European Commission

POTENTIAL IMPACTS OF BIOENERGY DEVELOPMENTS ON HABITATS AND SPECIES PROTECTED UNDER THE BIRDS AND HABITATS DIRECTIVES

Final Report

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September 2020

PDF	978-92-76-222088-6	10.2779/614742	KH-02-20-718-EN-N

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Citation: Bowyer, C, Tucker, G, Underwood, E, Nanni, S, Becerra, G, Pantzar, M, Monteville, M, Riera, A, Kollenda, E, Richter, K, Stanová, V Š and Edwards, L (2020) Potential impacts of bioenergy developments on habitats and species protected under the Birds and Habitats Directives. Final report under EC Contract ENV.D.3/SER/2017/0002 Project: "Reviewing and mitigating the impacts of renewable energy developments on habitats and species protected under the Birds and Habitats Directives", Institute for European Environmental Policy, Arcadis, BirdLife International, NIRAS, Stella Consulting, Ecosystems Ltd, Brussels.

EC Contract ENV.D.3/SER/2017/0002

Project: "Reviewing and mitigating the impacts of renewable energy developments on habitats and species protected under the Birds and Habitats Directives"

September 2020

EXECUTIVE SUMMARY

The development of renewable energy sources is crucial for achieving the EU's energy and climate targets. At the same time, such developments may give rise to conflicts with EU biodiversity goals, especially those related to nature conservation. With an aim to assist stakeholders in managing these potential trade-offs and to understand better the potential direct and indirect impacts that the different forms of renewable energy developments (wind, solar, ocean, geothermal energy and bioenergy) may have on habitats and species protected under the EU legislation and the ways of mitigating them, the European Commission has implemented the project titled "Reviewing and mitigating the impacts of renewable energy developments on habitats and species protected under Birds and Habitats Directives"[1]. This report synthesises the messages arising from one of the 6 tasks of the project, which has addressed the potential impacts of bioenergy developments on species and habitats protected under the Birds and Habitats Directives.

The analysis considered the potential impacts associated with the cultivation, production and extraction of feedstocks for all bioenergy end uses on habitats and species protected under the EU's Birds and Habitats Directives. It reviewed policies in place in Europe, and in Member States, that may support the mitigation of negative impacts. Where gaps were identified these were defined and possible solutions explored.

The analysis focused on three main types of land use and land management consequences linked to use of biomass for energy, and the associated impacts on habitats and species:

1. Conventional crops (i.e. food and feed crops) including crops directly used for biofuels, bioliquids and biogas[2] and residues from agriculture[3] and anticipated changes in agricultural land management and land use;
2. Purpose grown energy crops cultivated on agricultural land[4] and the anticipated changes in agricultural land use;
3. Forest biomass from existing forest land including the primary forest residues[5] and the anticipated impact on forest management regimes.

It should be noted that changes in land use or management driven by bioenergy consumption may have positive, neutral or negative impacts depending on their scale, location, context and the EU protected habitats and species affected. Mitigation measures can, if correctly implemented, avoid or reduce impacts that may otherwise be detrimental for habitats and species of EU interest. This study aimed to understand better the risks for EU protected habitats and species posed by bioenergy demand now and to 2030, opportunities for

[1] https://ec.europa.eu/environment/nature/natura2000/management/natura_2000_and_renewable_energy_developments_en.htm

[2] The study focuses on oilseed rape, maize, wheat and other cereals, sugar-beet and grass

[3] Including residues from crops and from the management of semi-natural habitats

[4] Including Miscanthus, Reed Canary Grass, Short Rotation Coppice, afforestation with fast growing trees and small-scale tree planting

[5] Primary forest residues are those produced in-forest rather than those resulting from the processing of forest biomass they include stumps, thinning, tops and branches, deadwood, rejected sawlogs and other low value trees but excluding secondary residues arising from the processing of woody biomass for other end uses for example sawdust, cutter shavings etc as the latter residues do not represent primary extraction from forest for energy feedstocks

mitigation, the extent of existing policy coverage and future policy needs. To this end the following analysis was completed:

- Review covering the scale of demand and anticipated land use consequences of future EU use of biomass for energy up to 2030;
- Identification of the main risk factors for EU protected habitats and species, and assessment of species and habitat vulnerability to those risks based on recent (2015) levels of biomass use and that projected for 2030; and
- Analysis of the coverage of current policy in the EU (and Member States based on six national case examples), identification of policy gaps and consideration of additional governance needs to help mitigate identified risks to protected habitats and species in the EU.

Production of bioenergy feedstocks is commonly integrated with production of biomass for material, food or feed end uses more broadly. As a consequence, land management and land use changes reflect this interaction. This is taken into account in the analysis. This also means that messages and conclusions regarding policy gaps often apply more broadly to the production of biomass, not necessarily exclusively to biomass for energy.

The focus of this study is feedstock production in the EU. However, it is recognised that land areas outside the EU are deployed to meet the needs of Europe's bioenergy feedstock demands, and other biomass-based industries. With large-scale trade in commodities, in and out of the EU, there is a dynamic interplay between land uses that will affect biodiversity protection beyond the EU's borders.

Bioenergy, promoted as a form of renewable energy, is capable of delivering heat, power and transport fuels. It is generated by using heterogeneous feedstocks primarily from the agricultural and forestry sectors. As such, a broad sphere of policies could be of importance for protecting (and potentially enhancing) biodiversity from impacts associated with bioenergy production. The vulnerability analysis, that analysed EU habitats and species protected under the Habitats and Birds Directives, predicted future demand for bioenergy feedstocks will focus on woody biomass both from forests, land management and dedicated energy crops. This could lead to potential, increased intensity of forest management and the conversion of semi natural grasslands and other semi natural habitats for biomass feedstock production. These are considered to be the most significant risks to EU protected habitats and species associated with expanded, future bioenergy feedstock production. These impacts can, however, be mitigated by well targeted policy interventions.

Within the study four classes of policy intervention were identified as important when mitigating impacts on protected habitats and species associated with bioenergy. These reflect the need to consider nature protection measures, policy measures driving bioenergy demand and those intended to mitigate environmental impacts associated with biomass production.

1. Policies promoting renewable energy use i.e. those that impact on the scale of demand and the standards that bioenergy feedstocks comply with - primarily focused on promoting renewable energy and GHG emission reductions, given bioenergy's role in replacing fossil-based energy sources;

2. Policies to protect biodiversity from negative impacts i.e. policies in place to protect biodiversity from changes in supply or demand and associated changes in land use and land management including environmental assessments;
3. Policies supporting, determining or influencing approaches to land use and management i.e. policies that influence the nature of feedstock supply, how material is produced and any sustainability conditions mitigating biodiversity impact; and
4. Policies that establish reporting and monitoring systems i.e. those policies that deliver standardised baseline information (e.g. Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action) to help determine the level of bioenergy demand, feedstock use, feedstock sources and land management decisions associated with bioenergy feedstock production.

Taking into account existing policies to promote renewable energy to 2020 and 2030, and associated sustainability criteria for bioenergy, continued expansion in biomass demand from energy is anticipated. Over the period to 2030 demand is expected to evolve towards feedstocks from woody or lignocellulosic biomass for biofuels and solid biomass and use of agricultural residues and wastes for biogas. In this context there are two particular trends relevant to the habitats and species protected under the Habitats and Birds Directives:

- the potential cumulative land use change impact on semi natural habitats outside protected areas linked to an expanded area of lignocellulosic energy crops (including short rotation coppice and active afforestation); and
- the intensification of existing forest management including the extraction of forest residues.

The latter point is of particular importance, given that the majority Habitats Directive Annex I habitats in EU forests are currently considered to be in unfavourable conservation status.

The study highlights the important role that the Natura 2000 network has to play in the protection of EU protected habitats and species from the potential impacts of bioenergy feedstock production. This is because a very high proportion of the area of most types of Habitat Directive agricultural and forest habitat occur within the network; so too an expected substantial proportion of most protected species. Thus, the proper and full implementation of the Habitats Directive's Natura 2000 site protection and management measures, in combination with other policy measures (e.g. CAP regulations and funding), should be sufficient to avoid many of the potential impacts. In this respect it is important to emphasise that bioenergy feedstock production within Natura sites should be compatible with the site conservation objectives for its respective habitats and species.

However, EU protected habitats and species also occur outside the Natura 2000 network. Other mitigation measures will therefore be needed to avoid and reduce impacts to acceptable levels in these areas. The study has identified the following policy needs to further promote sustainable biomass use for energy and habitat and species protection in the EU. These needs take into account current policy heterogeneity and the ability of the EU and Member States to act. They should be addressed to enable biomass use for energy (and other end uses within the bioeconomy) that support the conservation of protected habitats and species in the EU.

