

# Biodiversity in the Fray: The European Union's Struggle to Protect a Shared Resource

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## **Abstract**

Biodiversity, a measure of diversity of life and ecosystem health, is an important part of the global commons. Biodiversity is a major challenge encompassing environmental, economic and social constraints that have resulted in unprecedented extinction rates. While there is a general lack of economic and social value attributed to biodiversity, the European Union has been a global environmental leader in this area, providing a unique case study of addressing biodiversity loss through concerted action. This paper analyzes EU policy to see what methods work to halt biodiversity loss, and which methods need improvement. After examining specific policy initiatives, the paper then concludes that while the EU has made strides in some areas, such as habitat protection, it lacks a more holistic approach that addresses the range of factors that reduce biodiversity, and this is why it has been unsuccessful at halting biodiversity loss.

## Introduction

What can governing bodies do to protect biodiversity? How effective are current policies to halt biodiversity loss? Biodiversity around the world is under threat with unprecedented extinction rates and loss of genetic diversity, and many ecosystems are experiencing severe degradation. There is no indication that efforts to prevent biodiversity loss are working as species continue to face unprecedented extinction rates. Thus, it is important to understand what governments and international organizations can do to reverse the widespread loss of biodiversity. This paper uses the European Union and its policies as a model for understanding what institutional actions can be taken to protect biodiversity and then evaluates the successes and failures of EU policy towards meeting this goal.

As a measure of diversity of life and ecosystem health, biodiversity is an important natural resource, providing ecosystems services such as food, building materials, air purification, water purification, and recreational value. Biodiversity can be understood as part of the global commons, a term that refers to resources that are universally shared by all of humanity. Common resources are often depleted because economically self-interested individuals collectively over-consume them.

This tragedy of the commons can be seen with the common resource of biodiversity, as with degradation of the atmosphere, oceans, and other natural resources. It is important to prevent the tragedy of the commons and protect biodiversity, but this has proved to be an elusive task. Using biodiversity as an example is illustrative for learning how to prevent the tragedy of the commons for biodiversity and for other components of the global commons as well. Understanding the tragedy of the commons illustrates why biodiversity loss occurs and also helps to learn what to do about it.

Joachim Spangenberg identifies several levels of biodiversity: systems diversity, species diversity, and genetic diversity.<sup>1</sup> From these levels, it is easier to identify the trends in biodiversity loss, as well as the causes and solutions. In ecosystems, biodiversity loss is primarily driven by human interference through exploitation and changing geo-chemical and climatic frameworks. At the species level, biodiversity loss is driven through habitat fragmentation, competition with invasive species, and eco-toxics. At the genetic level, diversity is lost through selective pressures in a changing environment, genetic pollution through modification, and reduction of population numbers. All three of the levels of biodiversity are important for protection, as they each contribute to overall biodiversity. Losing biodiversity on any level is a large problem for ecosystem health and needs to be dealt with to protect ecosystems and ecosystem services.

Biodiversity is important for several reasons that have direct impacts for humans. Some species, for instance, have medicinal properties, and it is important to preserve them so they can be used for health promotion. Many plants and animals provide other valuable services- preventing erosion, moderating each other's populations, and maintaining a general equilibrium in the world. Genetic diversity makes a species more resilient, and having a variety of species makes an ecosystem healthier. Healthy ecosystems resist disease, which allows them to be used later for lumber, hunting, fishing, or hiking, to name only a few ways that the surrounding environment is a boon to human standard of living. Additionally, ecosystems have evolved to be in equilibrium with their climates and surroundings, and disturbing this balance can have unforeseen consequences, such as extinction waves, erosion and flooding, and decreases in primary productivity.

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<sup>1</sup> (Spangenberg, 2007)

Ferraro & Kiss suggest that direct institutional intervention has proven to be the most effective way to protect the environment and is the best way to address biodiversity loss in terms of ability, cost, benefits, and sustainability.<sup>2</sup> In a broader international context, various efforts have been made to protect biodiversity on a global scale, but these have yet to demonstrate results and prove Ferraro & Kiss' point. For example, the Biodiversity Convention, which emerged in 1992, is one of the main international attempts to protect biodiversity. However, since compliance is voluntary, and it lacks targets and timetables, the overall effect in mitigating biodiversity loss has been minimal, and biodiversity loss has continued despite the international agreement.

The Biodiversity Convention is an example of the failures to date of the international system in adequately protecting biodiversity. While international institutions have the potential to be a credible method for protecting biodiversity, they can only be truly successful if they clearly define and enforce the rules to ensure compliance with international agreements and promote credible commitments. There is currently no example of successful protection of biodiversity at either a national or international level, which is a large oversight.

Knowing this, the European Union has taken it upon itself to manage and protect biodiversity. Europe is often seen as a bastion of important environmental policy initiatives, and it has collectively been one of the key drivers for environmental protection. From the Stockholm Convention on the Human Environment in 1972 to Copenhagen in 2009, Europe has hosted environmental conferences, promoted environmental measures, and generally led the effort to protect the natural world from anthropogenic harm. Both at the regional and domestic level, European states have collectively played an important role in promoting environmental protection and sustainability around the world. With its reputation on the line, the EU wants to

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<sup>2</sup> (Ferraro & Kiss, 2002)

take significant steps to halt biodiversity loss and continue to lead the rest of the world in environmental protection.

For this reason, the EU's action on biodiversity loss is important. The EU is one of the most influential international organizations, and it has the ability to address issues related to the global commons. It is useful to assess the EU's response to biodiversity loss as a case study to understand proper management of important resources, including both the successes and failures of EU policy.

By analyzing biodiversity loss in Europe and the effectiveness of EU policy, it is possible to assess what potential actions other governing bodies could take to protect biodiversity, and to a greater extent, the global commons. Therefore, it is important to evaluate the actions that the EU has taken to counteract biodiversity loss, as a means to understand how policy can be emulated in other national or regional contexts. By learning from the EU, governing bodies can learn which policy approaches work and which do not, and can more successfully address the problem of biodiversity loss.

## **Literature Review**

### **Tragedy of the Commons**

The discussion on common resources in environmental policy can perhaps best be illustrated with the tragedy of the commons. This term was coined by Garrett Hardin in his eponymous article published in *Science* in 1968.<sup>3</sup> Hardin used this term to describe the demise of commonly held land in the United Kingdom. This land was used for grazing animals, and each individual had an incentive to add one more animal to the land. The cost of adding the animal was dispersed throughout the community, but the individual reaped all the benefits. As every

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<sup>3</sup> (Hardin, 1968)

person felt the same incentives, every person added additional animals until the land was degraded beyond use.

Ultimately, the common land was overburdened because every individual took the same action in overconsumption in response to these incentives, but Hardin suggests that this can be prevented. He discusses the problems of population growth and pollution, the difficulty of legislating temperance, and ultimately suggesting “mutual coercion mutually agreed upon” as the solution to the tragedy of the commons.<sup>4</sup> This could be accomplished through government regulation or privatization of resources.

Hardin contends that the only way to prevent individuals from creating the tragedy of the commons is to coerce them to protect the commons. Hardin clearly articulates the cause of degradation of common resources, collective self-interest, and the solution, coercion through regulation and policy of restriction or through private ownership (individuals care about degradation of their property). These two choices for response to the tragedy of the commons have come to define the debate on responses to the loss of common resources.

The topic of the tragedy of the commons is not without controversy, and there have been several challenges to Hardin’s thesis. Susan Buck, who responded to Hardin with the article *No Tragedy of the Commons*, argues that his logic is wrong and that even his metaphor is faulty. Buck points to community law and societal norms that prevented overuse of the commons in the times when they flourished.<sup>5</sup> Buck argues that the commons did not disappear because they were universal and unregulated, but rather that regulation and privatization caused them to disappear because the need for societal norms was removed. This has allowed the tragedy of the commons to occur, according to Buck. This is in stark contrast to Hardin, and it introduces the important

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<sup>4</sup> (Hardin, 1968)

<sup>5</sup> (Buck, 2004)

aspect of norms and societal constraints to the debate on common resources. Societal norms add a new and useful perspective to the discussion on the tragedy of the commons.

