaltningslag (2017:900).

cooperated with each other on this issue. Unfortunately, I have not been able to investigate this during this thesis.

The differences may also be the result of differences in participation in the development of the handbook by the CABs, since implementation of policies depends on public participation (Eden, 1996). For example, CABs which were more involved in the development of the handbook, might have been more positive towards EC and, as a result, might have demanded compensation to a larger extent. During this thesis, I have not been able to investigate to which extent each CAB participated in the development of the handbook. This is something that a future study could include. It is also possible that CABs which were more successful in spreading the handbook among its public officers demanded EC to a larger extent. However, this has also not been investigated during this thesis.

I also expected that CABs in counties with more agricultural land would demand EC to a larger extent than those with less agricultural land, also as a result of diffusion (Jordan & Huitema, 2014b). I thought that these would have more knowledge in habitat protection areas as well as a larger number of habitat protection areas, leading to both more applications and more approved applications. However, no such pattern could be seen either.

The differences between the CABs could also be explained by the large variation of the number of decisions, which ranges from 0 to 124 decisions. For CABs with very few decisions, such as Södermanland (4), Norrbotten (5), Västernorrland (6), Jämtland (7), and Blekinge (11), even a few approvals would result in a large proportion of approvals with demand on EC. For example, one approval in Norrbotten (with 5 decisions in total) would result in a proportion of approvals of 20%. On the other hand, in a CAB with many decisions, such as Västra Götaland (124), a few approvals would result in a small proportion. For example, 1 approval in Västra Götaland would result in a proportion of less than 1%.

Also, the comparison between the CABs was only based on decisions from one case file and year. As a result, it only offers a part of the potential differences between the CABs. To get a more accurate picture of the use of EC in different counties, a more comprehensive study is needed. I suggest that such study includes decisions from several years and forms of protection.

To sum up, the differences between the CABs, indicate that there is a need for an improved consistency when handling cases across Sweden.

## 5.2. Comparison between 2011–2014 and 2015–2018

For the comparison between the two mappings, only the proportion of approvals with demand on EC was calculated.

### 5.2.1. Approvals with demand on EC

I expected that the demands on EC would increase for the period 2015–2018 compared to 2011–2014 due to the increased focus on EC from the authorities, among others the publication of the Swedish EPA's handbook on EC. However, the proportion of approvals with demand on EC showed no trend between the two mappings (2011–2014 and 2015–2018) for any of the three forms of protection (section 4.2.1–4.2.3). Thus, the second hypothesis "the proportion of decisions with demand on EC has increased for the period 2015–2018 compared to 2011–2014" is not supported.

There are several possible explanations to why there were no trend between the two mappings. One explanation could be that the Swedish EPA's handbook on EC had not been implemented yet. As mentioned previously, the time it takes to implement environmental policies is usually very long, due to the complexity of environmental problems (Mickwitz, 2003). Hence, it might have been too soon to see an increased use of EC, as a result of the publication of the handbook.

It is also possible that the handbook had been implemented among the CABs, but still did not result in an increased use of EC for the period 2015–2018 compared to 2011–2014. Even if there was a trend between the two periods, it would not be possible to determine whether the handbook was the reason for those changes or not, since there are many other factors that might affect the use of EC in Sweden. Another explanation to why no trend could be seen between the two periods, might be due to differences in the methods used in the two mappings. These differences are discussed in section 5.4.2.

When comparing the results from the two mappings (2011–2014 and 2015–2018), I noticed that the proportion of approvals with demand on EC was similar. For both mappings, the smallest proportion of approvals with demand on EC was seen in Protected Areas, and the largest for Habitat Protection Areas, with no significant difference between the two periods (1,5 % respectively 2,9 % for Protected Areas, 4.9 % respective 4.1% for Species Protection, and 83% respectively 73% for Habitat Protection Areas). This also indicated that the handbook on EC has not had a large effect on the use of EC in Sweden.

## 5.3. The goals of the Swedish EPA's handbook

I wanted to investigate if the goals of the Swedish EPA's handbook on EC ("to help increase the use of EC in Sweden" and "to provide a more uniform use of the regulations on EC in the Environmental Code") had been achieved since the publication of the handbook in 2016. As there were no previously collected data to evaluate the second goal, I chose to focus on the first goal of the handbook.

Therefore, I wanted to answer the question: Has the goal "to help increase the use of EC in Sweden" of the Swedish EPA's handbook on EC been achieved?

The proportion of approvals with demand on EC showed no trend for any of the three forms of protection during the period 2015–2018 (section 4.1.1–4.1.3), which means there were no increase in the use of EC in Sweden during this period. Also, there were no differences between the two mappings (2015–2018 and 2011–2014). As a result, the handbook does not seem to have had the desired effect on the use of EC. Hence, the answer to the research question is that the first goal of the handbook "to help increase the use of EC in Sweden" has not been achieved. That the goal of the handbook has not been achieved might be due to that it is too soon to see any effect of the handbook on the use of EC in Sweden.

## 5.4. Evaluation of method

In this section, I discuss why the method was chosen, alternative methods, and problems that arose during the execution of the method. I also suggest some alterations to anyone who wish to repeat the mapping in the future.

### 5.4.1. Choice of method

To map the use of EC and the application of the regulations on EC in the Environmental Code, I chose to do a *systematic evaluation*. This form of policy evaluation, which has increased in popularity during the last decades, is used to determine the impacts of a policy in a systematic and objective way. Systematic evaluations typically involve specifying goals, collecting data on the inputs and outputs of the policy, as well as quantitative approaches and statistical analyses (Anderson 2010). In this thesis, the evaluation was designed to fit the method used by Kolb (2015), to enable comparison between the two mappings (2011–2014 and 2015–2018). Similar methods have also been used by others, for example Persson *et al.* (2015) and Villarroya & Puig (2010). However, Persson *et al.* (2015) also used qualitative data collected through e-mail, phone calls, and two case studies.

To discuss if the goals of the handbook had been achieved, I chose to do a *before-and-after study*. In before-and-after studies, the conditions before and after the implementation of a policy are compared (Anderson, 2010). In this thesis, I compared the application of EC before and after the publication of the Swedish EPA's handbook. Advantages with before-and-after studies include low costs and less time consumption than other approaches (Anderson, 2010). However, due to the large amount of data in this study the process still became very time-consuming. A disadvantage with before-and-after studies is that it is hard to determine if the observed changes are caused by the policy or other factors (Anderson, 2010). As a result, I would not be able to determine if the handbook was the cause of the

potential differences between the two mappings. Therefore, I chose to discuss if the goals of the handbook had been achieved, as well as the possible effect of the handbook.

Other common methods used to evaluate policies are qualitative approaches, including literature studies and interviews. For example, Koh *et al.* (2017) used a combination of case studies, interviews and analysis of legal documents, and as mentioned above, Persson *et al.* (2015) also used qualitative data collected through e-mail, phone calls, and two case studies. Similar approaches could probably have been used to reach the aim of this study. However, to enable comparison between the two mappings (2011–2014 and 2015–2018), I chose to use the same method as Kolb (2015).

### 5.4.2. Execution of method

It was difficult to follow Kolb's method (2015) in a satisfying way, since the description was too general. For example, it did not include what criteria had been used to determine which measures were considered to be EC. As a result, I had to make several assumptions, that might have affected the comparison between the two data sets (see Appendix 4. Method).