- Ensure that existing environmental assessments (EIA, SEA procedures as set out in their respective Directives and Appropriate Assessment, as foreseen by article 6.3 of

the Habitats Directive) are implemented effectively and in a way that identifies and mitigates impacts associated with bioenergy feedstock production and use.

- Ensure that policies to protect against inappropriate land use change on agricultural land i.e. specifically loss of semi natural habitats, are effectively implemented. Taking into account the effective implementation of requirements under Article 6.2 of the Habitats Directive relating to the deterioration of habitats and disturbance of species. This includes rules under the current CAP greening provisions, for the protection of permanent grasslands and associated rules on impact assessment.
- Strengthen the implementation of sustainable forest management at EU and national level. Specifically, this should ensure consistent and effective mitigation of potential impacts associated with an increase in demand for woody biomass including emphasising the assessment of 'downstream' impacts of new facilities utilising woody material within environmental assessments, where applicable.
- Facilitate, support and enable 'better and best practice' to secure sustainable supply chains, emphasising bottom-up, coordinated action.
- Strengthen policy coherence and the coverage and coherence of data sets (in particular the relationship between biomass demand, land use and land management change) to facilitate understanding and enable informed dialogue on risks and impacts to biodiversity.

CONTENTS

SECTION 1 - INTRODUCTION TO THE ANALYTICAL APPROACH, EU BIOENERGY DEMAND AND POTENTIAL BIODIVERSITY CONSEQUENCES

1 INTRODUCTION TO THE TASK

The aim of this Task is to review and analyse the potential impacts of bioenergy developments on habitats and species protected under the Birds and Habitats Directives and make suggestions for possible mitigation measures taking into account broader legislative requirements. It is one of the six Tasks covered in a wider EU project titled: "Reviewing and mitigating the impacts of renewable energy developments on habitats and species protected under the Birds and Habitats Directives".

Within this analysis EU protected habitats and species[6], comprise:

- 'natural habitats of Community interest' listed in Annex I of the Habitats Directive – hereafter referred to as HD habitats;
- 'species of Community interest' as listed in Annexes II and/or IV or V of the Habitats Directive – hereafter referred to as HD species; and
- bird species listed in Annex I of the Birds Directive that require special conservation measures – hereafter referred to as BD birds.

Such habitats and species are likely to be particularly sensitive to environmental changes, including those relating to bioenergy production. Furthermore, they either comprise natural and semi-natural habitats, or are species that mostly tend to be dependent on these types of habitats. Therefore, whilst this study's results are highly relevant to the EU's nature conservation policy priorities, they are not necessarily representative of impacts on more widespread and generalist species.

Unlike other renewable energy technologies, bioenergy relies on a raw material feedstock that is 'used' within the energy process. Biomass can be regrown, but this requires the use of land, water and nutrients for ongoing production (Bowyer et al, 2015). **Associated environmental impacts are sensitive to the level of supply, meaning a change in biomass use for energy influences land use or land management[7]. Increased demand for bioenergy will drive demand for bioenergy feedstocks, which are generated primarily from agricultural and forest commodities**. The impacts on EU protected habitats and species that result from demand for biomass for energy are a consequence of increased demand for certain agricultural and forestry commodities[8].

[6] The word species is used to refer to the species or subspecies taxa as listed in the directives.

[7] It should be noted that this change in land management might involve more integrated production choices, i.e. combining food and feed production with biomass for energy outputs or materials on biogas combined with successional cropping

[8] According to Eurostat data agricultural land (defined as Utilised Agricultural Area in 2015) accounts for approximately 42% of total land area in the EU28. In addition, 38% of the total land area is considered forest (based on Forest Europe data for 2015).

As a consequence, this study is focused upon the potential impacts associated with the cultivation, production and extraction of feedstocks that are utilised within all bioenergy end uses. For facilities using biomass to produce power, heat or transport fuels the raw material must be grown, harvested, sourced and consumed on an ongoing basis. As a consequence, ongoing efforts to understand, monitor and control feedstock production and usage patterns are essential to determining desired environmental outcomes. From a biodiversity perspective it was considered that the direct impact of bioenergy plant construction was of more limited importance compared to the potential land use and land management impacts associated with the sourcing of feedstocks throughout the plant's lifetime. Moreover, it was agreed with the European Commission that other tasks within the project focus on the impacts on specific installations.

The analysis focused on three main types of land use and land management consequences linked to use of biomass for energy, and the associated impacts on habitats and species. These covered:

4. Conventional crops (i.e. food and feed crops) including crops directly used for biofuels, bioliquids and biogas[9] and residues from agriculture[10] and anticipated changes in agricultural land management and land use;
5. Purpose grown energy crops cultivated on agricultural land[11] and the anticipated changes in agricultural land use;
6. Forest biomass from existing forest land including the use of roundwood and primary forest residues[12] and the anticipated impact on forest management regimes.

It should be noted that changes in land use or management driven by bioenergy consumption may have positive, neutral or negative impacts depending on their scale, location, context and the EU protected habitats and species affected.

Mitigation measures can, if correctly implemented, avoid or reduce impacts that may otherwise be detrimental for habitats and species of EU interest. The aim of this analysis is to review and analyse the potential impacts of bioenergy developments on habitats and species protected under the Birds and Habitats Directives and make suggestions for possible mitigation measures. The analysis considers bioenergy demand now and to 2030, the extent of existing policy coverage and future policy needs. To this end the following analysis was completed:

- Review covering the scale of demand and estimated land use consequences of future EU use of biomass for energy up to 2030;

[9] The study focuses on oilseed rape, maize, wheat and other cereals, sugar-beet and grass

[10] Including residues from crops and from the management of semi-natural habitats

[11] Including Miscanthus, Reed Canary Grass, Short Rotation Coppice, afforestation with fast growing trees and small-scale tree planting

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- Identification of the main risk factors for EU protected habitats and species, and assessment of species and habitat vulnerability to those risks based on recent (2015) levels of biomass use and that projected for 2030; and
- Analysis of the coverage of current policy in the EU (and Member States based on six national case examples), identification of policy gaps and consideration of additional governance needs to help mitigate identified risks to protected habitats and species in the EU.

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The focus of this study is feedstock production in the EU. However, it is recognised that land areas outside the EU, is deployed to meet the needs of Europe's bioenergy feedstock demands, and other biomass-based industries. ***With large-scale trade in commodities in and out of the EU, there is a dynamic interplay between land uses that can affect biodiversity protection beyond the EU's borders***.

Box 1 – Introducing Protected Habitats and Species in Europe – The Focus of the Analysis

The main EU policy instruments that contribute to the EU biodiversity goals are the Birds and Habitats Directives. The Directives have two primary approaches to achieving their objectives: firstly, measures for the protection of species wherever they occur; and secondly the protection of sites of particular importance for species and habitats of Community Interest. The protected sites, designated under the two Directives, are intended to form 'a coherent ecological network' referred to as the Natura 2000 network. It should be noted that habitats and species of EU interest may occur outside of Natura 2000 sites (as well as in them) or may be reliant on ecological corridors and other forms of connectivity outside protected sites to maintain their populations. Species listed on Annex IV of the Habitats Directive are covered by the legal protection of Articles 12 to 16 throughout their natural range within the EU (including specific areas outside Natura 2000 where the species occur, in particular breeding sites and resting places for the animals). While certain plant and animal species benefit from both the Directive articles on conservation of natural habitats and habitats of species (i.e. the Natura 2000 network) and the articles on protection of species, the scope and the nature of the relevant provisions are different.

The overall goal of the Directives is to achieve favourable conservation status of the EU protected habitats and (non-bird) species, or to maintain wild naturally occurring bird populations at a level which corresponds to ecological, scientific and cultural requirements. Achieving favourable conservation status may require Member States to take active measures outside Natura 2000 as well as inside the network. The Habitats Directive states that Member States shall endeavour, where they consider it necessary, in their land-use

planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora. In this context it should be noted that Measures taken pursuant with the Habitats Directive 'shall take account of economic, social and cultural requirements and regional and local characteristics' (Article 2(3)).The Birds Directive states that Member States shall take the requisite measures to maintain the population of wild native bird species across their EU territory. This analysis therefore looks at potential impacts both within and outside Natura 2000 sites.

2 DEMAND FOR BIOENERGY FEEDSTOCKS – EU CONTEXT

'Energy from renewable sources' or 'renewable energy' includes that sourced from biomass – meaning the '*biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin*'. Bioenergy is the use of biomass (in the form of biomass fuels[13], biogas[14], bioliquids[15] and biofuels[16]) to produce power, heating or cooling, or transport fuels.