These two perspectives are a summary of the debate about common resources and are instructive for the debate about biodiversity loss. As a common resource, it is important to consider the effect of regulation, privatization, and societal constraints on biodiversity to understand why biodiversity loss occurs. These themes are present throughout the literature on biodiversity loss and extinction. In the discussion on biodiversity loss, there are five key factors that are seen as the drivers of the problem: habitat loss, invasive species, lack of both economic and social value, and the adverse impacts of some institutional policies. All of these are present in Europe and throughout the rest of the world, so it is important to fully understand these five interlocking causes of biodiversity loss.

### **Habitat loss**

One common way to promote protection of biodiversity is through wilderness reserves, wildlife refuges, and other government-created protected regions. This is due to habitat loss existing as one of the primary causal factors for biodiversity loss and extinction. Habitats around the world are destroyed for agriculture, urbanization, climate change, infrastructure development, and resource extraction. Habitats are an important part of healthy ecosystems, so it is only natural that with habitat destruction and fragmentation as rampant as it is, there are serious biodiversity consequences.

A debate exists among ecologists about whether it is more beneficial to have several small protected regions or a single but large protected region.<sup>6</sup> Small regions that are isolated tend to support less life than the same area would if it were incorporated into a large area.<sup>7</sup> Large

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<sup>6</sup> (Quammen, 1997)

<sup>7</sup> (Quammen, 1997)

ecosystems can support large densities because there is more ability for movement, more separation from human activity, and more protection from external threats. On the other hand, small regions spread out over a continent would be able to protect biodiversity in numerous climates and regions, and they have their own benefits, despite not being able to support the same density of life.

In *Song of the Dodo*, David Quammen describes divided ecosystems as a rug. When cut into pieces, a rug will fray. Similarly, when cut into pieces, an ecosystem “fray” at all edges.<sup>8</sup> The area isn’t decreased by cutting the ecosystem into pieces, but the smaller areas are no longer as productive and they cannot support the same density of life, especially near the edges. Whatever choice a government makes, it is important to consider that the impact of dedicating an area for protection depends greatly on the context. In Spangenberg’s explanation of the three levels of biodiversity- ecosystem, species, and genetic- it is clear that all levels of biodiversity will be subject to extreme stress if a habitat is fragmented or destroyed. While some ecologists may argue over whether it should be large or small nature reserves that governing bodies should promote, there is consensus that destroying habitat destroys biodiversity.<sup>9</sup>

The alteration or destruction of a habitat can have immediate and long term effects. Some species are lost quickly and there are cascading effects through trophic levels and the ecosystem.<sup>10</sup> This indicates that there may be species destined for extinction beyond what current policy could prevent and is typically referred to as extinction debt. Extinction debt can be created when predators are eliminated from an ecosystem, allowing their prey to flourish. Thus a population crash occurs, where the ecosystem cannot support the large population and there is a massive die-off. Keystone species hold an ecosystem together, and removing them has

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<sup>8</sup> (Quammen, 1997)

<sup>9</sup> (Quammen, 1997)

<sup>10</sup> (Krauss, et al., 2010)

unforeseen consequences. The main point is that when biodiversity is diminished, there can be large cascading impacts, and that changes in habitat and relationships between coexisting species can have unintended consequences.

In concurrence with arguments for habitat protection, Fischer & Lindenmayer expand by noting that it is important to consider ecosystem connectivity, landscape connectivity, and species connectivity, an important point to add to the discussion on the importance of biological corridors.<sup>11</sup> Much like the three levels of biodiversity, all three of these connectivity types are important parts of a healthy habitat. If a species is in a contiguous ecosystem, for instance, but separated into several groups, it is not connected to the extent required to promote genetic diversity and population strength. The species is effectively split into separate ecosystems. Fischer & Lindenmayer add that loss of vegetation cover is one factor that can likely precipitate further species loss as vegetation, such as trees in a forest, can be an important part of the habitat.<sup>12</sup>

As several authors have indicated, habitat loss is one of the severe ways in which biodiversity is threatened and lost. With unprotected habitats, plants and animals are left vulnerable to anthropogenic harm, which can often have cascading impacts throughout an ecosystem. Protecting habitats is clearly an important part of the broader goal to protect biodiversity.

### **Invasive Species**

Throughout the world, invasive species are brought by trade. Through ships, planes, and other cargo, species manage to stow away.<sup>13</sup> Through this trade, invasive species arrive in a new ecosystem and spread, decimating populations of native species, thereby destroying biodiversity.

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<sup>11</sup> (Fischer & Lindenmayer, 2007)

<sup>12</sup> (Fischer & Lindenmayer, 2007)

<sup>13</sup> (European Environment Agency, 2009)

These species include animal, plant, fungus, and more. As with all invasive species, they bring pathogens and other methods for destroying native populations.

In *The Journal of Applied Ecology*, Philip Hulme declared that in recent decades, “the world has entered a new phase in the magnitude and diversity of biological invasions: the Era of Globalization.”<sup>14</sup> The worldwide increase in trade brings with it invasive species, and according to the ecological economist’s perspective, trade is another key reason why biodiversity loss occurs. The invasive species brought by trade are ravaging the land and preventing native species from thriving. Though an unintended consequence of international trade, the most prolific way that diseases and invasive species are spread is trade. The problem of invasive species is continuing to expand with ever-greater trade volumes.

The argument for free trade is that it promotes specialization, comparative advantage, and a general increase in well being for all countries involved. The globalized world makes powerful incentives for free trade. However when biodiversity is concerned, scholars point out that trade is one of the leading causes of biodiversity loss because of its tendency to introduce invasive species. These species are accidentally brought to new regions and if they are not discovered and eliminated, they can decimate existing populations of native species. This reduces an ecosystem’s ability to function correctly and it also reduces its ability to provide the ecosystem services upon which society relies.

In this case, when invasive species are brought as an externality of trade, market imbalances could be regulated by tariffs, which might prevent such influx of invasive species.<sup>15</sup> According to this argument by Margolis, Shogren, & Fischer, protection akin to protectionism needs to be allowed when it is protecting biodiversity (this would differ from protectionism for

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<sup>14</sup> (Hulme, 2009)

<sup>15</sup> (Margolis, Shogren, & Fischer, 2005)

domestic business). The World Trade Organization allows protectionism in certain cases when national interests are concerned, and environmentalists often want tariffs or other methods to prevent importation of products that are environmentally harmful in production, but this is not always the case as it can be a contentious issue when the exporting countries accuse the importing countries of establishing unfair trade barriers.

Research by Westphal, Browne, MacKinnon, & Noble provides a model that predicts the number of invasive species, and the most accurate independent variable is the degree of international trade. They conclude that problems of biodiversity loss are at least partially a response to globalization.<sup>16</sup> There is no way to truly protect biodiversity without dealing with invasive species, and this can be accomplished through tariffs and other economic measures. Political economists recognize that economic incentives have the ability to reduce invasive species brought by trade if there are penalties associated with accidental introduction. This is one such way to try to offset the negative impact that invasive species have on biodiversity and to try to create a plan to protect ecosystem health.

### **Lack of Economic Value**

According to ecological economists, one large aspect of the problem of biodiversity loss is the inability to measure biodiversity and its economic value. This is a problem on several levels, because as many scholars such as Spangenberg, have noted, there are several levels of biodiversity. Furthermore, it is difficult to determine what the precise economic value is of an ecosystem service, especially when compared with other goods on the market.

Still, many economists, including Czajkowski, Buszko-Briggs, & Hanley, suggest that the inability to measure biodiversity is one of the key reasons that it is decreasing at such a rapid

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<sup>16</sup> (Westphal, Browne, MacKinnon, & Noble, 2008)

rate.<sup>17</sup> Efforts have been made to define and measure biodiversity, but it is still an intangible concept, and this makes it difficult to attach a value to biodiversity or to determine whether the costs to protect biodiversity are worth paying. The problem is that individuals are not aware of how much economic value healthy ecosystems can provide, nor how much can be lost if these ecosystems are damaged.

A study conducted by Czajkowski, Buszko-Briggs, & Hanley attempted to put a value to biodiversity in a forest in Poland and found that households were willing to pay, on average, up to 20 Euros per household per year to protect the forest. This number varied considerably from other similar surveys across Europe, showing that pricing biodiversity is not an easy task, especially because different individuals in different regions would see a different economic value.

Many people do not know how to attach monetary value to an ecosystem, and the value identified can change from person to person and from region to region, which in many ways throws the entire practice into question. The study is useful because it demonstrates the environmental economist's perspective that putting a price on biodiversity is an important first step in any effort at protection. Giving something a monetary value means that its consequent removal is a loss in national value or income. While it is difficult to obtain this price, it is useful to find how much individuals value the ecosystems.