In addition, I found errors in Kolb's report (2015). In table 1, I suspect that *the number of decisions with demand on EC* and *the total number of decisions* for Habitat Protection Areas (year 2013) had been mixed together, since the former was larger than the latter (399 respectively 349). To investigate this, I counted *the total number of decisions* in the case file in Modena and found it to be approximately 390, which made me confident that the numbers had been mixed together. Unfortunately, I could not control *the number of decisions with demand on EC* in Kolb's data (2015), as the data was not complete. In table 1, I also noticed that some percentages had been calculated incorrectly.

For Species Protection and Protected Areas, I used a series of keywords to search for decisions with demand on EC in Modena. The advantage of this method is that it is a fast way to find decisions which may have a demand on EC. However, the disadvantage is that the method will not include all decisions with demand on EC. For example, Kolb (2015) reported that decisions regarding Habitat Protection Areas seldom contained the chosen keywords, even though EC had been demanded.

Also, I noticed that some decisions had not been scanned into digitally readable files, and therefore would not result in any matches no matter which keywords were used to search for these decisions. I noticed that this was more common in older decisions. The results reported in this thesis may thus be an underestimation of the actual proportion of decisions with demand on EC, but less underestimated than the proportion in Kolb (2015), since Kolb's mapping included older decisions (2011–2014).

For Habitat Protection Areas, I examined all decisions for the year 2018. The advantage of this approach is that I do not make any deviations from the data and no assumptions, whereas the disadvantage is that it is very time-consuming. Since the data collection was so time-consuming, I decided to only examine 100 random decisions for each year for the period 2015–2017. Since I selected the decisions randomly, it gives an estimate of the data, but there is always a risk to get distorted data with this approach and it is difficult to estimate the extent of the distortion. Examining only 100 decisions can both underestimate and overestimate the proportion of decisions with demand on EC. Compared to using keywords to find decisions to examine, the results from this approach is probably more accurate. Also, it is easy to calculate the corresponding total number of decisions from the 100 selected decisions.

To test how well the 100 randomly selected decisions for 2015–2017 would represent the full dataset, I performed a validation using the data from 2018. I compared 100 randomly selected decisions from 2018 to the full dataset (i.e. all decisions) of the same year and repeated it three times. The variation was approximately ±5 percentage points, which was deemed satisfying. As a result, the method of examining only 100 decisions was used.

This thesis has been delimited to the use of EC in Sweden, and the application of the regulations on EC in the Environmental Code in permits and exemptions for Species Protection, Protected Areas, and Habitat Protection Areas (section 1.3 Delimitations). As a result, only parts of the use of EC in Sweden are covered. There are, for example, several other forms of protection where EC can be demanded in cases of permits and exemptions according to the Environmental Code, several of which was included by Kolb (2015). Even among the three forms of protection in this thesis, it is likely that all decisions were not included.

As I delimited the mapping to decisions available in the Swedish EPA's case management system, there is a risk of missing decisions that should have been submitted to the Swedish EPA by the reviewing authority, but for some reason were not. For example, only a few municipalities had submitted decision to the Swedish EPA, whereas all CABs were represented in the data. It seems more likely that most of the municipalities had not submitted their decisions, than that they had not made any decisions where EC could be demanded. To get a better coverage of the decisions, it would therefore be better if there was a common computer system in which the Swedish EPA could see the decisions made by the CABs and municipalities.

### 5.4.3. Suggested alterations in the method

I suggest a couple of alterations in the method to anyone who wish to repeat this mapping or do a follow-up in the future. I suggest selecting some of the documents to examine, since it was very time-consuming to examine all decisions in a case

file. For example, a sample size of 278 decisions would be needed to get a good estimate of 1,000 decision with 95% confidence level and 5% margin of error (SurveyMonkey, 2019). However, if there is enough time and resources to examine all documents, this is preferred since no deviations are made from the data.

I also suggest that the documents are selected through randomization, as I did for Habitat Protection Areas (2015–2017), instead of searching for decisions with a series of keywords, as I did for Species Protection and Protected Areas. The main reason for this, is that relevant decisions might be sorted out when using keywords and it is difficult to estimate to what extent this may occur. The approach of random selection is a widely used method within scientific research and as long as the sample size is large enough, it will give a good estimate of the entire data set.

Since the data collection was very time-consuming, I also suggest that as much as possible of the collection is automized. During the selection of documents, I realized that it was difficult to extract the data efficiently from Modena. As a result, I had to manually copy and paste more than 3,000 web links into Excel. Early in the process I did attempt to automatically extract data from Modena, but this had to be done by the manufacturers of the case management system and would result in a cost of 15,000 SEK, which was not possible due to a limited budget. However, if I could have extracted this data automatically, I would have saved a lot of time.

The examination of the documents was even more time-consuming than the actual selection of the documents, since I manually examined 1,800 decisions. If the examination process could be automized, for example by using a software which could read the documents digitally and search for index words, a lot of time would be saved. Unfortunately, I think this would be difficult, since there are several challenges associated with this method. For example, the right index words have to be chosen and the fact that the decisions are written differently has to be accounted for. Also, decisions that had not been scanned into digitally readable files, would have to be examined manually or scanned into readable files.

If there is a desire to get a broader picture of the use of EC in Sweden, I also suggest including additional forms of protection, not only decisions regarding Protected Areas, Species Protection and Habitat Protection Areas. Finally, I suggest that the counted decisions are sorted into shorter time periods than a year, for example months or weeks. This approach would result in a larger number of data points, making it easier to perform statistical analyses, such as regression analysis, and perhaps also to see changes over time. Combining this approach with collecting data from a longer time period, would also increase the possibility to see changes over time, which might help evaluate if the handbook has affected the use of EC in Sweden.

## 5.5. Future research

During the making of this thesis, I only found a few Swedish studies that evaluate EC from a policy perspective. Thus, there seems to be a gap between implemented policies on EC and knowledge about their effects on the use of EC in Sweden. To fill this gap, I believe further research is need.

Most urgent is the need to evaluate the effectiveness of EC as a tool for nature conservation since EC has been chosen as one of the main environmental policies to halt biodiversity loss in Sweden. This is especially important since some research suggest that EC is not very effective or has failed to meet the goal of no net loss. For example, Brown & Veneman (2001) showed that wetland construction projects did not meet the requirements to offset wetland losses they were supposed to. In another study, Curran *et al.* (2014) found that EC leads to net loss of biodiversity, which indicates that EC may not be an effective policy to halt biodiversity loss, and perhaps other approaches should be considered.

In many other countries, compensations pools are used as an alternative to EC, for example in Germany and the U.S. (Koh *et al.*, 2019). I would like to see comparative studies on EC and compensation pools in Sweden to see which approach is most effective and to give grounds for formulating potential new policies, as there is limited research concerning this today. For example, a study by Nordin *et al.* (2016) focused on the requirements to implement compensation pools in Sweden, however not on the effectiveness of compensation pools to halt biodiversity loss, and at Södertörns högskola a project on ecological compensation pools in the agricultural landscape is currently being finished (Södertörns högskola, 2019). According to Utredningen om ekologisk kompensation (2017), it is important that experiments with compensation pools are carried out, and hopefully we will see more of these studies in the future.