Policy is a one driver of bioenergy demand in the EU. There is no stated target for the consumption of bioenergy; however, bioenergy demand is associated with targets for the promotion of energy from renewable sources[17]. Bioenergy is one of the options Member States can use to meet their renewable energy targets; however, the contribution of bioenergy to 2020 and 2030 goals is neither limited nor required[18]. Its use for energy depends on interactions between demand, availability and cost of other renewable energy sources and fossil fuels, the extent of energy efficiency measures adopted, wider energy (including grid) infrastructure and rural development investment decisions, and competition in terms of demand for agricultural and forest biomass.

Bioenergy demand is linked with two binding targets currently set out in Directive 2009/28/EC on the promotion of energy from renewable sources, known as the RED. The first requires that 20% of energy use be from renewable sources by 2020 (which is differentiated into nationally binding targets per Member State); the second, that at least 10% of transport fuels come from renewable sources by 2020 in all Member States. Up to 2020, the RED[19] sets out

[13] 'biomass fuels' means gaseous and solid fuels produced from biomass - Article 2 Directive (EU) 2018/2001

[14] 'biogas' means gaseous fuels produced from biomass - Article 2 Directive (EU) 2018/2001

[15] 'bioliquids' means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass - Article 2 Directive (EU) 2018/2001

[16] 'biofuels' means liquid fuel for transport produced from biomass - Article 2 Directive (EU) 2018/2001

[17] For 2020 renewable energy targets are set out in Directive 2009/28/EC i.e. the Renewable Energy Directive known as the RED. They require that 20% of energy use be from renewable sources by 2020 (which is differentiated into nationally binding targets per Member State) and that at least 10% of transport fuels come from renewable sources by 2020 in all Member States. Beyond 2020 targets for renewable energy have been set out in Directive 2018/2001 (known as RED II or the recast Renewable Energy Directive). This states that Member States shall collectively ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 32%. Member States will determine their own targets and commitments and set these out in Integrated National Energy and Climate Plans. To promote renewable energy in the transport sector each Member State shall also place an obligation on fuel suppliers to ensure the share of renewable energy supplied is at least 14% of final consumption by 2030.

[18] The contribution of food and feed crops i.e. starch-rich crops, sugar crops or oil crops produced on agricultural land as a main crop (excluding residues, waste or ligno-cellulosic material and intermediate crops, such as catch crops and cover crops, provided that the use of such intermediate crops does not trigger demand for additional land) used to produce biofuels and bioliquids and other biomass fuels used in transport is limited to a maximum of 7% of final consumption of energy in the road and rail transport sectors in each Member State under Article 26 of Directive (EU) 2018/2001

[19] As amended by Directive 2015/1513 with the intention of limiting indirect land use change impacts associated with increased demand for biofuel and bioliquid feedstocks. While Directive 2009/28/EC set out sustainability criteria to limit direct land use change, indirect land use change was considered to be occurring at scale i.e.

sustainability criteria specifying rules to be complied with if transport biofuels or bioliquids used for heat or power are to be counted towards the targets set in RED or supported by national policies and funds.

Beyond 2020, targets for renewable energy have been set out in Directive 2018/2001 (known as RED II or the recast Renewable Energy Directive). This states that Member States shall collectively ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 32%. Member States will determine their own targets and commitments based on the 32% figure, to be set out in Integrated National Energy and Climate Plans. To promote renewable energy in the transport sector each Member State shall also place an obligation on fuel suppliers to ensure the share of renewable energy supplied for final consumption in the transport sector is at least 14% by 2030. In parallel the Directive puts in place rules to specifically promote advanced biofuels and biogas based transport fuels produced from specific feedstocks20 (as set out in Annex IX of the Directive). In addition, for all biofuels, bioliquids and biomass fuels consumed in the transport sector, the RED II places a limit on the use of feedstocks derived from food and feed crops21 and a declining cap on high indirect land use change-risk biofuels, bioliquids or biomass fuels produced from food and feed crops. RED II also extends sustainability criteria to all biomass used for energy (i.e. beyond biofuels (and other renewable transport fuels) and bioliquids to include biomass fuels used for heat and power). The existing sustainability criteria set out in RED, for biomass feedstocks are split into rules for agricultural biomass and new criteria for forest biomass (see section 5 for further details).

There are established supply chains for biomass which require relatively limited transformational change of the energy systems in order to enable take up. It can also be stored and used rapidly on demand, hence has been supported as standby capacity in some Member States. As a result, in 2017 the most important source of renewable energy in the EU-28 was wood and other solid biofuels, accounting for 42.0 % of primary renewables production (Eurostat[22]). In 2017 total renewable energy consumption in the EU reached 13.9% of total energy consumption across the EU 28. Wood and solid biomass, liquid biofuels, biogas and renewable wastes i.e. all biomass accounted for 8.6% of total EU 28 energy

where exiting production was being displaced onto other land to make way for biofuel feedstocks. Directive 2015/1513 increased GHG emission saving requirements and applied a limit to the contribution biofuels made from crop-based feedstocks could make to the renewable transport fuel target (capped at 7 per cent of transport fuels).

[20] The RED II, Article 25 states that 'within the minimum share referred to in the first subparagraph, the contribution of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX as a share of final consumption of energy in the transport sector shall be at least 0,2 % in 2022, at least 1 % in 2025 and at least 3,5 % in 2030.' In addition, for advanced biofuels and biogas for transport produced from the list of feedstocks set out in Annex IX their contribution 'towards the minimum shares referred to in the first and fourth subparagraphs of Article 25(1) may be considered to be twice their energy content'.

[21] Defined as 'starch-rich crops, sugar crops or oil crops produced on agricultural land as a main crop excluding residues, waste or ligno-cellulosic material and intermediate crops, such as catch crops and cover crops, provided that the use of such intermediate crops does not trigger demand for additional land' (Article 2)

[22] Primary production of energy from renewable sources EU-28 1990-2017

consumption in 2017, representing approximately 62% of total renewable energy consumption in the EU (Eurostat[23]).

Analysis by IRENA and European Commission (2018) modelled potential use of renewable energy to 2030, identifying that 33% of energy could be sourced from renewable energy and 34% if 30% energy efficiency measures are applied with full implementation of all renewable energy options[24]. This is slightly higher than the 32% ultimately adopted under REDII. The study estimates that bioenergy's contribution to energy would grow to deliver 12.2EJ of energy by 2030, representing a twofold increase between 2010 and 2030[25]. In terms of overall renewable energy demand, biomass from energy expands to 2030 in terms of the total volume used; however, it declines as a proportion of total RES (as the pool of other RES technologies expands faster) from 67% in 2010 to 55% in 2030. The expansion in biomass use volume is focused on transport biofuels;[26] within district heating; and within heating and cooling for industry.

Modelling produced to support the EU's long-term strategic vision for a prosperous, modern, competitive and climate neutral economy (European Commission, 2018a) noted that in all scenarios there is a growth in bioenergy demand to 2030, beyond this growth and usage varies considerably depending on the penetration of other renewable sources and alternatives in industry in particular alternative solutions to the production of heat. In terms of the feedstocks used to produce biomass energy, waste is envisaged to play an important and significantly expanded role to 2030. However, in addition to 2030 all scenarios foresee an expansion in the use of forest residues with the forest sector providing 60 to 65 Mtoe of wood for energy. In addition, they foresee expansion in use of agricultural residues and, dependent on scenario an extensive increase in the use of products from short rotation coppice (SRC) and lignocellulosic grasses (such as switch grass and miscanthus)[27].

As a consequence of the increased scale of demand, analysis looking at land use change[28] identified impacts on forest systems (i.e. the intensification in forest management (Forsell et

[23] Share of renewables in gross inland energy consumption, 2017 - https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Share_of_renewables_in_gross_inland_energy_consumption,_2017_(%25).png https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Figure_3-Primary_production_of_energy_from_renewable_sources_EU-28_1990-2017.png At the time of drafting 2018 data was published but the specific share of renewable energy sourced from biomass had not been fully broken down. See: https://ec.europa.eu/eurostat/documents/38154/4956088/SUMMARY+partial+provisional+results+SHARES+2018/25ce9f29-7053-17c5-12a6-8efe878b6031

[24] This would include use of biodiesel, biomass in industry, conventional bioethanol, biomass in power and district heat and advanced bioethanol.