The problem of value was also noted by Kallio, Hänninen, Vainikainen, & Luque in 2008 in Finland. While protecting biodiversity was important, finding the relative costs and benefits was not easy, which halted political decision-making.<sup>18</sup> Political decisions often rely on evaluating tradeoffs, and biodiversity does not currently have a stated economic value. This

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<sup>17</sup> (Czajkowski, Buszko-Briggs, & Hanley, 2009)

<sup>18</sup> (Kallio, Hänninen, Vainikainen, & Luque, 2008)

means that in a cost-benefit analysis, there is no voice given to the health of ecosystems.

Although there are costs of destroying ecosystems, these are not represented. Additionally, the economic argument for protecting biodiversity is not strong when it comes to small areas, for instance, because the costs of destroying an ecosystem are diffuse and the benefits are concentrated (large benefits are due to resource extraction).

Still, concentrating biodiversity efforts on specific regions rather than broadly covering everything may be more effective at protecting overall biodiversity by focusing on the methods that may be most successful or more easily adopted. Economic tradeoffs from the protection of forests include loss of national income from logging industries, and gains to national income from establishing national parks and charging for entrance.<sup>19</sup> A useful way to understand the varying interests and stakeholders, the cost/benefit analysis is an important part in judging policy decisions when it comes to environmental issues, so attaching relative costs is a crucial step.

The clear message from environmental economists is that everything, including biodiversity, has a price. It is important to place a monetary value on biodiversity so that it can be protected adequately, but it is also important to recognize that for the political process to work towards protecting biodiversity, there must be a convincing cost/benefit analysis, and sometimes this will mean sacrificing protection in one area for protection in another. Biodiversity has economic value, both tangible and intangible.

It is important when doing a cost/benefit analysis on biodiversity issues that the value of biodiversity is seen, not just in the value that people assign to it, but the value that ordinary citizens may not be aware of. When recognizing these benefits, it can be demonstrated that market failures lead to losses in biodiversity. The need for policy intervention can be shown

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<sup>19</sup> (Kallio, Hänninen, Vainikainen, & Luque, 2008)

when it is clear that these benefits exist.<sup>20</sup> Without attaching value to biodiversity, environmental economists suggest that all the benefits of biodiversity will inevitably be lost.

### **Societal Consciousness**

To political ecologists, social, economic, and political factors that define the relationship between humans and their environment are the key ways to understand biodiversity loss.

Illustrating this, a study in Sweden recently evaluated how farmers relate to the concept of *naturintresse*, feelings of closeness to or appreciation of nature. While many farmers enjoyed hiking, outdoor activities, or if they valued nature for the sake of farming, they did not identify as caring about nature.<sup>21</sup> It seems that environmentalism carried a certain negative connotation, and that they did not want to be included in the group of people that are close to nature, even though they rely on nature for their livelihoods and recreational activities.

Furthermore, there was an interesting find between *naturintresse* and the adoption of Agro-Environmental Schemes (AES), which were government sponsored methods for improving agricultural techniques so as to have a lower environmental impact. They were implemented with economic incentives to promote widespread adoption. Farmers that already cared about the environment adopted these AES, but they would have done so regardless of the economic incentive. Farmers that adopted them for economic reasons did not show any change in attitude towards the environment.<sup>22</sup>

The conclusion is that the AES did not lead to any substantive cognitive or motivational change, and that AES simply reinforced existing ideas. To the political ecologist, this shows that the root of environmental problems is not a lack of policy or a lack of scientific knowledge about environmental problems, but a lack of interest in adopting environmental policies due to

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<sup>20</sup> (OECD, 2004)

<sup>21</sup> (Boonstra, Ahnström, & Hallgren, 2011)

<sup>22</sup> (Boonstra, Ahnström, & Hallgren, 2011)

unconcern or disassociation with environmental issues. Here, an economic incentive was powerful enough to create a change in behavior, but that change disappeared as soon as the economic incentive was withdrawn. It was not successful in creating a permanent change in thought or behavior. This shows that there needs to be a deeper connection to ecosystem health to make it a priority for society and in EU policy.

In *The Historic Roots of our Ecological Crisis*, Lynn White, Jr. argues that the cause of environmental degradation is the predominance of Judeo-Christian religious beliefs, and the way they determine the relationship between humans and their environment. In short, White argues that Judeo-Christian beliefs place humans superior to the environment and this dominance leads to exploitation.<sup>23</sup>

Before Christianity was the dominant religion in Europe, the Roman Empire was predominantly Pagan. Paganism had a close relationship between humans and the environment. Springs and trees had their own guardian spirits, for instance. These disappeared with the conversion to Christianity. Furthermore, most people were reliant on agriculture as a livelihood, making that bond even more important. Currently, most people do not have any connection to the farm where their food is grown or raised.

When Christianity became the dominant religion in Europe, the connection to nature was forever changed. Humans were given an elevated status where they had control over nature. This view has impacted science, philosophy, and policies towards environmental protection. When Earth is simply an object to be used, it does not merit the same protections as when it is full of spirits and is sacred.<sup>24</sup> This is another way of looking at how societal norms can play an important role in shaping action toward biodiversity.

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<sup>23</sup> (White, 1967)

<sup>24</sup> (White, 1967)

In terms of political ecology and philosophy, the way to address biodiversity loss in Europe is to alter perceptions about the importance of the environment and the role that it plays. To the political ecologists, the way that we make sense of environmental issues affects how we deal with them, so it is important to change perceptions on environmental issues to effectively deal with them. This is the only way to truly give value to biodiversity and to prevent further biodiversity loss. This reflects the points made by Buck that societal norms are the best way to protect a common resource.

### **Adverse Policy**

The primary drivers of biodiversity loss can also be tied to existing policy. Some policies, while not intended to have any ecological impact, positive or negative, still have a negative impact on biodiversity. Frequently, these policies bring into light the conflict between a government's goals: environmental protection on the one hand, and economic growth, industrialization, and infrastructure on the other. The policies to promote these latter goals can often have environmental consequences, making this a salient issue for biodiversity loss. These policies are a problem in themselves because they compound the other factors pushing biodiversity loss. One of the best ways to look at the impacts of adverse policy is to study agricultural policy. Agricultural policies are not intended to have anything to do with biodiversity, and yet they build on the other causes of biodiversity loss to exacerbate the problem.

Starting in the 20<sup>th</sup> century, new technology allowed for greater land use for agriculture, known as the Green Revolution. The Green Revolution promotes homogenization of agriculture, expansion of the land occupied for agricultural purposes, land intensification, and an increased importance placed on agriculture in society. The result of this has been habitat degradation,

overproduction of food, intensification of farming practices, and concentration of fewer and more specialized farms.<sup>25</sup> Efforts have been made to restore farmland, but these are not always successful, and in areas of otherwise high biodiversity, farmers can plant too narrow a range of species, and actually further decrease biodiversity.

Henle *et al.*, who identify many of the key problems associated with the agricultural policies, also prescribe solutions. These include regulatory approaches, incentives, participatory approaches, and more generic approaches. They also call for monitoring to ensure that agricultural practices do not continue to destroy biodiversity. This means monitoring conflicts between stakeholders, socioeconomic conflicts between conservation and profits, and monitoring the status and trends of biodiversity to assess effectiveness.<sup>26</sup> It is reasonably possible to have agricultural practices that do not destroy biodiversity on and off the farm.

The example of agriculture shows that policies used by states to promote their goals, often economic, are known to have the adverse impact of reducing biodiversity, whether by encouraging high-intensity and unsustainable agriculture, thereby reducing natural ecosystems or farmland biodiversity; promoting elimination of trade barriers, which expands the problem of invasive species; expanding cities, reducing available land for healthy ecosystems; promoting natural resource extraction while ignoring the value of preserved resources; or simply ignoring the problem of biodiversity loss, thereby allowing the general public to continue to give it no societal value.

### **Evaluation of Biodiversity Loss and the Tragedy of the Commons**

Evaluating the ways to prevent the tragedy of the commons- government action, privatization, or societal norms, it is clear to see that these three factors are present in the five

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<sup>25</sup> (Henle, et al., 2008)

<sup>26</sup> (Henle, et al., 2008)

major identified causes of biodiversity loss. Each of these views brings something different to the discussion on biodiversity loss, and this makes each a valuable method of looking at the issue. These different lenses are important conceptually for addressing and understanding the problem of biodiversity loss, and no solution can be effective without a comprehensive view of the many causes.