# 6. Conclusions

The conclusions from this thesis are:

- Ecological compensation is only used to a limited extent and differs between different case files, regarding:
    - to what extent ecological compensation is demanded,
    - to what extent the Swedish Environmental Code is referred to, and
    - to which section in the Swedish Environmental Code there is a reference.
- CABs might demand ecological compensation to different extent.
- There are no differences between the two mappings (2011–2014 and 2015–2018) regarding to what extent ecological compensation is demanded. However, there are some uncertainties due to differences in the methods of the two mappings.
- The handbook on ecological compensation does not seem to have had the desired effect on the use of EC.

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# Appendix 1

Data was collected from the thirteen case files in *Table A1*.

*Table A1. The thirteen case files from which data was collected.*

| Form of protection | Case number | Year |
|---|---|---|
| Species Protection | NV-00118-15 | 2015 |
| Species Protection | NV-00200-16 | 2016 |
| Species Protection | NV-00032-17 | 2017 |
| Species Protection | NV-00026-18 | 2018 |
| | | |
| Protected Areas | NV-00088-15 | 2015 |
| Protected Areas | NV-00064-16 | 2016 |
| Protected Areas | NV-00041-17 | 2017 |
| Protected Areas | NV-00010-18 | 2018 |
| Protected Areas | NV-02616-18 | 2018 |
| | | |
| Habitat Protection Areas | NV-00095-15 | 2015 |
| Habitat Protection Areas | NV-00067-16 | 2016 |
| Habitat Protection Areas | NV-00046-17 | 2017 |
| Habitat Protection Areas | NV-00009-18 | 2018 |

# Appendix 2

Kolb (2015) had collected data from the twelve case files in *Table A2*.

*Table A2. Twelve of the case files, which Kolb (2015) had collected data from.*

| Form of protection | Case number | Year |
|---|---|---|
| Protected Areas | NV-00055-11 | 2011 |
| Protected Areas | NV-00201-12 | 2012 |
| Protected Areas | NV-00138-13 | 2013 |
| Protected Areas | NV-00381-14 | 2014 |
| | | |
| Habitat Protection Areas | NV-00093-11 | 2011 |
| Habitat Protection Areas | NV-00286-12 | 2012 |
| Habitat Protection Areas | NV-00144-13 | 2013 |
| Habitat Protection Areas | NV-00382-14 | 2014 |
| | | |
| Species Protection | NV-00181-11 | 2011 |
| Species Protection | NV-02986-12 | 2012 |
| Species Protection | NV-01255-13 | 2013 |
| Species Protection | NV-00127-14 | 2014 |

# Appendix 3. Validation of Kolb's method

The method used by Kolb (2015) was validated the to see if the method description was understood and applied as intended. Three random case files from Appendix 1 in Kolb (2015) were selected: NV-00201-12, NV-01255-13, and NV-00381-14. *The total number of decisions* and *the number of rejections* in the selected case files were counted according to the description by Kolb (2015). However, for the case file NV-01255-13 (Species Protection), rejections were not counted since Kolb had not counted *the number of rejections* for any of the case files regarding Species Protection. The author was contacted to obtain a more detailed description of the method, which could not be provided.

*The total number of decisions* and *the number of rejections* were then compared to table 1 in Kolb (2015). *The total number of decisions* did not differ much between the two results (*Table A3*), with 961, 707, and 155 counted decisions for Kolb (2015) and 967, 740, and 160 counted decision for the validation. This is a difference of 0.6–4.7%. *The number of rejections*, on the other hand, differed between the two results (*Table A4*), with 14 and 7 counted rejections for Kolb (2015), and 25 and 14 counted rejections for the validation. This is a difference of almost 80% for the case file from 2012 and 100% for the case file from 2014.

*Table A3. Comparison between the total number of decisions counted by Kolb (2015) and in this thesis using Kolb's method.*

| Case file | Case file number | Year | Total number of counted decisions | | Difference | |
|---|---|---|---|---|---|---|
| | | | Kolb | Sjöholm | (number) | (%) |
| Protected Areas | NV-00201-12 | 2012 | 961 | 967 | 6 | 0.6 |
| Protected Areas | NV-00381-14 | 2014 | 707 | 740 | 33 | 4.7 |
| Species Protection | NV-01255-13 | 2013 | 155 | 160 | 5 | 3.2 |

*Table A4. Comparison between the number of rejections counted by Kolb (2015) and in this thesis using Kolb's method.*

| Case file | Case file number | Year | Number of counted rejections | | Difference | |
|---|---|---|---|---|---|---|
| | | | Kolb | Sjöholm | (number) | (%) |
| Protected Areas | NV-00201-12 | 2012 | 14 | 25 | 11 | 78.6 |
| Protected Areas | NV-00381-14 | 2014 | 7 | 14 | 7 | 100 |

Similar results were obtained for *the total number of decisions*, but not for *the number of rejections* even though the method description by Kolb (2015) was followed. There can be several reasons for this. The method description could have been wrongly interpreted during the validation thus causing a difference in results. Another possibility is that Kolb's method description did not contain the proper information needed to repeat the procedure. When the author was contacted it was indicated that the method was written afterwards, which would open the possibility that the method described was not actually the method used when the data was collected. Lastly, the difference could also be due to changes in the way decisions are stored in the Swedish EPA's case management system. However, when asking employees at the Swedish EPA no one knew of such a change, making this explanation less likely.

Based on the results from the validation, it was decided to follow Kolb's method description for counting *the total number of decisions*. It was also decided to alter the method for counting *the number of rejections* by using more keywords when searching for rejections in Modena (see Appendix 4. Method).

# Appendix 4. Method

A *systematic evaluation* (Anderson, 2010) was done to map the use of EC and the application of the regulations on EC in the Environmental Code. To discuss if the goals of the handbook have been achieved, a *before-and-after study* (Anderson, 2010) was done to compare the application before and after the publication of the Swedish EPA's handbook. Consequently, the method consisted of the following two parts: a mapping for the period 2015–2018 and a comparison with the first mapping (2011–2014).

Three types of case files were selected from the first mapping: Species Protection, Protected Areas and Habitat Protection areas. Thirteen case files were found for the period 2015–2018 in the case files management system (see *Table A1*, Appendix 1).

For all formulas that have been used, see Appendix 5. Formulas. For the case files Protected Areas and Habitat Protection Areas, partial approvals/rejections have been treated as approvals. There were no such decisions for the case files Species Protection.

## Mapping 2015–2018

The mapping for the period 2015–2018 was done in three steps: data collection, data processing, and statistics.

### Data Collection

Data was collected from the Swedish EPA's case file management system Modena (version 3.7) from January until May of 2019. Data was collected from permits and exemptions from the thirteen case files (*Table A1*, Appendix 1) for the period 2015-01-01 to 2018-12-31. The data collection can be summarized in the following steps:

1. Selection of documents for examination
2. Examination of selected documents
3. Calculation of the total number of decisions
4. Calculation of the number of rejections

*1. Selection of documents for examination*

Since it was not possible to examine all documents in the case files, and to resemble the method used in first mapping, a selection was made of which documents were going to be examined.

For the case files Species Protection and Protected Areas, documents were selected using a series of keywords. In every case file, the "advanced free text search" function in Modena was used to search for everything with any of the following words: *compensation measure*, *the compensation measure*, *compensation measures*, *compensation*, *compensate*, *compensates*, *compensating* and *compensated* [*kompensationsåtgärd*, *kompensationsåtgärden*, *kompensations-åtgärder*, *kompensation*, *kompenserar* and *kompenseras*]. All matches, i.e. acts and/or documents containing any of these words, were marked in bold in the system and the web links were copied into Excel manually. The web links contained information about case file number, reviewing authority, name of the document, and web address.