[25] It should be noted that under the reference case (which assumes the continuation of existing and planned policies to deliver approximately 24% RES by 2030) biomass demand is expected to grow substantially to reach 9.6 EJ by 2030

[26] It should be noted that the analysis predates the new EU rules now potentially restricting what can be used both in terms of crops, ILUC impacting fuels and promotion of advanced fuels);

[27] Scenarios range between demand 38 Mtoe of bioenergy from SRC and lignocellulosic grasses to 108 Mtoe

[28] In the form of the modelled future scenarios completed under the RECEBIO I (Forsell et al, 2016a), RECEBIO II (Forsell et al, 2016b) and Biosustain (PwC et al, 2017) projects and the European Commission LTS analysis (European Commission, 2018a).

al, 2016b)[29] and an expansion in land used for energy crops i.e. SRC and lignocellulosic grasses and forest land within the EU (European Commission, 2018a). The same studies also predict that there will be a loss of semi natural land (although conversion of protected sites was excluded from the analysis) including specifically non-productive grassland and scrub and reconversion of abandoned agricultural land primarily to lignocellulosic crops and short to medium term tree rotations. The extent of impacts within the EU will, however, depend on the profile of imports from third countries. Further detail on the extent and profiling of demand is presented in section 2 and the separate Annex report.

3 BIOENERGY DEMAND AND BIODIVERSITY

Unlike other renewable energy technologies, bioenergy relies on a raw material feedstock that is 'used' within the energy process; while biomass can be regrown, this requires the use of land, water and nutrients for ongoing production (Bowyer et al, 2015). The key challenge for bioenergy, indeed for all biomass production, is that the environmental impacts are sensitive to the level of supply. The change in biomass use for energy has implications associated with changes in land use or land management, which affects the exposure of biodiversity to feedstock production. Changes in land use and land management for biomass production can have negative, neutral or positive impacts on biodiversity, depending on the scale, locations and choices made for the feedstocks, the approach to production, and the conditions in place before change.

Increased demand for bioenergy, will drive increased demand for bioenergy feedstocks, which are generated primarily from agricultural and forest commodities. The impacts on habitats and species protected under the Habitats and Birds Directives that result from demand for biomass for energy, will be linked to the increased demand for certain agricultural and forestry commodities. Analysis within this report therefore focuses on:

- Impacts associated land-use change driven by crops used for energy, such as establishment of dedicated energy plantations, cultivation of dedicated energy crops and the associated consequences for protected habitats or species;
- land management impacts of increased biomass demand including:
    - increased removal of biomass from forests that are currently harvested and managed, by taking leaves, branches, dead wood, extracting stumps, etc.;
    - harvesting forests more frequently, thus reducing rotation period and the potential loss of older forests or tree stands;
    - harvesting and management of forest that would otherwise not be exploited;
    - intensification of other land uses including cropland and grasslands (e.g., taking more residues, increases in fertilisation level, higher share of monoculture with fewer rotations).

The subsequent sections of this report investigate the questions of bioenergy and biodiversity interactions taking into account the above categorisation of potential impacts and their

[29] It should also be noted that within RECEBIO I analysis looking at increasing volumes of wood use for energy were seen before additional land was converted to managed forest, the team inferred that this implied an intensification of forest management in addition to conversion in order to meet biomass demand.

extent. It should, however, be noted that the impacts of bioenergy extraction will often not be distinct from wider biomass extraction or cultivation for other purposes. Moreover, the actual end use of biomass material may not be known when cultivating or harvesting a crop. This will depend, inter alia, on wider trends in commodity prices, access to processing facilities for bioenergy/alternatives, and the quality of material produced and thus its value in competing markets.

SECTION 2 – ANALYSING THE POTENTIAL IMPACTS OF BIOENERGY DEVELOPMENTS ON HABITATS AND SPECIES PROTECTED UNDER THE BIRDS AND HABITATS DIRECTIVES

The assessment of sensitivity and vulnerability of protected habitats and species was conducted based on a comparison between the likely sensitivity of species (i.e. inherent risk factors linked to relevant species and habitats of EU interest) and exposure to likely pressures (based on current and future anticipated demand for bioenergy and the associated land use consequences). It covers the main types of biomass feedstock produced in the EU according to the typology set out in Section 1 i.e. conventional crops (including food and feed crops) and residues used for bioenergy, purpose grown energy crops, forest biomass. It considers, and attempts to quantify, the sensitivity of EU protected habitats and species to:

- Impacts on species associated with habitat loss (e.g. conversion of grassland to bioenergy cropland).
- Direct mortality of species (e.g. losses of ground nesting birds during the harvest of bioenergy crops).
- Disturbance of species (e.g. from noise or visible movements of machinery or people such as during forestry operations).
- Habitat condition change due to changes in land management associated with bioenergy feedstock demand (e.g. increased fertiliser use, change in crop type cultivated or intensity of management, more intensive forest management).

The assessment focusses on the impacts on relevant species and habitats of EU interest. The assessment involves the following steps, the outcomes of which are presented in the following chapters, with detailed material presented in the separate Annex report:

- Description and estimation of current bioenergy feedstock production (baseline built on data from the JRC and Eurostat) and review of the models of anticipated bioenergy feedstock demand in EU in 2030 and 2050 (based on publications from the European Commission);
- Review of published literature on sensitivity of habitats and species of EU interest associated with cropland, forests, heath and scrub to agricultural and forest land use change and management associated with bioenergy feedstock production (nearly 500 references).
- Assessment of the vulnerability of habitats and species of EU interest: this combined scored sensitivity of each relevant habitat and species to the reviewed agricultural and forest interventions, with the assessment of current and 2030 exposure to these interventions to the extent they are linked to bioenergy demand, with and without full protection in the Natura 2000 network.

4 Examining Estimates of Bioenergy Demand and Its Impacts on European Land Use and Management Now and Into the Future

To understand the consequences associated with bioenergy production for habitats and species protected under the Habitats and Birds Directives it is first necessary to gauge the scale of demand for different commodities associated with bioenergy feedstock production. This analysis brings together information on the production of biomass and potential use of biomass in the different energy end uses. The following section summarises details of EU production of potential bioenergy feedstocks in the EU 28, all data sources and more detailed analysis can be found in Section 2 of the separate Annex report.

This analysis summarises bioenergy feedstock production according to the following typology used throughout this study:

- Bioenergy from conventional food and feed crops
    - Main crops used for biofuels, bioliquids and biogas
    - Agricultural crop-based residues[30]
- Energy crops, focusing on novel crops and non-food crops (e.g. Miscanthus)
- Woody biomass used directly for energy i.e. excluding secondary wood sources
    - Roundwood
    - Primary forest residues

Ahead of the presentation of data a number of limitations should be noted. As explained in section 1, the extent of biomass demand is not fixed as it is part of the wider demand and goal setting for renewable energy as a whole. Moreover, in contrast to other sectors, biomass for energy may feed into energy demand via multiple production processes and end uses including: biofuels for transport, liquid biofuels for heat and power, solid biomass for heat, power and combined heat and power in the form of logs, wood chips or pellets at multiple scales, biogas converted into transport fuels, electricity or heat. Finally, biomass demanded for energy often has alternative uses, therefore determining the portion of demand, and impacts associated with only the bioenergy end uses, can be difficult to differentiate from broader trends (Box 2 presents key information on land use in the EU illustrating the integrated nature of feedstock production with wider biomass production for food, feed and material uses).

[30] It should be noted that while residues from semi-natural habitat management etc can be used for bioenergy the extent and quantity will be dictated by the management needs of the site in question, not broader demand pressures or production pressures.

Box 2 – Land use in Europe – delivering agricultural and forestry products

The land use, land cover and management of land will determine the habitats and species identified to be protected and the ability to mitigate impacts on a specific habitat or species deemed of importance. As noted above the two important land uses for bioenergy feedstock production are agriculture and forest. In Europe both agricultural land and forests are primarily managed to deliver biomass outputs, together with other public goods for society. The approach to cultivation and management will influence in particular semi natural habitats and their ability to deliver biomass alongside biodiversity protection.

In 2015 the total Utilised Agricultural Area (UAA) in the EU 28 covered nearly 179 million ha (approximately 42% of total land area). While the largest part (59.8%) consisted of arable land (107 million ha), close to one third was occupied by permanent grassland (59 million ha), and 6.6% by permanent crops (12 million ha). The proportions of UAA dedicated to different land covers varies considerably from 98.6% of UAA being arable land in Finland, to 30.2% in Portugal and 10.2 % in Ireland (Eurostat, 2017).