These three factors are interlocking in many ways. There are relationships between each and the other; it is impossible to completely isolate one. For instance, habitat loss is inherently tied to the presence of invasive species, which can destroy habitats, the economic and social value given to the ecosystem, and the government policies that either destroy or protect habitats. They need to be addressed comprehensively and understood as five interdependent causes of biodiversity loss.

The argument for habitat protection as one of the major causes of biodiversity loss is salient because many human actions destroy habitats, from agriculture, to urbanization, to resource extraction, to infrastructure and transportation routes, and it is easy to see how this can reduce biodiversity. Preserving habitats is thus one of the important topics to address, but also one of the most difficult because so many functions of the economy and society require habitat destruction. Resource consumption, agriculture, city construction, and many other aspects of society negatively impact habitats, so it can be difficult to generate consensus for habitat protection.

The important message that the invasive species discussion brings to the table is that international trade is one of the key drivers of invasive species introduction in the modern world, and that monitoring and preventing this is critical for any true protection of biodiversity. The world economy relies heavily on free exchange of goods, capital, services, and labor, so it is

crucial for their economy that trade continues, but that is in direct contrast with the goal of protecting biodiversity. This is an important juxtaposition. The protectionist argument is that to prevent biodiversity loss, tariffs need to be imposed. Tariffs of this kind are allowed by the WTO if it can be proven that there is need for tariffs for ethical, environmental, or other such reasons. The drawback to tariffs, of course, is that they limit free trade, so many of the other benefits of having free trade will be less accessible.

The environmental economists take a different approach and say that the reason biodiversity loss occurs is because there is no value tied to a health environment or to biodiversity. This means that it is a problem of value and priorities. Economists believe in the power of the market to provide the equilibrium quantity, and this requires accurate representation of prices. The strength of this view is that identifying value as the problem, while not necessarily providing a solution, does provide an understanding of the issue that is otherwise lacking.

The political ecologists, philosophers, and anthropologists see the relation between humanity and the environment as one of the key drivers that underlie environmental change around the world. This is an important connection, but right now the relation is not strong. Due to this disconnect between humanity and Earth, degradation occurs, and it occurs at an ever accelerating rate. There can be no real effort to prevent biodiversity loss if Europeans do not actually care about the surrounding ecosystems and place value in the health of their environment. The importance of repairing the relationship between humanity and the environment is in many ways similar to the argument for giving biodiversity a monetary value, but in this instance it is instead an ethical or emotional value.

The difference between the economists and anthropologists in this discussion on biodiversity loss is primarily whether it is economic or social value that is important for

protection of a resource. While both disciplines address the value that is given to common resources, the different approaches present an important distinction, and it brings up the dichotomy between Shallow and Deep Ecology, which are two competing perspectives of the importance of protecting ecosystems.

Shallow Ecology argues that humans are stewards of the environment and need to protect Earth in order to continue to survive. This is the anthropocentric and more “economically-focused” perspective. It contends that it is important to protect ecosystems because of the benefits that society gains from them. This is in many ways aligned with the idea presented by ecological economists that argues for ecosystem capital accounting. It is tangible, and can represent that value to Shallow Ecologists. Shallow Ecology is likely to be one of the more cohesive ways to make a push for ecological protection because it can have a more personal connection with individuals by putting them into the equation.

On the other hand, Deep Ecology argues that everything has equal right to exist, independent of humanity. This is ecocentric, rather than anthropocentric, and it aligns more closely with the argument that the anthropologists make- that if humans assign societal value to biodiversity, it will be preserved. Both of these are important conceptual frameworks for understanding biodiversity loss and knowing what to do to prevent it. While Deep Ecology is not as easily understood and accepted because it relies on less tangible qualities, Shallow Ecology is simple to adopt. Still, for many Deep Ecology is a good representation of how they feel towards ecosystems, and they can relate to wanting to protect them simply for the sake of having them exist. Deep ecology cannot have as concrete an impact on policy because it does not bring the economic argument, but it can have an impact on societal norms. Both of these perspectives are important for protecting biodiversity.

The view of adverse policy as a driver of biodiversity loss clearly shows that expansion of agriculture has prompted biodiversity loss by changing land use and by mono-culture, the planting of uniform crops over a large area. From this perspective, biodiversity loss is not due to lack of institutions, it is due to misuse of the institutions in place- sending money to farmers to reward them for environmentally unsustainable agricultural practices, in this instance.

As agriculture is such an important aspect of the economy and its societal importance for many Europeans, it is very important to consider all the aspects that agriculture plays in shaping biodiversity loss. There is often a conflict between industry and the environment, and here the conflict is that protecting biodiversity limits the land and the agricultural methods that can be employed to promote the already overgrown industry. Understanding the problem fully from a scientific perspective is necessary to override the constant desire to promote large scale, land intensive, mono-cropping agriculture.

Each perspective makes important points about the causes and solutions to biodiversity loss, their methods could be combined and used to provide a clear understanding of the issue as well as a practical solution to protect biodiversity. With these several representations of the causes of biodiversity loss, it is possible to evaluate the EU's response but observing how it addresses each cause. This is important for understanding how the EU has made strides in protection biodiversity, as well as learning from the EU's inability to halt biodiversity loss by its 2010 deadline.

### **Case Study**

To see the effectiveness of EU policy toward biodiversity, this section analyzes policies in relation to the five identified causes of biodiversity loss- habitat loss, invasive species, lack of economic and societal value, and adverse policy. Each of the policies selected are aimed at

illustrating the different responses to biodiversity loss through action taken by the European Environment Agency, and provide a comparative lens to understand the compatibility of such initiatives with other European goals. This section identifies the policies, analyzes the strengths and weaknesses, and finally discusses which policies are having a positive impact on efforts to protect biodiversity, and which policies are not able to effectively halt biodiversity loss.

The EU has been trying to halt and reverse biodiversity loss for years, and originally set a goal to halt biodiversity loss by 2010. As 2010 came and went, biodiversity loss continued and a new goal was set for 2020. A biodiversity strategy was published in 2011 and it outlined the steps that the EU intends to take to reach this goal by a new deadline of 2020. By addressing the range of causes of biodiversity loss, it is clear why the EU did not meet its goal in 2010 and also clear what the EU must do to meet its new goal in 2020.

The case study analyzes several policies, which includes the Natura 2000 habitat protection network, the planned early warning and rapid response system for invasive species, the EU's planned ecosystem capital accounting system, the EEA's efforts to promote biodiversity education, and the efforts to reform the Common Agricultural Policy. These policies show that while the EU is making small progress in some areas, the larger problem of biodiversity loss is going largely unsolved.

### **Habitat Loss**

Some of the important steps that have been taken to protect habitats include dedicating roughly 17% of all EU land to conservation, with over 25,000 separate protected zones and about 900,000 km<sup>2</sup> of land. The network of conservation is known as Natura 2000 and is the largest grouping of protected areas in the world, which makes an average of roughly 36 km<sup>2</sup> for every

protected zone.<sup>27</sup> The Natura 2000 network covers large areas of land and ocean, and it is regarded by the EU as one of the most successful efforts to halt biodiversity loss. It has certainly been an important way that the EU has enforced its commitment to halting biodiversity loss, as this protected network should play a large role in halting habitat loss and habitat fragmentation. It is a clear move in the right direction.