During the first mapping, Kolb (2015) had realized that decisions regarding Habitat Protection Areas seldom contained the word "compensation", even though EC had been demanded. As a result, keywords were not used to select documents for the case files Habitat Protection Areas. Instead another search function in Modena was used. In each case file, a search for the act type "decision" was made and all acts containing decisions were marked in bold in the system. The web links of the decisions in the marked acts were then copied manually into Excel. It was later realized that it would not be possible to examine all the selected documents in the case files Habitat Protection Areas and therefore a second selection was made. For the years 2015–2017, a random selection of 100 documents per year was made using the random number generator in Excel.

Formulas were used in Excel to extract the following information from the web links: case file number, reviewing authority, name of the document, and web address. In some cases, it was not possible to extract the reviewing authority from the web links using the formulas and, in those cases, that information was added manually. The name of the case file and the year was also added manually in Excel.

*2. Examination of selected documents*

All the selected documents were opened using the web links in Excel, each one separately, and examined manually. The examination was performed according to *Figure 13* and from each document, the following data was collected:

- Decision (approval, rejection or partial approval/rejection)
- Demand on EC ("yes" or "no")
- Reference to the regulations on EC in the Environmental Code ("yes" or "no")
- Reference to section in the Environmental Code (Chapter 7, section 7, Chapter 7, section 29, and/or Chapter 16, section 9).

Since the mapping was limited to permits and exemptions, it was first examined if each document was a decision. This had to be done since the case files also contained other types of documents. All other types of documents were sorted out, including e-mails, other messages, attachments to decisions, copies of decisions, suggested decisions, corrected decisions, injunctions, applications on reassessment of injunctions, supervisory matters, appeals, prohibitions, applications, dismissals, decisions on creation of nature reserves, decisions on introduction of habitat protection areas, exemptions on terrain driving, and exemptions from the law regarding terrain driving. An exception was made for protocols from municipality committee meetings, as they contain one or more decisions.

EC can only be demanded in approvals (or partial approvals). For that reason, all decisions that were not approvals did not have to be investigated for EC. Furthermore, reference to the regulations on EC in the Environmental Code can only be made in approvals (or partial approvals) with demand on EC. As a result, approvals that did not have a demand on EC did not have to be investigated for reference to the Environmental Code.

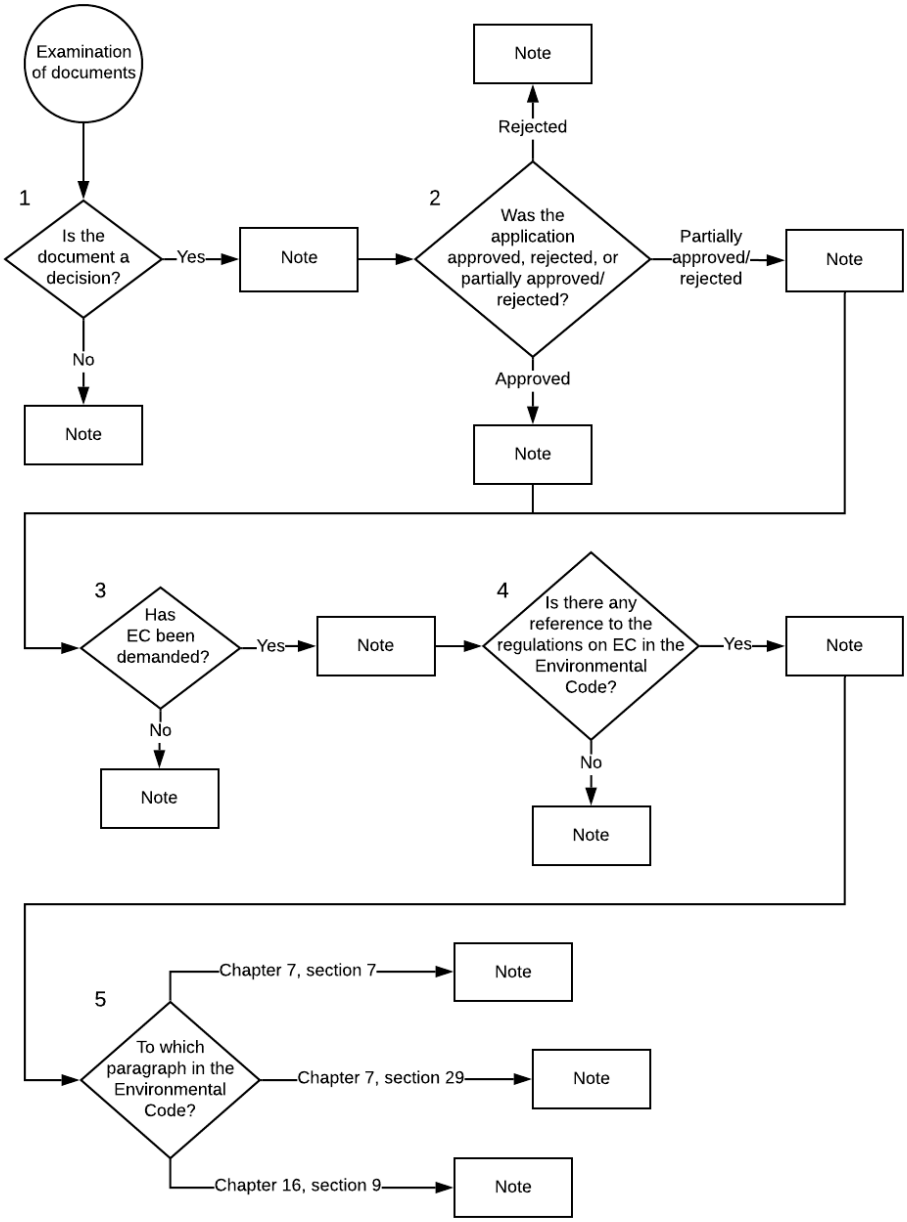


*Figure 13. Flow chart describing the examination process of the selected documents. Each document is examined separately in the following order: (1) it is determined whether the document is a permit and/or an exemption, (2) if it is a decision, it is determined whether the decision is an approval, a rejection, or a partial approval/rejection, (3) if the decision is an approval or a partial approval/ rejection, it is determined whether EC has been demanded, (4) if EC has been demanded, it is determined whether the reviewing authority has referred to the regulations on EC in the Environmental Code, and (5) if so, to which section in the Environmental Code.*

To make sure the examination was consistent for all documents, a set of criteria was decided during the beginning of the examination process. The first criterion was that the measure that was applied for could not be EC. For example, in an application to build a wetland, the measure to build the wetland cannot be deemed as EC, as this is the measure that is being applied for. However, if the reviewing

authority demands that another wetland should be built at another location, the second wetland could be deemed as EC.

Another important criterion was to primarily use the assessment of the reviewing authority. If the reviewing authority had deemed a measure to be EC, by explicitly writing this in the decision, it was deemed as EC. However, if the reviewing authority had not expressed a demand on EC, it had to be determined whether the measure 1) had any demands and 2) if these demands were EC.