In 2015 forest area in the EU28 amounted to approximately 161 million ha and accounted for 38% of the total land area. Other wooded lands cover an additional 21 million ha (5%). According to Forest Europe Report, which also includes countries in addition to the EU, around 87% of European forests were classified as semi-natural in 2015. Undisturbed forests cover around 3% (7.3 million ha) and plantations 9% (12.9 million ha) of forest area. Over the last 15 years, the area of forest in Europe designated for biodiversity and landscape protection increased by half a million hectares annually. Around 12.2% (or 29.9 million ha) of European forests are protected with the main objective of conserving biodiversity. The strictness of protection for biodiversity varies considerably within Europe: while restrictive protection with minimal or no intervention dominates in North Europe and some East European countries, active management in protected areas is more common in Central and South European countries [31].It has been estimated that approximately 384, 000 km^2 of forest are included in the Natura 2000 Network. This represents around 50% of the total area in Natura 2000 and around 21% of the total forest resource in the EU (European Commission, 2015b).

5 BIOFUELS AND BIOGAS FROM CONVENTIONAL FOOD CROPS

5.1.1 Current Use of Conventional Crops for Energy

When considering conventional crops for bioenergy the primary uses are for biodiesel, bioethanol and biogas. The following section presents data on current and anticipated future use of these fuels alongside data on the production of crops relevant to their production in Europe. As noted above it is often challenging to determine the exact proportion of change attributable to feedstock production for their end uses. This is a consequence of the integrated nature of the production system.

[31] Data on forests is taken from the State of Europe's Forest 2015 report by Forest Europe (Forest Europe, 2015). It should be noted that where possible data is set out for EU28, but wider 'European' statistics include data reported from European countries outside the EU for example Iceland.

Biodiesel production shows a number of trends in terms of crop-based feedstocks produced in Europe on agricultural land. The use of rapeseed-based oils has declined marginally between 2010 and 2015, though fluctuating over this period. This is most likely due to comparative demand and prices on the commodity markets. Level of soybean-based oils has also declined since 2010. The use of sunflower oil for biodiesel doubled from 140,000 tonnes to 330,000 tonnes over the same period. It was estimated that approximately 43% of rape seed production was used for biodiesel production in 2015 (AEBIOM, 2017).

The main oilseeds, rape and turnip rape, sunflower seed and soybeans[32], were grown on 11.6 million ha across the EU Member States in 2015 (10.8% of the total arable land). EU production of main oilseeds has grown considerably in recent years, namely 31.7% by volume from 2007 to 2015. The increase in production was in part due to expanded cropland area and in part due to increases in yield per unit area. Specifically, the production of:

- Soya bean production in Europe increased by 183.2% from 2007 to 2015. Italy, France, Croatia and Hungary were among the countries with the largest increases both in harvested tonnes and in cultivated hectares of soya;
- Sunflower seed production increased by 62.2% between 2007 and 2015, reaching 7.9 million tonnes in 2015. The corresponding cultivated area of sunflower seed increased by 19.8% from 2007 to 2015.
- Rape and turnip rape seed grew more moderately during the same time span with an increase of 17.2% of the harvested production and a 5.4% increase of the cultivation area.

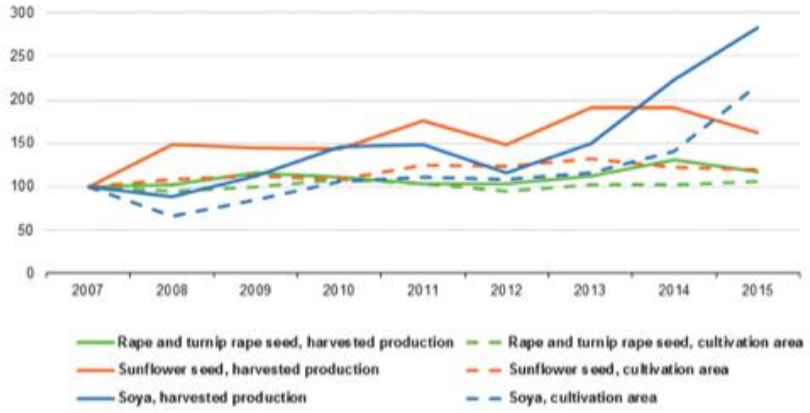


Figure 2 – Evolution of harvested production and cultivated area of rape and turnip seed, sunflower seed and soya, EU 28, 2007-15; 2007 =100 – Source of data Eurostat apro_acs_a

Statistics for ***bioethanol*** consumption in Europe suggest that corn-based ethanol has expanded to the greatest degree in terms of feedstocks use. The level of wheat used as a

[32] Oil Seed Production in Europe (data extracted from (Eurostat, 2017)).

feedstock has also increased significantly, with a more limited expansion in sugar-based bioethanol It should be noted that specifically in the case of corn-based and sugar-based bioethanol feedstock cultivation is primarily located in third countries. Approximately 12% of sugar beet production and approximately 4% of common wheat production was estimated as being used for bioethanol production in Europe in 2015 (AEBIOM, 2017).

Cereal production[33] in the EU 28has fluctuated considerably since 2007. This is linked to imbalances in supply and demand associated with high prices in 2007 and unfavourable weather conditions in 2009. Despite the production decreases of 2009, 2010, 2012 and 2015 the total level of cereal production in the EU-28 stood 20.3% higher in 2015 than in 2007 (an increase of 53.5 million tonnes). In contrast to production, the harvested area of cereals in the EU-28 remained relatively stable between 2007 and 2015 – never fluctuating by more than 6%. It should be noted that the areas of cereal production are considered to be shifting with increasing areas of cultivation in Baltic Member States, Belgium and Bulgaria.

The ***biogas*** market has evolved significantly since 2010. Biogas production has expanded, estimated to have almost doubled between 2010 and 2015 and this expansion is primarily based on agricultural inputs (EBA, 2017)[34]. However, commonly statistics report jointly in terms of agricultural categories. They do not distinguish between the sources i.e. dedicated crop-based biogas, grass-based biogas, crop residue-based material or manure.

Crops harvested in the green are noted in the EU statistics to be used for fodder or biogas production. The EU statistics focus on green maize. Green maize was harvested from almost 6.2 million ha in the EU-28 in 2015. The area increased by 0.7 million ha in 2015 (+13.4%) compared to the 2010 area. The area of green maize is noted to be expanding, but production and expansions are concentrated in specific Member States (Eurostat, 2018a). This is likely to be both as a result of demand for feed as well as to meet biogas demand. In 2015 it was estimated that 7.5% of maize was used to meet bioenergy demand (AEBIOM, 2017).

5.1.2 Future demand for conventional food crops for bioenergy

Looking to 2030 the use of conventional crops for bioenergy production, in particular for biodiesel and bioethanol production is anticipated to stagnate and, in some cases, decline; although modest increases are anticipated in usage to 2020. This is driven by the changes in the EU policy baseline with RED II set to: apply sustainability requirements to all agricultural biomass used for energy (i.e. including biogas) post 2020; cap biofuels and bioliquids at 2020

[33] Only cereal production is considered here, while the EU does produce sugar beet analysis of the trend data suggests that *recent trends have in production appears have been primarily linked to production quotas and change in subsidy systems. Note again increasing yields to area of production are significant. Moreover There is no overarching trend to define and the statistics suggest that there are not major changes wheat or grain maize to suggest that EU production is shifting to take account of bioethanol production*
– see separate Annex report for details.

[34] According to the European Biogas Association between 2009 (earliest EBA data) and 2016, the total number of biogas plants rose from 6,227 to 17,662 installations (+11,435 units). Most of that growth derives from the increase in plants running on agricultural substrates: these went from 4,797 units in 2009 to 12,496 installations in 2016 (+7,699 units, 67% of the total increase).

levels, which in turn are capped at a maximum of 7% of transport fuels by rules set in Directive (EU) 2015/1513[35] i.e. Member States may choose to set this at a lower level; and limit 'high indirect land-use change risk food or feed crop based biofuels, bioliquids and biomass fuels produced from food and feed crops'[36], which should decrease to 0% by 31 December 2030 at the latest.

According to the European Commission's Agricultural Outlook (2018-2030) (European Commission, 2018b) reaching the 2020 cap on biofuels produced from food and feed crops could translate into a further increase in crop-based biofuel consumption in 2019 and 2020 i.e. the 7% cap in 2020 still allows some increase in consumption rates. The types of food and feed crops being used to produce bioenergy feedstocks are expected to change. Whether feedstocks are determined to be high-ILUC-risk or low-ILUC-risk will impact on the types of feedstock used to produce biofuels to meet EU demand.

Overall, the share of crop-based biofuels, in energy terms, is projected to increase from 4.7 % in 2020 to 5.5 % in 2030, driven by biofuel mandates set by Member States. However, it should be noted that these figures include imports as well as domestic production. When only domestic production is included there is a decline in biofuel production from European food and feed crops. This sees first generation biodiesel production in Europe remain relatively static and first generation ethanol production decline slightly (i.e. around 4 per cent) [37].