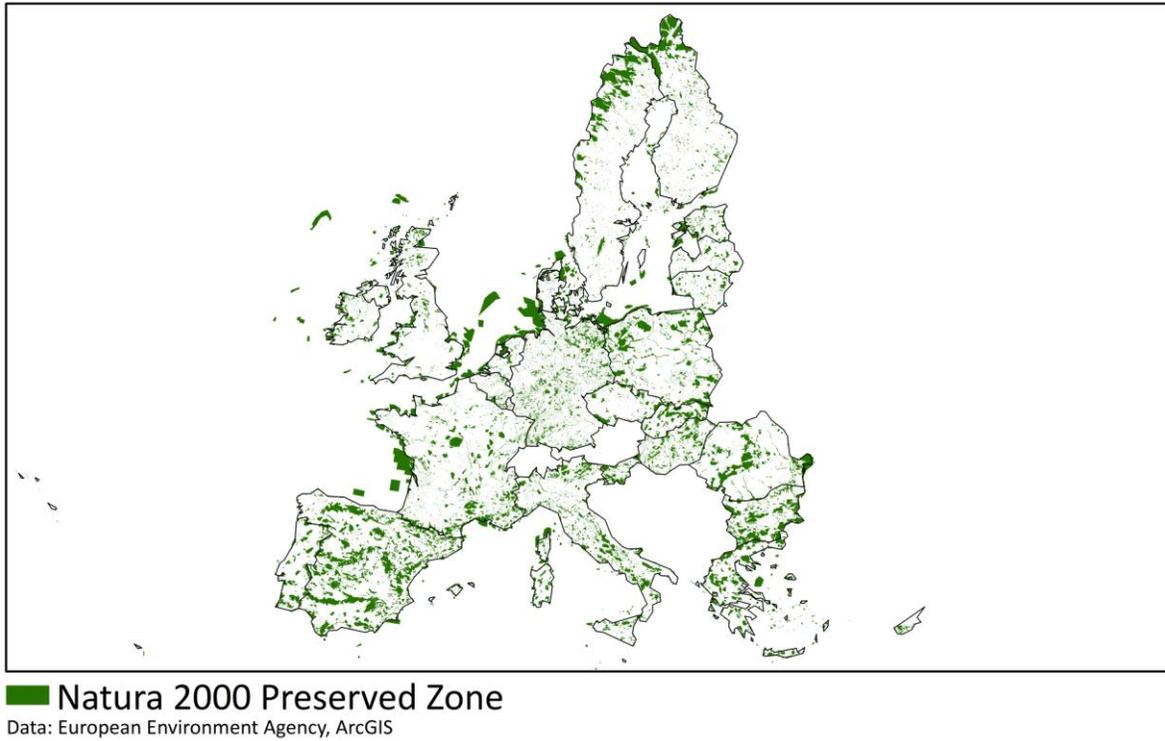
The Natura 2000 program, however, brings into light the questions and debate of large wildlife reserves and smaller wildlife reserves. Europe needs to consider not only the quantity of reserves and amount of space, but the effectiveness of its policies. Isolating these protected regions from each other with roads, distance, and other barriers prevents species from moving between them and they are stuck in their particular region. Ensuring ecological corridors is in this way an important consideration. As seen in Figure 1, the Natura 2000 network has many substantial nature reserves, although the connectedness across Europe is not as significant as might be desired. Additionally, Austria has no apparent nature reserves that appear at this scale.

As seen in Figure 2, Austria has nature reserves around its border, but still none appear in the rest of the country. The large gap that Austria (as well as Switzerland- however outside the EU) creates here is effectively a large impassable zone for terrestrial animals. Additionally, the seeds that these animals may carry now cannot pass this region. Figure 2 also shows that there are many smaller regions protected by Natura 2000. These are important to protect, but it does bring back the debate between ecologists on whether it is more valuable to have one large or several small protected habitats.

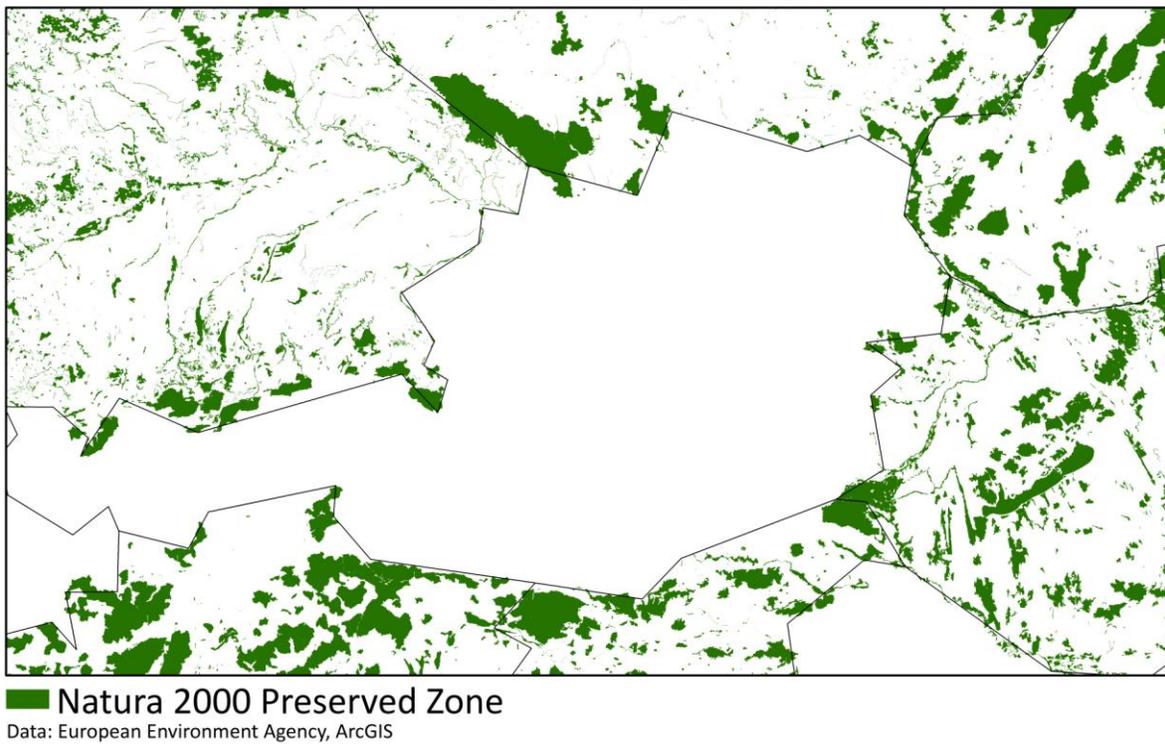
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<sup>27</sup> (European Environment Agency, 2012)

**Figure 1: Natura 2000 in Europe**



**Figure 2: Natura 2000 in Austria**



In sum, Natura 2000 is an incredible step towards biodiversity protection- the largest such habitat protection network in the world. While it does not constitute the only EU efforts to protect habitat, it is by far the largest such effort. It has had significant positive impacts on protecting biodiversity. This is a successful example of the steps the EU is taking towards biodiversity protection. The Natura 2000 project is an important wildlife system, but there are still important areas for improvement. Natura 2000 is vast, but because it is spread over an entire continent it is difficult to get the connectivity needed to allow species to move and ensure greater genetic diversity.

Furthermore, many of the protected regions are small in size, which brings into light the fact that smaller habitats cannot hope to preserve as dense of a population as larger habitats. If the EU were to improve Natura 2000 by focusing on connectivity and size, it would make a large difference in increasing the positive impacts that already exist. Additionally, expanding the area, especially in Austria, would have a significant impact on Natura 2000's effectiveness.

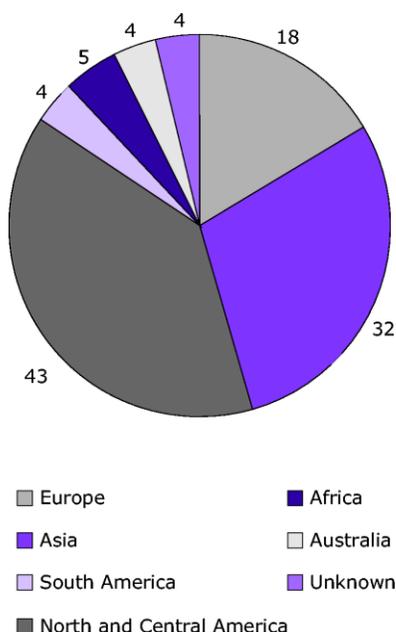
### **Eliminating Invasive Species**

Europe wants to promote free movement of goods, capital, services, and labor. To do this, the EU has reduced tariffs internally and externally. Additionally, European countries participate in the World Trade Organization, which promotes free trade. All of this is good economically, but it also has made the European economy a center for imports and exports. This has made Europe vulnerable to invasive species, and the European Union is now home to over 10,000 different invasive species, which are easily spread and difficult to remove because they have no natural predators. With the reduction of trade barriers within the EU, it is easy for invasive species to not only arrive, but also to move from country to country.