The following measures were considered to be EC:

- Building wetland, pond, or ditch
- Widening of ditch
- Replanting trees/planting new trees
- Fauna depot/placing of dead wood
- Creating tree snag
- Creating stone wall/cairn/non-arable outcrop
- Elongating an already existing stone wall
- Adding stones to an already existing stone wall
- Moving a cairn
- Maintenance
- Irrigation
- Zone free from agriculture
- Impact attenuator/collision protection
- Damage protection (e.g. roe deer protection)
- Placement of nesting boxes for e.g. bats and insects
- Moving seeds, plants, vegetation layer and topsoil layer
- Replanting plants/planting new plants
- Reed cutting
- Roadside mowing

The following measures were not considered to be EC:

- Reporting findings to the County Administrative Board

- Reporting findings to the Swedish Species Observation System (*Artportalen*)
- Knowledge

No description of which criteria that had been used by Kolb (2015) during the first mapping (2011–2014) could be found.

*3. Calculation of the total number of decisions*

*The total number of decisions* in each case file had to be calculated to be able to calculate *the number of approvals* (see
).

For the case files Species Protection, a search for the act type "decision" was made in Modena and all matches, i.e. all acts that contained decisions, were marked in bold in the system and counted manually. The same procedure was done for the case files Protected Areas. However, in these cases some decisions were found that did not belong to the case file (in the folders called "wrongly distributed decisions"), which were excluded. For the year 2018, there were two case files for Protected Areas. To get *the total number of decisions* for this year, the number of decisions from the two case files were added together.

For the case files Habitat Protection Areas, a search for the act type "decision" had already been made during the selection of documents for examination (step 1 of the data collection). Instead, the documents that had been saved in Excel were counted during this step. During the examination of selected documents (step 2 of the data collection) it was discovered that some of the documents were not decisions. For that reason, an adjustment was made to get the number of decisions instead of the number of documents (see below).

For the years 2015–2017, *the total number of decisions* in each case file was calculated using formula 1. The data in Excel was used to count *the total number of documents* in each case file (in formula 1), whereas *the proportion of examined decisions* in each case file (in formula 1) was calculated using formula 2. The data in Excel was used to count *the total number of examined documents* in each case file (in formula 2 and 3 (see below)), whereas *the number of examined decisions* in each case file (in formula 2) was calculated using formula 3. The data in Excel was used to count *the number of documents that are not decisions* in each case file (in formula 3). *The total number of examined documents* in each case file (in formula 3) had already been counted (see above).

Since all decisions for the year 2018 had been examined during the examination of selected documents (step 2 of the data collection) *the total number of decisions* was the same as *the number of examined decisions*. *The number of examined decisions* in the case files was calculated using formula 3. The data in Excel was

used to count *the total number of examined documents* and *the number of documents that are not decisions* in the case file (in formula 3).

$$\begin{aligned}\text{Total number of decisions} &= \text{Total number of documents} \\ &* \text{Proportion of examined decisions}\end{aligned} \quad (1.)$$

$$\text{Proportion of examined decisions} = \frac{\text{Number of examined decisions}}{\text{Total number of examined documents}} \quad (2.)$$

$$\begin{aligned}\text{Number of examined decisions} &= \text{Total number of examined documents} \\ &- \text{Number of documents that are not decisions}\end{aligned} \quad (3.)$$

*4. Calculation of the number of rejections*

As with *the total number of decisions*, *the number of rejections* in each case file had to be calculated to be able to calculate *the number of approvals* (see
).

Since it was not possible to go through all documents in the case files, a selection of documents to examine for rejections was made. During the validation of Kolb's method (see Appendix 3. Validation of Kolb's method) it had been detected that several rejections had been missed during the first mapping. As a result, more keywords were used to select documents. After the documents had been selected, each document was examined manually to confirm that it was a rejection. No manual examination was described by Kolb (2015) in the first mapping.

For the case files Species Protection and Protected Areas, documents were selected using a series of keywords. In each case file, the "advanced free text search" function in Modena was used to search for everything with any of the following words: *reject*, *rejects*, *rejecting*, *rejection*, *not approved*, *do not approve*, *not granted*, and *do not grant [avslår*, *avslå*, *avslag*, *medges ej*, *medges inte*, *medger ej*, *medger inte*, *beviljas ej*, *beviljas inte*, *beviljar ej* and *beviljar inte*]. All matches, i.e. acts and/or documents containing any of these words, were marked in the system. Web links to the following documents were copied into Excel manually: marked documents (if there were several documents in the act the one named "decision" was selected), documents in an marked act (if there were several documents in the act the one named "decision" was selected), and documents with the file name "decision" for which the act was not marked, but another document in the act was. This was done to include any decisions that had not been scanned into digitally readable files, and therefore would not result in any match.

All selected documents were opened using the web links in Excel and were examined manually according to *Figure 14*. The examination included a series of

steps to ensure that the examination process was the same for all documents. First, it was investigated if the document was a decision, since the mapping was limited to permits and exemptions. As with the examination of selected documents (step 2 of the data collection), this had to be done since the case files contained other types of documents as well. All other types of documents were sorted out, including e-mails, attachments to decisions, copies of decisions, suggested decisions, corrected decisions, injunctions, supervisory matters, appeals, rejections of appeals, prohibitions, interim prohibitions, prolonged prohibitions, reversals of prohibitions, exemptions on water protection areas, and prohibition of access to wildlife and bird sanctuaries. Then, it was investigated whether each document was an approval, rejection, or partial approval/rejection.

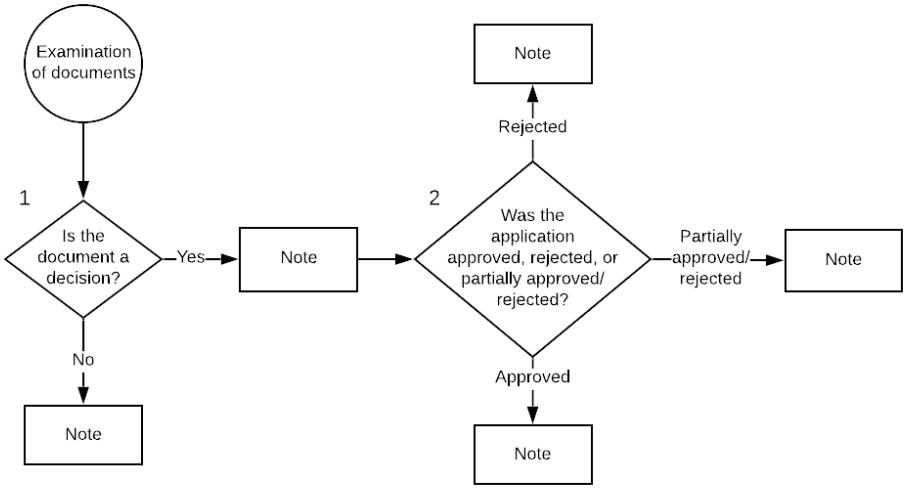


*Figure 14. Flow chart describing the examination process to determine if the selected documents are rejections. Each document is examined separately in the following order: (1) it is determined whether the document is a permit and/or an exemption, (2) if it is a decision, it is determined whether the decision is an approval, a rejection, or a partial approval/rejection.*

The data in Excel was then used to count the *number of rejections* in each case file. For the year 2018, there were two case files for Protected Areas and to get *the number of rejections* for the year *the number of rejections* in the two case files were added together.