5.1.3 Residues from Agricultural Crops

The total agricultural biomass produced annually in the European Union is estimated at 956 Mt of dry matter. The fraction of the biomass which is not the primary aim of the production process (e.g. dry biomass from leaves, stems), is referred to as residue production. Production of agricultural residues in Europe is estimated as 442 Mt or 46% of total agricultural biomass production (Camia et al, 2018). Agricultural residues are often discussed in the context of advanced biofuels. However, data on advanced bioethanol production (AEBIOM, 2017) shows limited adoption in 2015. Agricultural residues can also be used in other forms of biomass for energy including as an input to pellet production, biogas or dedicated biomass plant. However, at present there is no coherent data on the extent of their use.

[35] As set out in article 26 of RED II, the use of food and feed based conventional biofuels would be capped at *a maximum of 7%* of gross final consumption in road and rail transport in that Member State/or no more than 1 percentage point higher than their contribution in 2020.

[36] RED II, Article 25 - The basis for determining high/low indirect land use change (ILUC) risk biofuels, bioliquids and biomass fuels is determined by a delegated Regulation 2019/807 adopted on 13 March 2019. This sets out the basis for determining high ILUC risk feedstocks and certifying low ILUC risk feedstocks. Low ILUC risk certification is linked to use of abandoned and degraded land and production by smallholders (i.e. less than 2ha). High ILUC is determined based on increases in global trends in production and that a proportion of expansion occurs on high carbon stock land.

[37] It should be noted that the Agricultural Outlook data is used rather than studies completed for the impact assessment of the RED II proposals. This is because the policy baseline has changed significantly as a result of amendments made during the approval of REDII. The Agricultural Outlook 2018 takes this into account

Information on agricultural residues is limited, the proportion of residues being produced associated with a given crop, or the volume of residual material is not recorded. For example, information about volume or area of cereal straw would not be differentiated from the areas of overall cereal production. Hence 'estimates of agricultural residues (in Camia et al (2018)) are based on empirical models[38] […] the uncertainties are relatively large indicating the need for future improvements in the models used to estimate agricultural residue production'.

Based on analysis by JRC in relation to residue production it is estimated that: cereals represent 74% of total agricultural residue production (329 Mt/yr), while oil-bearing crops is the second group of importance with 17% (73 Mt/yr). Total residue biomass from agriculture has increased slightly between 1998 and 2015. This is linked to expansion in areas of 'high residue producing crops' e.g. oil seeds. Only a proportion of this total production is currently collected. Analysis by JRC (Camia et al, 2018) has attempted to estimate the share of collected crop residues i.e. the fraction of crop residues which is collected and enters bioeconomy value chains. This is estimated to range from 25% for cereals to 10% for oil bearing crops and 0% for pulses.

Studies have estimated the available potential of agricultural residues for use for energy. For example analysis looking at available wastes and residues for advanced biofuels (Malins et al, 2013) estimated that around 122 million tonnes of agricultural residues are currently sustainably available, based on the assumption that one-third of residues must remain in the field to maintain soil quality, and one-third must be left for existing uses. Biomass Futures work identified a straw potential of 127 million tonnes for the EU-27 (before Croatia's accession) in 2020 for energy (Elbersen et al, 2012). These studies are helpful in supporting estimates of potential future residue use for energy.

5.2 Energy crops, focusing on novel crops and non-food crops

Centralised EU data sets on energy crop usage are inconsistent in terms of their coverage and the baselines applied in different Member States. Therefore, national case study sources have been identified and used as a basis for estimating areas for Short Rotation Coppice (SRC) and Miscanthus cultivation – used as proxies for wider energy crop areas. The SRCplus project reported areas of SRC for France as 2,457 ha, 2,088 ha in Czechia and between 4000 and 6000 ha for Germany in 2012 (Dimitriou et al, 2014). Data for the UK (Defra, 2017) and France (France Miscanthus, 2018) suggests that in 2015 they had 6,905 ha and approximately 5,000 ha of Miscanthus respectively. Although it should be noted that France Miscanthus considered only two thirds to be currently in use for energy, the other third is used primarily for mulching and animal bedding.

[38] Residue production is currently deduced from economic production using empirical models that describe, for each individual crop, the relationship between biomass cumulated in plant storage organs and biomass produced in other aboveground organs (e.g. leaves, stems, etc.). Although relationships exist for most crops, estimating residue production solely from economic production is an over-simplification, as genetic factors (varietal differences), agro-climatic conditions, and agro-management practices (e.g. irrigation, fertilizing) influence the relationship. As a result, the uncertainties can be large in most of the model estimates for specific yield intervals (Camia et al, 2018).

Modelling studies[39] produced for the European Commission anticipate a significant increase in the area of energy crops to 2030, both SRC and other perennial lignocellulosic crops e.g. Miscanthus. The RECEBIO I analysis identified an increase in SRC under its BAU scenario from 10,000ha in 2010, 2,500,000 ha by 2030 to 3,400,000 ha in 2050 and under its EU Emission Reduction Scenario (where ambition and use of bioenergy increases to 2050) 8,900,000 ha in 2050. It should be noted that the 2010 data are model outcomes run from 2000 base year.

Advanced bioethanol use is anticipated to increase and expand to 2030; in combination with other wood uses for energy. The use of SRC in particular is seen as an alternative to intensification of forest uses or imports of biomass material from third countries[40]. It should be noted that SRC expansion in particular is seen within the modelled results as occurring on 'other natural land' (Forsell et al, 2016a) or 'surplus land' (PwC et al, 2017). This is land not currently in active use for agriculture or forestry, and not designated for nature conservation[41]. In reality, however this is noted by the study authors to often include other semi natural land and scrub land potentially of biodiversity importance particularly for protected species that will often sit outside protected habitat areas (Forsell, 2016a).

5.3 Biomass from primary wood production

5.3.1 Use of woody biomass for energy

Analysis of use of woody biomass focuses on the consumption of biomass volumes in the form of wood flows, comparing this to total stock of material and annual increments in growing stock (measured in Mm^3). Wood flow analysis examines the level of extraction of wood and the uses to which it then 'flows' allowing proportions being used for energy to be estimated.

The total wood used from EU forests in 2015 was estimated by the JRC as 921 Mm^3 (Cazzaniga et al, 2019). There are variable estimates of the proportion of wood use for energy compared to material uses. Studies estimate between 31% (Indufor, 2013) and 49% (Cazzaniga et al, 2019) of wood used being for energy[42]. However, around 50% of this energy (48% in Keränen & Alakangas, 2014 and 51% in Indufor (2013)) is produced using primary wood i.e. material that has not already been utilised or become a waste stream from an industrial process. Analysis by Camia et al (2018) has identified, however, that the split between wood for energy and material use varies considerably between EU Member States.

[39] Recebio I (Forsell et al, 2016a) and Recebio II (Forsell et al, 2016b) and Biosustain (PwC et al, 2017) studies all completed for the European Commission in support of the impact assessment of the RED II proposals.

[40] Based on RECEBIO I sensitivity analysis

[41] Protected land is completely excluded from scope of the modelling in terms of production. While this is not a 100% accurate picture of production, this assumption was required to set clear rules within the model.

[42] This is consistent with more recent findings, for example in the 2015 Joint Wood Energy Enquiry of 38.2% of the wood fibres for energy generation derive directly from woody biomass from forests and wooded areas outside forests (UNECE/FAO, 2015). Data reveals the trend that member states increasingly source wood energy from indirect sources (e.g., wood residues and processed wood based fuels) and less wood directly from the forests. Also wood energy use in the industry and residential sector decreased while the power and heat sector consumed more wood for energy.

Analysis in Cazzaniga et al (2019) compiled data on past wood extraction and use reviewing total wood use, the split between energy and materials and the use of both direct wood and indirect wood sources for energy. Within the JRC data the following trends are suggested:

- that total wood use in the EU 28 is increasing (rising from 737Mm3 in 2009 to 921Mm3 in 2015), this includes a limited volume of imports, but the majority is from EU forests;
- that the percentage of total wood use for energy has increased, as has the total volume of wood used for energy (rising from 338Mm3 in 2009 and 45.8% of use to 451Mm3 in 2015 and 49%);
- that the proportion of direct wood i.e. biomass entering energy production without further treatment is declining while the proportion of indirect wood used for heat and power are increasing. Direct wood encompasses the majority of 'primary biomass extraction for energy' including wood chips. However, some of the indirect wood bracket would likely also include primary biomass from forests i.e. thinning and other forest residues used for pellet production.

It should, however, be noted that data from Eurostat provides a somewhat different picture. Production of roundwood declined significantly during the financial crisis between 2008 and 2010. As a consequence, the JRC figures were assessing from a changed economic baseline.