There is an inherent contradiction in EU policy goals between trade and environmental protection, which brings up the adverse policy cause of biodiversity loss. However, even if the EU were to embrace environmental protection rather than free trade in attempt to halt invasive species, the problem would still exist. Invasive species would still likely arrive in Europe, even with quotas, barriers, or other restrictions.

For this reason, invasive species in Europe are a problem beyond adverse policy, and require policies directed toward preventing their arrival and eliminating them, regardless of trade quantities. Better policies to address invasive species may be able to reduce the biodiversity-decreasing nature of trade to try to remove this contradiction in EU policy, but it is also important to address policy for dealing with invasive species once they arrive. As seen in Figure 3, many of the invasive species in Europe come from North and Central America, likely due to trade. But another significant portion comes from within Europe, which has only been worsened by easing of restrictions on trade and travel.

**Figure 3: Area of Origin of Invasive Species in Europe**



In its Biodiversity Action Plan, dated in 2011, the EU acknowledged that it had no comprehensive, policy dedicated to addressing invasive species that was uniform across the EU. At the same time, one of the targets for 2020, after failing in 2010, is to identify, control, and eradicate priority invasive species and to manage and prevent the introduction of new species. The EU has a system to control invasive species in the planning process.<sup>28</sup> This planned early warning and rapid response system aims to identify invasive species immediately and proscribe action to contain and eliminate them. The early warning and rapid response system would be an improvement because it would harmonize EU policy and give directions for how to prevent and eliminate invasive species.

While the target is good, it is a critical error that the EU does not have a comprehensive policy to prevent invasive species already in place. This is an instance that highlights the problems the EU often experiences when trying to create and unify international policy. It is startling that the EU did not have a successful policy in place before their 2010 goal to halt biodiversity loss, and it shows a clear area of needed improvement. Moreover, as invasive species are brought about in large part through trade and travel, an organization that exists to promote a borderless continent with large imports and exports will doubtlessly encounter difficulties in finding acceptable ways to prevent invasive species.

This warning system will focus on new arrivals, and help the EU to organize a response to prevent widespread impact. The system will include a watch list, risk analysis, and action response. This plan will focus on specific entry points, such as ports, and will take the form of border control and quarantine. This is notable, as the EU is actively trying to create a borderless Europe. After detection, risk analysis, and spread of information, the typical action can be

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<sup>28</sup> (European Environment Agency, 2010)

expected to be eradication, control of population, or no action at all if it is not politically or technically feasible.<sup>29</sup>

As the program focuses on new arrivals, it raises the question of how the EU plans to respond to the invasive species already in place. It would seem that if a unified policy is the best way to eliminate new invasive species, there should also be a unified policy for how to deal with current invasive species, which are already at work reducing biodiversity in Europe and destabilizing ecosystems. The absence of this plan is another factor that has weakened the EU's approach to addressing the problem of invasive species.

### **Giving Economic Value to Biodiversity**

The EU does not currently have a concrete plan in action to assign an economic value to biodiversity and its loss.<sup>30</sup> Like its plan for invasive species, the EU does have an experimental framework for ecosystem capital accounting under development. While this directly addresses concerns about assigning value to biodiversity, it is still an error that there is no comparable system in place. The presence of a plan such as this in 2010 would have been a strong factor for encouraging protection of biodiversity loss.

When this plan is implemented, it will be a phenomenal step, and it will be used to monitor loss of value and give a much needed representation of stored value in the environment. Capital is measured as stocks of biomass, adjusted for freshwater, landscape, and preservation. The system classifies areas by land type, water type, ecosystem, etc, and assigns value that can be directly represented as monetary value. This process is still in experimental stages, so there is no other method that the EU has been using to accomplish this purpose.

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<sup>29</sup> (European Environment Agency, 2010)

<sup>30</sup> (European Environment Agency, 2011)

The capital accounting system functions by identifying ecosystems and resource stocks. Next, a value is assigned to resources based on the economic impact of those services to the economy, the economic value of the resources in the market, and the economic impact that losing the resources would have on the economy. Depreciation in capital is calculated based on the resources removed or destroyed, and then this depreciation will be represented as part of GDP, giving real economic value to ecosystems where governments and society are most likely to notice.

Indicators for this system include ecosystem surplus, demand for ecosystem services, total ecosystem capital potential, degradation of capital, consumption of capital, equivalents for imports, exports, and GDP.<sup>31</sup> These indicators will be used to give a holistic representation of ecosystem capital, which can be used for various purposes including representing ecosystem debt.

This system has not yet been implemented, but the experimental framework shows quantitative measures, statistical analysis, and it should be a reliable measure of ecosystem capital. Having this measure of ecosystem capital is a valuable way of representing the true economic benefits that exist from a healthy ecosystem, and this is an important process for the EU to implement to halt biodiversity loss. Having an economic value for biodiversity is useful to governments for evaluating the ecological impact of policy, for conducting cost/benefit analyses, and for measuring the negative economic impact of environmentally destructive industrial activities.

Interestingly, this system is not in creation solely for the purpose of protecting biodiversity directly, but rather it is to also represent the economic loss of ecosystem capital, as the EU recognizes that ecosystems have an economic value that needs to be represented. Giving

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<sup>31</sup> (European Environment Agency, 2011)

value to ecosystem services will have the extra impact of quantifying losses in biodiversity. This is in many ways the opposite of the adverse policy impacts on biodiversity, and it is encouraging to see the EU addressing biodiversity from this perspective.

No ecosystem capital accounting metric like this currently exists to protect ecosystem services and biodiversity, so it is important that the EU find a successful way to implement this revolutionary plan. Ecosystem capital accounting has been discussed by scientists and ecologists for many years, and the EU is now blazing the trail in this policy area. While it is being implemented later than would have been required to impact the 2010 goal of halting biodiversity loss, it is still important to note that the EU is embracing its role as the global environmental leader in its development of a system to calculate ecosystem value and represent it as an aspect of GDP. While this plan is not yet in place, when it is implemented it will be an important aspect of protecting biodiversity.

### **Social Value for Biodiversity**

Societal value is another area where there has not been a comprehensive plan. Most information and calls for support are done directly through the EEA and its publications. These publications provide excellent information about biodiversity loss and the importance of healthy ecosystems. While there is no clear policy to promote education about biodiversity, these EU publications are the closest EU action to such a policy, and they will be my unit of analysis for promoting societal value of biodiversity, although they are not a policy and have not yielded significant results.

The EEA is the primary educational tool that the EU has to raise social awareness and concern for environmental issues including biodiversity, and the EEA has prioritized biodiversity. Lessons about the importance of healthy ecosystems are abundant on the EEA's

website and throughout its publications, but there is no discernible policy to directly educate EU citizens about biodiversity.<sup>32</sup> It would seem that the EU publications regarding biodiversity loss are not widely read outside the academic and scientific community, but rather that they are primarily used by individuals who already are aware of the issues that are facing ecosystem health.

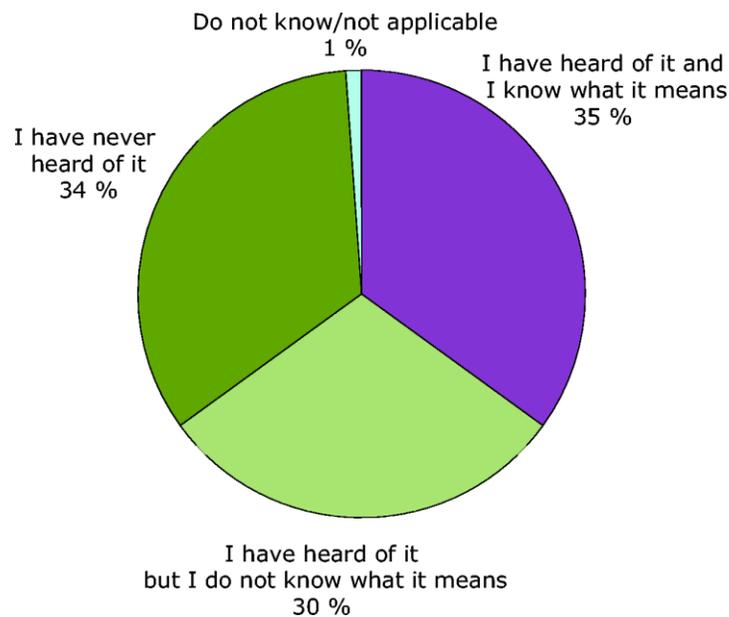
Clearly, it is an error that the EU did not have a policy to promote societal value for biodiversity before the 2010 deadline to halt biodiversity loss, and it is not apparent that there is any way to remedy this by the new 2020 deadline to halt biodiversity loss. There is no plan in process as there is with invasive species and ecosystem capital accounting, so this is the area that is most in need of improvement. The failure of the EU to properly promote education and awareness about biodiversity loss is apparent in the lack of knowledge that is measured in individuals in the EU, showing that addressing social values for biodiversity is one of the EU's weakest attempts to halt biodiversity loss.