For the case files Habitat Protection Areas, the documents to examine had already been selected during the selection of documents for examination (step 1 of the data collection). The documents had also already been examined during the examination of selected documents (step 2 of the data collection) to determine whether they were rejections. As a result, *the number of rejections* in each case file was calculated using the collected data. For the years 2015–2017, *the number of rejections* in each case file was calculated using formula 4. *The proportion of rejections* in each case file (in formula 4) was calculated using formula 5. *The*

*number of rejections* in each case file (in formula 5) was calculated using formula 6. *The number of examined decisions* in each case file (in formula 5, 6 and 2 (see below)) was calculated using formula 3. The data in Excel was used to count *the number of approvals* in each case file (in formula 6). *The number of examined decisions* in each case file (in formula 6) had already been calculated using formula 3 (see above). The data in Excel was used to count *the total number of examined documents* in each case file (in formula 3 and 2 (see below)) and *the number of documents that are not decisions* in each case file (in formula 3). *The total number of decisions* in each case file (in formula 4) was calculated using formula 1. The data in Excel was used to count the *total number of documents* in each case file (in formula 1), whereas *the proportion of examined decisions* in each case file (in formula 1) was calculated using formula 2. *The number of examined decisions* in each case file (in formula 2) had already been calculated using formula 3 (see above). The data in Excel had already been used to count *the total number of examined documents* in each case file (in formula 2 (see above)).

$$\text{Number of rejections} = \text{Proportion of rejections} \cdot \text{Total number of decisions} \quad (4.)$$

$$\text{Proportion of rejections} = \frac{\text{Number of rejections}}{\text{Number of examined decisions}} \quad (5.)$$

$$\text{Number of rejections} = \text{Number of examined decisions} - \text{Number of approvals} \quad (6.)$$

All decisions for the year 2018 had been examined during the examination of selected documents (step 2 of the data collection). *The number of rejections* was calculated using formula 6. *The number of examined decisions* in the case file (in formula 6) was calculated using formula 3. The data in Excel was used to count *the number of approvals* in the case file (in formula 6). The data in Excel was used to count both *the total number of examined documents* and *the number of documents that are not decisions* in the case file (in formula 3).

## Data processing

The collected data in Excel was used to:

- Calculate the proportion of approvals with demand on EC
- Calculate the proportion of demands on EC with reference to the Environmental Code
- Calculate the proportion of demands on EC with reference to the regulations Chapter 7, section 7 and 29, and Chapter 16, section 9 in the Environmental Code

- Compare the use of EC between different CABs

*Approvals with demand on EC*

To determine to what extent EC had been demanded in all decisions where EC could be demanded (i.e. all approvals), the *proportion of approvals with demand on EC* was calculated.

For all case files, *the proportion of approvals with demand on EC* for each year was calculated using formula 7. For the case files Species Protection and Protected Areas, the data in Excel was used to count *the number of approvals with demand on EC* in each case file (in formula 7), whereas *the number of approvals* in each case file (in formula 7) was calculated using formula 8. *The total number of decisions* in each case file (in formula 8) had already been calculated in step 3 of the data collection (see above) and *the number of rejections* in each case file (in formula 8) had already been calculated in step 4 of the data collection (see above). For the case files Habitat Protection Areas, the data in Excel was used to count both *the number of approvals with demand on EC* and *the number of approvals* in each case file (in formula 7).

$$\text{Proportion of approvals with demand on EC} = \frac{\text{Number of approvals with demand on EC}}{\text{Number of approvals}} \quad (7.)$$

$$\text{Number of approvals} = \text{Total number of decisions} - \text{Number of rejections} \quad (8.)$$

*The proportion of approvals with demand on EC* was plotted against *year* for all case files of the same type (Species Protection, Protected Areas, and Habitat Protection Areas).

*Demands on EC with reference to the Environmental Code*

*The proportion of demands on EC with reference to the Environmental Code* was calculated. This was done to determine to what extent that the reviewing authority referred to the Environmental Code, out of all decisions where there should be reference to the Environmental Code (i.e. all approvals with demand on EC). For all case files, *the proportion of demands on EC with reference to the Environmental Code* was calculated using formula 9. The data in Excel was used to count both *the number of demands on EC with reference to the Environmental Code* and the *number of approvals with demand on EC* in each case file (in formula 9).

$$\text{Proportion of demands on EC with reference to the Environmental Code} = \frac{\text{Number of demands on EC with reference to the Environmental Code}}{\text{Number of approvals with demand on EC}} \quad (9.)$$

*The proportion of demands on EC with reference to the Environmental Code* was plotted against *year* for all case files of the same type (Species Protection, Protected Areas, and Habitat Protection Areas).

*Reference to section in the Environmental Code*

To investigate to what extent the regulations Chapter 7, section 7 and 29, and Chapter 16, section 9 in the Environmental Code had been referred to, *the proportion of demands on EC with reference to section in the Environmental Code* was calculated for each section separately.

For all case files, *the proportion of demands on EC with reference to section in the Environmental Code* was calculated using formula 10. Data from all years for the period 2015–2018 were used in formula 10, instead of calculating each year separately as in the other formulas. For the case files Species Protection and Protected Areas, the data in Excel was used to calculate *the number of demands on EC with reference to section in the Environmental Code* in each case files (in formula 10), which were then added together. The same procedure was done for *the number of demands on EC with reference to the Environmental Code* in each case files (in formula 10). For Protected Areas, there were two case files for the year 2018 and to get *the number of demands on EC with reference to section in the Environmental Code* for this year, the number in the two case files were added together. The same procedure was done for *the number of demands on EC with reference to the Environmental Code* for this year.

$$\text{Prop. of demands on EC with ref. to section in the Env. Code for the period 2015 2018} = \frac{\sum \text{Number of demands on EC with ref. to section in the Env. Code (2015 2018)}}{\sum \text{Number of demands on EC with ref. to the Env. Code (2015 2018)}} \quad (10.)$$

For the case files Habitat Protection Areas, the data for the years 2015–2017 consisted of approximately 100 randomly selection decisions, whereas the data for the year 2018 consisted of all decisions for that year. As a result, *the number of demands on EC with reference to section in the Environmental Code* in each case file (in formula 10) was calculated in different ways before they were added together (see below). The same procedure was done for *the number of demands on EC with reference to the Environmental Code* in each case file (in formula 10).

For the years 2015–2017, *the number of demands on EC with reference to section in the Environmental Code* in each case file (in formula 10) was calculated using formula 11. The data in Excel was used to count *the number of demands on EC with reference to section in the Environmental Code* in each case file (in formula 11), whereas *the total number of decisions* in each case file (in formula 11) was calculated using formula 1. The data in Excel was used to count *the total number of documents* in each case file (in formula 1), whereas *the proportion of examined decisions* in each case file (in formula 1) was calculated using formula 2. *The*

*number of examined decisions* in each case file (in both formula 11 and 2), was calculated using formula 3. The data in Excel was used to count both *the total number of examined documents* in each case file (in formula 3 and 2) and *the number of documents that are not decisions* in each case file (in formula 3).

$$\text{Number of demands on EC with reference to section in the Environmental Code} = \text{Number of demands on EC with reference to section in the Environmental Code} \cdot \left(\frac{\text{Total number of decisions}}{\text{Number of examined decisions}}\right) \quad (11.)$$