5.3.2 Use of Forestry Residues

In the context of this analysis forestry residues are considered to be the use of primary forestry residues i.e. unprocessed material linked to direct forest extraction. This review does not consider the residues emerging as by-products from wider industrial wood processing.

Few studies actually look in detail at the quantity of primary residues being removed from European forests. In their 2018 analysis of biomass production, supply, uses and flows in the EU, the JRC estimate that over the period 2004-2013 the yearly average wood felling was 281Mt of which 224Mt were removed and 27Mt (20%) were left in the forest as logging residues. However, they also note that reported removals have been shown to be underestimated up to 20% (Camia et al, 2018).

Given the challenges of quantifying such data, studies tend to look at the products associated with the use of residues. In the case of primary residues from forest management the main product produced is wood chip for energy (although studies note that some roundwood may also be used). Low value wood i.e. rejected sawlogs, thinning and undersized trees are also being utilised for pellet production (where such facilities exist), although studies have shown that the primary source for wood pellets in Europe is industrial by-products (approximately 74% according to UNECE/FAO (2013)). Hence use of domestically produced wood chip and, to a lesser extent wood pellets, can be used as a proxy to identify volumes/trends in use of primary residue use.

Forest chips are fresh wood chips made of wood being harvested directly from the forest, used for energy production, and has not had any previous industrial use. Use of forest chips made of tops and branches and small diameter stemwood is tightly integrated in industrial

roundwood supply. Forest chip raw material is also collected from thinning operations in young and mid aged forest stands aside with pulpwood harvest (Pekkanen et al, 2016).

Use of forest chip has been increasing in the EU, estimated as approximately 45 Mm3/a (2011) (Pekkanen et al, 2016). Major consumers of forest chips in the EU (in 2011) were Sweden (10.5 million m3/a), Germany (9.0 million m3/a), Finland (7.5 million m3/a) and Italy (6.3 million m3/a). The data illustrate a strong increasing trend in the consumption of forest chips for the whole of the EU between 2007 and 2011.

It is not possible to determine the exact proportion of forest residue use nor attribute proportions to bioenergy use. However, it is possible to presume that the use of primary forest residues is increasing - based on the consumption of domestically produced wood chip that utilises this as a primary input. It should be noted, however, that a proportion of this shift will be from traditional use of forest primary residues for energy.

5.3.3 Future use of woody biomass

Of European countries, 60% reporting to Forest Europe (2015) have explicit targets for increasing domestic wood production with the objectives of meeting the increasing demand in both material and energy use (i.e. Finland, Germany), and reducing the trade deficit (France). One third of these countries also report quantitative objectives for greater energy use in the range of 20% to 60%. The countries referred to increased mobilisation (Finland, France), increased productivity (Sweden), increased forest area (Ireland) and increasing managed area (Hungary) as a means of meeting these targets. This reflects both the prioritisation of biomass for energy, but also wider promotion of biomass products within the economy (i.e. efforts to promote the Bioeconomy).

When considering the future demand for woody biomass for energy, two studies using Globiom modelling, Recebio I and Recebio II (Forsell et al, 2016a; Forsell et al, 2016b), consider the impacts of using solid, wood biomass in particular in the heat and electricity sectors (see the separate Annex report for full details of these studies' findings). These studies estimated the shift in the area of used and unused forest, the expansion in forest area and proportion of wood extracted used for bioenergy. Both studies note an increase in forest area to 2030 and 2050, including the expansion of forest land specifically at the expense of land classified as 'other natural land' i.e. primarily semi natural habitats. The studies also note a likely increase in intensity of wood supply and forest management.

Under Recebio I analysis showed an increase in the area of used forest under the business as usual (BAU) scenario from 105Mha in 2010 to 116 Mha in 2030 and 124Mha in 2050. This is primarily driven by afforestation of areas of 'other natural land'. There is also noted to be a decline in the area of unused forest[43] from 48 in 2010 to 42Mha by 2050. Recebio II used as

[43] Unused forest was defined within the Recebio I study as 'forests that currently do not contribute to wood supply (for economic reasons) as determined by the model. However, these forests may still be a source for collection and production of non-wood goods (e.g. food, wild game, ornamental plants)'.

its basis a revised set of figures for energy demand from biomass. Under the Recebio II BAU scenario 130Mha of used forest exist in 2050, again this expansion (35Mha split between SRC expansion and afforestation of land conversion between 2010 and 2050) comes at the expense of other natural land reducing this land category by more than 50%. It should be noted under scenarios that exhibited higher demand for biomass from energy, conversion of unused to used forest land was seen. It should also be noted that under Recebio I and II an expansion in domestic wood production was seen, at a rate greater than could be accounted for by afforestation increase.

Wood flow analysis under Recebio I identifies further patterns in terms of wood consumption. Wood consumption for both energy and material use increases over the period (from 306Mm3 in 2010 to 419Mm3 in 2050 for energy and 302Mm3 in 2010 to 379Mm3 in 2050 for material uses). This implies expanded wood demand overall and a shift in the proportions being used for energy – in 2010 approximately 50% is estimated to be used for energy; in 2030 approximately 54% is used for energy. The balance between use of industrial products compared to primary material remains between 50 and 55% over the period[44].

[44] Data based on wood flows see P37 of Recebio I task 3 report.

6 Analysing the Sensitivity and Vulnerability of EU Protected Habitats and Species to Bioenergy Feedstock Production

6.1 Introduction

6.1.1 The objectives and scope of the analysis.

This section aims to summarise the overall conclusions of the analysis on the vulnerability of EU protected habitats and species to the production of bioenergy feedstocks in the EU. Before considering the conclusions of the analysis, it is important to bear in mind the objectives, scope and limitations of this aspect of the study, and the implications for its interpretation.

Firstly, this study has focused on EU protected habitats and species. With the analysis EU protected habitats and species[45], comprise:

- 'natural habitats of Community interest' listed in Annex I of the Habitats Directive – hereafter referred to as HD habitats;
- 'species of Community interest' as listed in Annexes II and/or IV or V of the Habitats Directive – hereafter referred to as HD species; and
- bird species listed in Annex I of the Birds Directive that require special conservation measures – hereafter referred to as BD birds.

These habitats and species have been designated as of Community interest because they are of particular conservation concern in the EU, for example as a result of their rarity, uniqueness or fragility. Such habitats and species are therefore likely to be particularly sensitive to environmental changes, including those relating to bioenergy production. Furthermore, they either comprise natural / semi-natural habitats, or are species that mostly tend to be dependent on these types of habitats. Therefore, whilst this study's results are highly relevant to the EU's nature conservation policy priorities, they do not provide a representative indication of likely bioenergy feedstock production impacts on EU biodiversity in general (e.g. including common species that are found in intensively managed agricultural and forest areas).

It is also important to note that this study only considers biodiversity impacts in the EU, and does not consider those that may occur outside as a direct and indirect result of increasing bioenergy demand in the EU, although there is strong evidence that these may be substantial (Bowyer, 2010; Meletiou et al, 2019).

This summary is based on the full review and analysis described in Sections 3 and 4 of the separate Annex report.

6.1.2 The methodology and limitations of the analysis.

The analysis was structured by a list of risk factors associated with each of the bioenergy feedstock types in the scope of the study. For each of the bioenergy feedstock types, the study carried out:

[45] The word species is used to refer to the species or subspecies taxa as listed in the directives.

a) an assessment of the 2015 baseline levels of bioenergy feedstock production in the EU (pre-RED II) and projections for 2030 for each of the bioenergy feedstock;
b) review of key sources of evidence associated with the risk factors in order to identify sensitive EU protected habitats and species, and the causes of this sensitivity (including Member State reports on pressures on EU protected habitats and species relevant to bioenergy land uses; and a review of the scientific literature on the direct and indirect effects of land management associated with bioenergy on EU protected habitats and species).

Using these assessments of a) exposure, and b) sensitivity, we carried out a quantitative vulnerability analysis, which focused on a subset of the EU protected habitats and species that are associated with agricultural or forest ecosystems or otherwise potentially affected by agriculture or forestry. The baseline vulnerability assessment was an estimation of the potential exposure of each EU protected habitat or species to bioenergy feedstock production, combined with an estimation of its sensitivity to each of the identified risk factors. This was carried out firstly assuming no Natura 2000 protected area constraints (nor any other significant mitigation) and then assuming mitigation through protection within Natura 2000 areas. The 2030 vulnerability assessment was based on the estimated exposure of each EU protected habitat and species to bioenergy feedstock production in 2030, assuming sensitivity and Natura 2000 coverage levels do not significantly change.