In a recent poll, a third of EU citizens had never heard of biodiversity before, and only a third knew what it meant, leaving a third that had heard the term, but did not know what it was.<sup>33</sup> This shows that although the EEA is providing enormous data, charts, and publications, there is a disconnect between the mild efforts to educate about biodiversity and results. The EEA provides biodiversity data, which are clearly not widely read, and the EU does not have a comprehensive policy to promote biodiversity beyond these publications. It does not successfully indicate to society that biodiversity loss is a critical issue. There is effectively no policy to promote societal consciousness about biodiversity loss, because the efforts by the EEA do not appear to do much in this respect.

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<sup>32</sup> (European Environment Agency, 2012)

<sup>33</sup> (European Environment Agency, 2012)

**Figure 4: Response when asked about biodiversity loss**

Despite not knowing the threats of biodiversity loss, when made aware of the issues and asked if they are willing to take extra effort to protect biodiversity, roughly two thirds of Europeans said that they would take personal effort to protect nature. When fully explained to them, individuals recognize that biodiversity is a serious problem that needs to be addressed, seeing both the societal value and the economic value that are inherent in healthy ecosystems. Europeans are not ambivalent to ecosystem protection; they simply don't know that there is a problem to solve. These survey results show that the problem in Europe is not a lack of interest, but a lack of knowledge. When individuals are made aware of the problems that are facing biodiversity, it is likely that they will be interested in taking the necessary steps to protect this resource. This shows that biodiversity loss is merely a problem of awareness, not a problem of interest in healthy ecosystems.

### **Adverse Policy**

The EU policy that has perhaps the most negative impact on biodiversity is the Common Agricultural Policy, which promotes larger farms with more output. The CAP is an important

part of EU policy and is the EU's largest program. Industrialized agriculture is known for monoculture, pesticide, and degradation of land and water. All of these have a negative impact on biodiversity. The Green Revolution changed agriculture by introducing high yield crops, monoculture, and a scientific approach to farming. While this has produced much more agricultural output, it is incredibly resource intensive, destroys biodiversity on and off the farm, and is generally environmentally destructive. The CAP is directly preventing the EU from halting biodiversity loss by encouraging the agricultural practices that destroy ecosystems and reduce biodiversity.

Therefore, it is important that the EU address the CAP when crafting policy to prevent biodiversity loss, and the EU admits as much and has made this a priority in halting biodiversity loss. The EU has specified several ways in which it wants to reform and redirect the funding of the CAP towards sustainable agriculture, providing an opportunity to evaluate the success of this policy shift in addressing biodiversity loss. Reform of the CAP has become a large part of the discussion on protecting biodiversity, and some steps have been taken such as implementing payments for environmental services performed by farmers. The EEA is trying to redesign the CAP to encourage High Nature Value (HNV) farmland, which would encourage, rather than deplete, biodiversity.<sup>34</sup>

The EU is now using these efforts to try to redirect CAP funds to promote non-intensive farming and to encourage farmers to embrace diversity and HNV farming. Since CAP funds are partially direct payments, this can be a large incentive to farmers to adopt sustainable practices when they otherwise would not. Similar to the AES in Sweden, farmers respond to CAP incentives, even if it does not necessarily change their attitudes, and this can play a major role in increasing agricultural sustainability and protecting biodiversity.

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<sup>34</sup> (European Environment Agency, 2009)

The CAP has two Pillars to which funds are distributed. The first provides direct aid, and it is intended for market intervention and competitiveness. This could be considered the “Green Revolution Pillar” and it is the portion that promotes unsustainably and environmentally destructive agricultural practices. This pillar represents roughly 75% of CAP expenditures.<sup>35</sup> Pillar II focuses on rural development and environmental schemes, and it is the more sustainable pillar, through which funds to protect biodiversity would be spent.<sup>36</sup> Unfortunately for biodiversity and environmental health, countries with higher HNV percentages receive less Pillar I funds and more Pillar II funds, at just 25% of CAP expenditure. Less support is being spent to promote HNV farms, a clear fault in the efforts to reform the CAP and use it to promote rather than destroy biodiversity.

While is an important step that the EU has been promoting HNV farming through the CAP, it is important for the protection of biodiversity that they take their efforts further. The bulk of the CAP is still directly counteracting the EU’s other objective of eliminating biodiversity loss, presenting a direct conflict of EU goals and showing the problem of adverse policy impacts on biodiversity in Europe. With further efforts to reform the CAP, it would be possible to take an ineffective effort to protect biodiversity and strengthen it into an effective response.

### **Successes**

While this paper and case study focus largely on the improvements that the EU needs to make to successfully halt biodiversity loss, it is also important to acknowledge that the EU has been successful in reducing the problem in some areas. Although biodiversity is still being lost at an unprecedented rate, there are specific targets that have been successful.<sup>37</sup> In these instances, the situation is less grim that it previously was. For example, between 1990 and 2010, the

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<sup>35</sup> (European Environment Agency, 2009)

<sup>36</sup> (European Environment Agency, 2009)

<sup>37</sup> (European Environment Agency, 2010)

amount of ecosystems exposed to acidification from air pollution decreased by a dramatic 80%.<sup>38</sup> Without the acidification, soils and plants are healthier, and can support greater biodiversity. This small victory plays a role in protecting ecosystem health, and additional victories such as this are good first steps in preventing biodiversity loss. It's important to acknowledge the successes amid the failures. These are policies and programs that should be emulated for further success in dealing with biodiversity loss.

Additionally, while there is large room for improvement with European policy toward biodiversity, there are clear efforts that steps are being made in the right direction. While CAP, for instance, is still promoting high-intensity, low biodiversity agriculture, the EU is attempting to redirect those funds to HNV farming. Although they have not completely revision the program, it is not unreasonable to hope that there will continue to be improvement in the future. Additionally, national governments encourage HNV farming independent of CAP, which is an indication that biodiversity policy is also being pursued by national governments, rather than just through the EU.<sup>39</sup> While not complete, it is true that the EU has been trying to steer CAP in the right direction.

However, these examples don't mean that the battle has been won; they just show that perhaps Europe is close to turning a corner in its struggle to protect biodiversity. They are encouraging, but not concrete. Thus, while it is discouraging to see the EU fail to meet its goal to halt biodiversity loss by 2010, the progress that has been made in some areas does raise hope that there is potential to meet their next goal of halting biodiversity loss by 2020 if the EU adopts more comprehensive biodiversity policies that can adequately address the problems, or that they will have at least made progress towards that goal. The outlook may be bleak, but there is still

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<sup>38</sup> (European Environment Agency, 2012)

<sup>39</sup> (Boonstra, Ahnström, & Hallgren, 2011)

hope that improvements in EU policies can turn the tide, halting biodiversity loss and eventually seeing improvements.

### **Discussion and Analysis**

When evaluating the Natura 2000 program it is relevant to reflect on the single large/several small debate about habitat protection, the Natura 2000 program. This is relevant because of the size of the EU's Natura 2000 network. It is large collectively, but it is also important that the smaller fragments are not frayed away like a rug due to inadequate connectivity.

The Natura 2000 program and habitat protection is considered by the EEA to be one of the EU's most successful examples of biodiversity protection, and while this is true, it is important to still address its areas for improvement rather than assuming it is complete as it currently is. Connectivity is the largest issue with Natura 2000, and improvements to the program should be made in that line. The EU does acknowledge this fault of Natura 2000, and appears interested in addressing habitat connectivity. This next step would be encouraging and indicate a strong commitment to halting biodiversity loss.