For the same period, *the number of demands on EC with reference to the Environmental Code* in each case file (in formula 10) was calculated using formula 12. *The proportion of demands on EC with reference to the Environmental Code* in each case file (in formula 12) was calculated using formula 13. The data in Excel was used to count *the number of demands on EC with reference to the Environmental Code* in each case file (in formula 13), whereas *the number of examined decisions* in each case file (in both formula 13 and 2 (see below)) was calculated using formula 3. The data in Excel was used to count both *the total number of examined documents* in each case file (in formula 3 and 2) and *the number of documents that are not decisions* in each case file (in formula 3). *The total number of decisions* in each case file (in formula 12) was calculated using formula 1. The data in Excel was used to count *the total number of documents* in each case file (in formula 1), whereas *the proportion of examined decisions* in each case file (in formula 1) was calculated using formula 2. *The number of examined decision* and *the total number of examined documents* in each case file (in formula 2) had already been calculated using formula 3 (see above).

$$\text{Number of demands on EC with reference to the Environmental Code} = \text{Proportion of demands on EC with reference to the Environmental Code} \cdot \text{Total number of decisions} \quad (12.)$$

$$\text{Proportion of demands on EC with reference to the Environmental Code} = \frac{\text{Number of demands on EC with reference to the Environmental Code}}{\text{Number of examined decisions}} \quad (13.)$$

For the year 2018, the data in Excel was used to count both *the number of demands on EC with reference to section in the Environmental Code* and *the number of demands on EC with reference to the Environmental Code* in each case file (in formula 10).

*Differences between County Administrative Boards*

To compare to what extent the CABs demanded EC, out of all decisions where they could demand EC (i.e. all approvals), *the proportion of approvals with demand on EC* was calculated for all 21 CABs. To do this, all decisions in the case file had to be examined, which was only done for one case file (Habitat Protection Areas, year 2018).

*The proportion of approvals with demand on EC* for each CAB, was calculated using formula 7. The data in Excel was used to count both *the number of approvals with demand on EC* for each CAB (in formula 7) and *the number of approvals* for each CAB (in formula 7 and formula 14 (see below)).

*The proportion of approvals with demand on EC* for the case file Habitat Protection Areas for 2018 was plotted against *CAB* to investigate if the application of the regulations on EC in the Environmental Code varied between different authorities (the first research question). The CABs were ordered from north to south (based on the location of the county town) to investigate if there were any north-south gradient. *The proportion of approvals with demand on EC* was also plotted against the *area of agricultural land* in each county to investigate if there were any correlation between the amount of agricultural land in each county and to what extent EC is demanded. *The number of approvals* was added in brackets after the CAB to illustrate the relationship between the proportion of approvals and the number of approvals.

Also, *the proportion of approvals* for each CAB was calculated using formula 14. *The number of approvals* for each CAB (in formula 14) had already been calculated (see above) and the data in Excel was used to count *the total number of decisions* for each CAB (in formula 14).

$$\text{Proportion of approvals} = \frac{\text{Number of approvals}}{\text{Total number of decisions}} \qquad (14.)$$

## Statistics

Statistical analyses were done using RStudio (version 1.2.1335). To investigate whether the proportion of decisions with demand on EC had increased during the period 2015–2018, for Species Protection, Protected Areas, and Habitat Protection Areas respectively (hypothesis 1), linear regression analysis was performed for each form of protection using the *lm* function in RStudio. Linear regression analysis was also performed for each form of protection to investigate if the proportion of decisions where the reviewing authority had referred to the legislations on EC in the Environmental Code had increased during the period 2015–2018 (hypothesis 4). Again, the *lm* function was used. This was done even though there were only one data point per year, i.e. four data points in total (see Discussion).

To investigate if the proportion of decisions with demand on EC differed between cases of Species Protection, Protected Areas and Habitat Protection Areas (hypothesis 3), a Wilcoxon rank sum test was performed between each pair. Here, the *wilcox.test* function was used. The same procedure was done for the proportion of demands on EC with reference to the regulations on EC in the Environmental Code.

# Comparison 2011–2014 and 2015–2018

The use of EC was mapped for the period 2015–2018 and compared to data from the first mapping (2011–2014).

## Data collection

Data for the period 2011-01-01 to 2014-10-05 from the first mapping was compared to parts of the collected data from the mapping 2015–2018 (data for the period 2015-01-01 to 2018-10-05). The data from the last three months (2018-10-06 to 2018-12-31) of the mapping 2015–2018 were excluded from the comparison, to make the comparison as accurate as possible. The majority of the data that was used in the comparison of the two mappings had already been collected during step 1 and 2 of the data collection for the mapping 2015–2018. However, *the total number of decisions* (in step 3 of the data collection) and *the number of rejections* (in step 4 of the data collection) had to be re-calculated to match the shorter time period.

*The total number of decision* (in step 3 of the data collection) was counted in a similar way as in the mapping for 2015–2018. For the case files Species Protection, *the total number of decisions* was counted in the same way as in the mapping for 2015–2018. The same procedure was done for the case files Protected Areas, but this time the decisions that had been found that did not belong to the case file (in the folders called “wrongly distributed decisions”) were not excluded. This was done to make the methods as similar as possible, since no such adjustment was mentioned by Kolb (2015). For the case files Habitat Protection Areas, *the total number of decisions* for the years 2015–2017 was calculated in the same way as for the case files Species Protection in the mapping 2015–2018. For the year 2018, *the total number of decisions* was calculated in the same way as for the case file Habitat Protection Areas for 2018 in the mapping for 2015–2018.

*The number of rejections* (in step 4 of the data collection), was counted in a similar way as in the mapping for 2015–2018. For the case files Species Protection, *the number of rejections* were not counted, as there was no such data presented by Kolb (2015). For the case files Protected Areas, *the number of rejections* was calculated in the same way as in the mapping for 2015–2018. For the case files Habitat Protection Areas, *the number of rejections* was calculated in a similar way

as in the mapping for 2015–2018. For the years 2015–2017, the same procedure was followed as for the mapping for 2015–2018, but with the difference that *the total number of decisions* in formula 4 had already been calculated in step 3 of the data collection. As a result, formula 1 and 2, did not have to be used here. For the year 2018, *the number of rejections* was calculated in the same way as in the mapping for 2015–2018.

## Data processing

The collected data in Excel (for the period January of 2015 to October of 2018) and the data from the first mapping (January of 2011 to October of 2014), was used to calculate *the proportion of approvals with demand on EC* for the two periods.

*Approvals with demand on EC*

To determine to what extent EC had been demanded, out of all decisions where EC could be demanded (i.e. all approvals), *the proportion of approvals with demand on EC* was calculated.

For the case files Species Protection (both periods), *the proportion of approvals with demand on EC* was calculated using formula 15. For the period January of 2011 to October of 2014, both *the number of approvals with demand on EC* and *the total number of decisions* in each case file (in formula 15) was collected from Kolb (2015). For the period January of 2015 to October of 2018, the data in Excel was used to count *the number of approvals with demand on EC* in each case file (in formula 15). *The total number of decisions* in each case file (in formula 15) had already been calculated in step 3 of the data collection (see above). Formula 7, which was used in the mapping for the period 2015–2018, was not used here since the *number of rejections* for the case files Species Protection was not presented by Kolb (2015).

$$\text{Proportion of approvals with demand on EC} = \frac{\text{Number of approvals with demand on EC}}{\text{Total number of decisions}} \quad (15.)$$

For the case files Protected Areas (both periods), *the proportion of approvals with demand on EC* was calculated using formula 7, which is the same formula that was used in the mapping for the period 2015–2018. For the period January of 2011 to October of 2014, *the number of approvals with demand on EC* in each case file (in formula 7) was collected from Kolb (2015), whereas *the number of approvals* in each case file (in formula 7) was calculated using formula 8. *The total number of decisions* and *the number of rejections* in each case file (in formula 8), was collected from Kolb (2015). For the period January of 2015 to October of 2018, the data in Excel was used to count *the number of approvals with demand on EC* in each case

file (in formula 7), whereas *the number of approvals* in each case file (in formula 7), was calculated using formula 8. *The total number of decisions* in each case file (in formula 8) had already been calculated in step 3 of the data collection (see above) and *the number of rejections* in each case file (in formula 8) had already been calculated in step 4 of the data collection (see above).