One of the more challenging parts of the problem of biodiversity loss is the presence and new arrival of invasive species. The current policies the EU is using to prevent invasive species are not working because they do not have a comprehensive plan to prevent and respond to invasive species. It is a good step to create the early warning system that is being shaped. However, it is discouraging that this policy is coming about after the 2010 deadline to halt biodiversity loss has passed, rather than before. This raises concerns that it will not be implemented, producing effective results before the next deadline, 2020, arrives. As with the ecosystem capital accounting plan, the early warning system for invasive species is still in its

formulation phase, and it still must prove itself useful. The sooner the plan is implemented, the sooner it can be tested and evaluated for its impact on preventing invasive species and protecting biodiversity. It is important for this to be done quickly and effectively so as to halt the tremendous amount of invasive species entering Europe.

It is encouraging to see the EU creating a comprehensive policy to give monetary value to ecosystems, which is in many ways one of the more challenging areas of the problem to address. It is unfortunate that the 2010 deadline to halt biodiversity loss came and went without this framework in place, and the 2020 deadline looms in the near future. This program requires detailed measurement and analysis, meaning that it may be difficult to accurately represent Europe's ecosystem capital by the deadline and use that information to protect the ecosystems. While it is an economic policy, it will have impacts for biodiversity. As many authors have indicated, true representation of economic value shows governments and planners that it is important to protect these resources. While this plan will have positive biodiversity implications, it is not yet in place. It is much too early to laud its design or achievements- those remain to be tested.

The EU needs to address its educational approach to biodiversity, which is virtually nonexistent at this point. European society needs to make this a priority, not just European governance. When only a third of the population knows what biodiversity is, it could be difficult to drum up support for some of the EU's policies. As there is no concrete EU directed policy to promote knowledge of biodiversity loss beyond its publications, this is one of the weaker areas of EU attempts to halt biodiversity loss. Other environmental issues, such as climate change, are increasingly in the public eye, which rallies support. EU efforts to place biodiversity at an equal level of importance and discourse would be an important step in rallying public support to

protect biodiversity. Promoting biodiversity loss to the level of public awareness that other environmental issues such as climate change enjoy would seem to play a large role in encouraging societal action.

Biodiversity currently lacks this societal support that it needs. Reflecting on Boonstra *et al.* and White, it is important to have society value ecosystem health for there to be true change. Eurobarometer polls show that Europeans are interested in protecting biodiversity, but only once they are aware of what it is and aware of the threats that it faces. If European leaders promote biodiversity education, talk about biodiversity and ecosystem services as frequently as they do climate change, thus making biodiversity a priority, Europeans will realize the necessity of halting biodiversity loss. This will address the lack of societal value given to biodiversity and help the EU move to halt biodiversity loss.

The EU's efforts to address the errors of the CAP are admirable, especially considering the importance of the CAP and its presence as a large portion of EU expenditure at roughly 40%. Transforming the CAP from an adverse policy to a beneficial policy cannot be an easy accomplishment, and the EU needs to expand its efforts of identifying positive ways to delegate funds to encourage farmers to improve diversity on their farms. However, the EU needs to embrace ecosystems, not just diverse farms, and should promote agriculture that does not replace ecosystems and that avoids ecosystem repercussions from fertilizer, runoff, salinization, and other adverse environmental impacts caused by agriculture. The EU needs to prioritize Pillar II of the CAP and promote environmental improvements through this method. Giving 75% of funds to the Pillar that effectively discourages HNV farming while promoting industrialized agriculture directly counteracts EU environmental policy toward biodiversity and this contradiction must be reconciled.

In sum, the EU has, perhaps unsurprisingly, been most able to address biodiversity loss through institutional policy in the form of Natura 2000. The EU has had trouble addressing invasive species and value, both economic and social. With a result of continued biodiversity loss, this indicates that simply addressing one cause cannot solve the problem, and it suggests that addressing all causes simultaneously is necessary. At the end of the line, the EU has focused mostly on tasks like Natura 2000- things that can be accomplished through broad policy. Some of the more complicated tasks, such as revising the CAP, giving economic value to an ecosystem, preventing invasive species, and changing societal norms, are not being taken as seriously as Natura 2000. This may be because it is more difficult approach those policy areas due to conflicts between EU economic, and agricultural priorities, whereas habitat protection can be more easily legislated and implemented.

If the EU were to make changes in policy to have the largest impact, their successes and failures suggest that some of the most important of these changes might be achieved by addressing the societal norms and public consciousness surrounding the issue of biodiversity loss. Currently, there is little public knowledge and little public concern, but if biodiversity were discussed more in public discourse, it is reasonable to suspect that it could become as salient an issue as climate change. Increased public interest in biodiversity could help to drive policy in other areas by showing public interest for expanding Natura 2000 and improving connectivity, redirecting funds in the CAP to promote more HNV farming, and finally implementing the plans to protect and respond to invasive species and to account for the economic value of ecosystems in as a part of GDP. Susan Buck's argument that societal norms can protect common resources would ring true in this respect.

The 2010 deadline for halting biodiversity loss passed without the goal being reached. This is understandable given the unbalanced nature of EU policy towards biodiversity. While ecosystem preservation is important, it is not enough- there needs to be attention given to meaningful CAP reform, ecosystem capital measurement, invasive species prevention, and societal concern. If a more holistic approach is implemented instead of the one-sided habitat fragmentation approach, the EU may be more successful at halting biodiversity loss by 2020 and finally turning the corner to protect biodiversity and ecosystem services.

### **Conclusions**

The EU is one of the global environmental leaders, and it has much to be commended for with respect to its efforts to protect biodiversity and prevent extinction. There is, however, much to be desired in the execution of its policies and implementation of its goals. Although the EU is a pioneer of transnational regulatory cooperation there is currently a credibility-expectations gap in this area. The EU has not been successful in halting biodiversity loss, thus failing to meet its 2010 deadline to do so. This has weakened its legitimacy as the global environmental leader and has prolonged the rapid loss of valuable ecosystem health and ecosystem services. Finding an adequate way of combating biodiversity loss is not only a necessary step for environmental health and combating the tragedy of the commons, but it is a way for the EU to continue to innovate and lead in environmental policy.

There are many factors that have caused a severe biodiversity crisis in Europe, and it is important that the EU embrace its role as the continent's most powerful body to introduce dramatic efforts to protect biodiversity. What the EU shows about protecting biodiversity is that governing bodies need to address five interlocking causes of biodiversity loss: habitat fragmentation, invasive species, and lack of economic and societal value, and adverse policy.

Creating policies to address just one aspect cannot be enough to halt extinction, and the more comprehensive the plan, the better. The causes of biodiversity loss are interdependent and so it is necessary to address them all, not just one aspect of the problem.

The tragedy of the commons explains that government action is one of the best ways to prevent the loss of a common resource, and this is a role that the EU is trying to embrace. It would seem that this case study shows the difficulty of protecting a common resource due to the many competing incentives.

A holistically engaged approach that addresses all the aspects of biodiversity loss has the ability to truly make strides towards protecting biodiversity in Europe. The EU's efforts to protect biodiversity primarily through Natura 2000 have shown that it is not enough to only address a portion of the problem, and its mild attempts to institute additional policies have not been dramatic or comprehensive enough to make a significant difference in halting biodiversity loss. The problem has continued.

The European Union is an important case study for biodiversity because it has the ability and interest in addressing the many causes of biodiversity loss. Understanding the successes and failures of the EU with respect to biodiversity is important for creating responsible management of biodiversity as part of the global commons. The EU shows that it is possible for an institution to take dramatic steps toward protecting biodiversity. The EEA has made large strides and although it has been unsuccessful in halting the march of biodiversity loss, it is arguable that steps have been moderately successful. There are many steps ahead for the EU, but it should be seen as an important example of what the world should be doing to protect biodiversity and prevent extinction.

Can the EU halt biodiversity loss? The answer is a qualified yes: the EU has the ability to halt biodiversity loss and protect the health of its ecosystems. However, it needs to learn from its failure to halt biodiversity loss by 2010 and embrace a more comprehensive policy toolbox. Other governments and institutions can learn from the EU and can also halt biodiversity loss. The key is a holistic approach. Reflecting on Hardin's *Tragedy of the Commons*, government action and privatization are two of the keys to protecting biodiversity. As Buck rightly points out, societal values are also important. These three factors of the tragedy of the commons are all seen in the EU's successes and failures in biodiversity policy, and are an important component of protecting biodiversity and other common resources. There have been successes in EU biodiversity policy. By expanding into the other policy areas and enforcing a deeper commitment to halting biodiversity loss, the EU can expect to see more success and continue to be a global environmental leader.

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