For the case files Habitat Protection Areas (both periods), *the proportion of approvals with demand on EC* was also calculated using formula 7. For the period January of 2011 to October of 2014, *the number of approvals with demand on EC* in each case file (in formula 7) was collected from Kolb (2015), whereas *the number of approvals* in each case file (in formula 7) was calculated using formula 8. *The total number of decisions* and *the number of rejections* in each case file (in formula 8) were collected from Kolb (2015).

For the period 2015–2017, *the number of approvals with demand on EC* in each case file (in formula 7) was calculated using formula 16. *The total number of decisions* in each case file (in formula 16) had already been calculated in step 3 of the data collection (see above) and *the proportion of approvals with demand on EC* in each case file (in formula 16) was calculated using formula 17. The data in Excel was used to count *the number of approvals with demand on EC* in each case file (in formula 17), whereas *the number of examined decisions* in each case file (in both formula 17 and 16 (see below)) was calculated using formula 3. The data in Excel was used to count both *the total number of examined documents* and *the number of documents that are not decisions* in each case file (in formula 3). *The number of approvals* in each case file (in formula 7) was calculated using formula 18. *The total number of decisions* in each case file (in formula 18) had already been calculated in step 3 of the data collection (see above) and *the proportion of approvals* in each case file (in formula 18) was calculated using formula 19. The data in Excel was used to count *the number of approvals* in each case file (in formula 19). *The number of examined decisions* in each case file (in formula 19) had already been calculated using formula 3 (see above).

For the period January to October of 2018, the data in Excel was used to count *the number of approvals with demand on EC* and *the number of approvals* in the case file (in formula 7).

$$\begin{aligned}\text{Number of approvals with demand on EC} &\\ = \text{Total number of decisions} &\\ \cdot \text{Proportion of approvals with demand on EC} &\end{aligned} \tag{16.}$$

$$\begin{aligned}\text{Proportion of approvals with demand on EC} &\\ = \frac{\text{Number of approvals with demand on EC}}{\text{Number of examined decisions}} &\end{aligned} \tag{17.}$$

$$\text{Number of approvals} = \text{Total number of decisions} \cdot \text{Proportion of approvals} \quad (18.)$$

$$\text{Proportion of approvals} = \frac{\text{Number of approvals}}{\text{Number of examined decisions}} \quad (19.)$$

For each period (2011–2014 and 2015–2018), *the proportion of approvals with demand on EC* was plotted against *year* for all case files of the same type (Species Protection, Protected Areas, and Habitat Protection Areas).

## Statistics

Statistical analyses were done using RStudio (version 1.2.1335). To investigate if the proportion of decisions with demand on EC had increased for the period 2015–2018 compared to 2011–2014 (hypothesis 2), Wilcoxon rank sum test was performed for each form of protection using the *wilcox.test* function in RStudio. In addition, linear regression analysis was performed for Species Protection, Protected Areas, and Habitat Protection Areas respectively during each mapping to give a better understanding of the proportion of decisions with demand on EC for each form of protection. Here, the *lm* function was used.

# Appendix 5. Formulas

Overview over the formulas which were used during the data collection and data processing. Reference to the Environmental Code refers to Chapter 7, section 7 and 29, and Chapter 16, section 9 in the Environmental Code.

$$\begin{aligned}\text{Total number of decisions} &= \text{Total number of documents} \\ &\cdot \text{Proportion of examined decisions}\end{aligned} \tag{1.}$$

$$\text{Proportion of examined decisions} = \frac{\text{Number of examined decisions}}{\text{Total number of examined documents}} \tag{2.}$$

$$\begin{aligned}\text{Number of examined decisions} &= \text{Total number of examined documents} \\ &- \text{Number of documents that are not decisions}\end{aligned} \tag{3.}$$

$$\text{Number of rejections} = \text{Proportion of rejections} \cdot \text{Total number of decisions} \tag{4.3.}$$

$$\text{Proportion of rejections} = \frac{\text{Number of rejections}}{\text{Number of examined decisions}} \tag{5.}$$

$$\text{Number of rejections} = \text{Number of examined decisions} - \text{Number of approvals} \tag{6.}$$

$$\begin{aligned}\text{Proportion of approvals with demand on EC} &= \frac{\text{Number of approvals with demand on EC}}{\text{Number of approvals}}\end{aligned} \tag{7.}$$

$$\text{Number of approvals} = \text{Total number of decisions} - \text{Number of rejections} \tag{8.}$$

$$\text{Proportion of demands on EC with reference to the Environmental Code} = \frac{\text{Number of demands on EC with reference to the Environmental Code}}{\text{Number of approvals with demand on EC}} \quad (9.)$$

$$\text{Proportion of demands on EC with reference to section in the Environmental Code for the period 2015 2018} = \frac{\sum \text{Number of demands on EC with reference to section in the Environmental Code (2015 2018)}}{\sum \text{Number of demands on EC with reference to the Environmental Code (2015 2018)}} \quad (10.)$$

$$\text{Number of demands on EC with reference to section in the Environmental Code} = \text{Number of demands on EC with reference to section in the Environmental Code} \cdot \left(\frac{\text{Total number of decisions}}{\text{Number of examined decisions}}\right) \quad (11.)$$

$$\text{Number of demands on EC with reference to the Environmental Code} = \text{Proportion of demands on EC with reference to the Environmental Code} \cdot \text{Total number of decisions} \quad (12.)$$

$$\text{Proportion of demands on EC with reference to the Environmental Code} = \frac{\text{Number of demands on EC with reference to the Environmental Code}}{\text{Number of examined decisions}} \quad (13.)$$

$$\text{Proportion of approvals} = \frac{\text{Number of approvals}}{\text{Total number of decisions}} \quad (14.)$$

$$\text{Proportion of approvals with demand on EC} = \frac{\text{Number of approvals with demand on EC}}{\text{Total number of decisions}} \quad (15.)$$

$$\text{Number of approvals with demand on EC} = \text{Total number of decisions} \cdot \text{Proportion of approvals with demand on EC} \quad (16.)$$

$$\text{Proportion of approvals with demand on EC} = \frac{\text{Number of approvals with demand on EC}}{\text{Number of examined decisions}} \quad (17.)$$

$$\text{Number of approvals} = \text{Total number of decisions} \cdot \text{Proportion of approvals} \quad (18.)$$

$$\text{Proportion of approvals} = \frac{\text{Number of approvals}}{\text{Number of examined decisions}} \tag{19.}$$

# Appendix 6. Data

The collected data was gathered in Excel. The Excel document is available in the Swedish EPA's case file system (case number NV-06301-19) and can be requested by anyone.