Consideration of the results and conclusions from this study should take into account the following key assumptions and constraints that affected the analysis that was undertaken. In particular:

- Whilst there is a good understanding of the ecological requirements of most EU protected habitats and species, which was sufficient to reliably identify the main bioenergy associated risk factors affecting them, direct evidence of their sensitivity to them is limited. This is partly because it is difficult to ascribe some key pressures (e.g. conversion of grassland to arable) to their drivers, including bioenergy feedstock demand. Also, some bioenergy feedstocks (e.g. Miscanthus), or agricultural / forestry practices (e.g. stump removal) are relatively new and/or uncommon and have not been widely studied.
- Due to the limited direct evidence, assessment of the sensitivity of habitats and species to the risk factors was often based on inference from a knowledge of the habitats' and species' ecology, and the general effects of agricultural and forestry practices on them. Whilst there was sufficient information to reliably infer sensitivity for most risk factors for most habitats and species, there was more uncertainty over some forestry practices (as further discussed below). Also, whether some agricultural and forest practices have positive or negative impacts depends to a large extent on their scale and context, e.g. the scale of bioenergy crop planting and afforestation, clear cut area, the biodiversity value of the exiting effected habitat.
- The calculation of the 2015 baselines for the production of each type of bioenergy feedstock was constrained by challenges associated with being able to make connections between data sets on production of biomass material and their end use. This is because at the point of production of biomass material the end use for energy is often not clear, biomass production for energy is integrated with wider production

for food, feed, materials etc. Clearly attributing volume change associated with energy and then linking this back to infield practices is challenging and leads to data gaps

- The development of the 2030 projections for the production of each type of bioenergy feedstock was hampered by a lack of clarity as to the exact level of bioenergy that would be utilised to 2030 and the associated consequences for land use. Modelling exercises have been run looking at changing demand for biomass-based energy, however, only some look at land use consequences and often the detail of this at the level needed to understand impacts on protected habitats and species is absent.
- The extent to which habitats and species are actually exposed to each of the biofuel feedstock types was difficult to assess as the location of their production is often uncertain, or not directly ascertainable (e.g. for conventional crops that may be used for food, forage or bioenergy). Furthermore, it was necessary to consider the extent to which exposure may result from the conversion of habitats or low levels of use for feedstock production. Thus, for example, all HD forest types are considered to be potentially exposed to biomass production for bioenergy purposes to some extent (i.e. had a general exposure level of >5%).
- With some bioenergy feedstocks (e.g. SRC) it is evident that their presence is currently entirely, or almost entirely, driven by bioenergy demand (but could in future be driven by broader changes in demand for biomass). It is therefore relatively straightforward to relate the exposure of each habitat and species to their respective risk factors to bioenergy demand. However, it was much more difficult to assess the degree to which some forestry related risk factors are driven by bioenergy feedstock, because some sources of forest biomass, such as thinnings, may be removed to some extent for other forestry purposes (see further discussion below).
- It was not possible to take into account all the possible mitigation measures in the estimation of residual impacts. This was partly due to insufficient data being available on the effectiveness of such mitigation measures, but also because many mitigation measures overlap and therefore their added value is unknown. Instead, residual impacts were only based on the assessment of Natura 2000 coverage (i.e. the proportion within the network) and the assumption that this would provide full protection for habitats and species within them. There is evidence that protection levels in Natura 2000 areas are not complete (see Section 3 of the separate Annex report). Therefore the true vulnerability scores probably lie somewhere between the estimates of potential and residual vulnerability. Estimates of Natura 2000 coverage were missing for a high proportion of HD and BD species (over 61%), and therefore the estimates of their residual vulnerability scores should be treated indicative.
- The assessment of the vulnerability of habitats and species to bioenergy feedstock production was primarily based on their direct impacts, but other studies have shown that in the EU indirect land use change (ILUC) resulting from the increased demand for the feedstocks may lead to more widespread impacts (e.g. the intensification of management on semi-natural habitats). As there is insufficient information available to assess such impacts reliably it was only possible to carry out an indicative assessment of the degree to which each EU protected habitat and species might be susceptible to ILUC. As this assessment was primarily based on expert judgement, the results should be treated with caution and considered to be only indicative.

Given these limitations, it is recommended that the individual habitat and species assessments, as provided in the separate Annex report (and in the accompanying Excel file), should be considered to be indicative and not used a source of reference for predicted or generalisable impacts. Instead, reference should be made to the combined assessments of the habitats and species as reported in Section 5 of the separate Annex report. Despite the data limitations and other constraints on the analysis, the results of this study provide a high level of certainty on the main bioenergy related risk factors for EU protected habitats and species, and the magnitude of impacts arising from the production of each of the main types of bioenergy feedstock in 2015 and as projected for 2030. These key results are set out in Section 4.2 of the Annex report and summarised below in relation to each of the types of bioenergy feedstock.

6.2 Conclusions on bioenergy feedstock types

6.2.1 Conventional crops (i.e. food and forage/feed crops)

Evidence from the wider agricultural literature (see Section 3.2 of the Annex report for detail) clearly shows that most EU protected species and habitats are highly sensitive to the risk factors associated with the production of bioenergy feedstocks from conventional crops (e.g. conversion to arable, increasing intensification of management). This is particularly the case where the growing of such crops leads to the conversion of semi-natural grassland and other semi-natural habitats (e.g. heathland, Mediterranean shrubland). Similar impacts occur where semi-natural grassland management is intensified, such as for the production of silage, but it is believed that this is rarely driven by a direct demand for bioenergy feedstocks.

In contrast, the use of existing arable land for bioenergy feedstocks has no impacts on HD habitats as they are absent. Similarly impacts on HD and BD species are much less than arise from the conversion of grassland etc, as typically only a few such species occur. These are mainly birds, and also tend to be restricted to areas of low intensity cereal production (such as in the dry steppe lands of Spain). Moreover, as the management of conventional crops is the same whether it is produced for food or for biofuels, the impacts are neutral if there are no changes in crop type. However, increasing demand for bioenergy feedstocks is known to be leading to changes in crop type in some areas. This is mainly leading to a switch from cereals to oilseed rape, which is unlikely to have significant impacts on EU protected species as few use such crops, and the ecological consequences from the change tend to be low and mixed. Bioenergy demand has also led to a considerable increase in the production of maize in some areas (on existing arable land and converted grassland) and this undoubtedly has detrimental impacts on a wide range of species (i.e. biodiversity in general). But impacts on EU protected species from the increase in maize on existing arable land are probably low, as few such species are present in conventional arable farmland (with the exception of the European Hamster *Cricetus cricetus* and certain plants and birds). For similar reasons, whilst the removal of residues from croplands may have some detrimental impacts on biodiversity in general (e.g. from reductions in organic matter) it is unlikely to have any effect on EU protected species or habitats.

The analysis of the use of conventional crops for bioenergy feedstock production clearly shows that in the baseline year of 2015 a very small proportion of EU farmland was being

used for this purpose, with only about 0.02% of grassland and cropland being converted to conventional crops for bioenergy feedstocks, and only about 0.5% affected by changes in crop type. Thus, overall exposure of EU protected habitats and species to the risk factors associated with the production of bioenergy through conventional crops is low. However, it should be borne in mind that the distribution of these crops is uneven, and that some areas have been subject to high levels of conversion (e.g. increases in oilseed rape crops in parts of south-east Europe) and large increases in maize production in Germany. In such areas impacts on EU protected habitats and species may be locally significant, especially where they have resulted from the conversion of grassland or other semi-natural habitats to conventional crops.

As the projections for 2030 do not indicate a substantial change in the use of conventional crops for bioenergy feedstock, then no significant change in impacts are expected. Although a considerable increase is expected in the use of crop residues for bioenergy feedstocks (potentially affecting 7% of cropland) this is unlikely to affect any EU protected species, for the reasons described above.

General conclusions are set out in Table 1 below, and some of the evidence of impacts is provided Box 3. Overall exposure of habitats and species of EU interest to these risk factors is considered low i.e. based on the proportion of total cropland intensification/semi-natural habitat conversion that can attributed specifically to bioenergy driven demand. However, the distribution of biomass production is uneven, and some areas have been subject to high levels of land use change, such as conversion of grassland to arable production[46].. In such areas, impacts on EU protected habitats and species may be locally significant, especially where they have resulted from the conversion of grassland or other semi-natural habitats to arable crops for energy production[47]. Whilst there may still be risks associated with use of conventional crops (in particular local level dynamics in land use change), policy support has shifted in focus away from use of 'food and feed' crops. Models looking to 2030 and beyond no longer predict significant expansion in their use as bioenergy feedstocks.

[46] Romania and eight other Member States reported under the Habitats Directive that grassland conversion to arable is causing the loss of grassland habitat types of EU interest, and Romania and Germany reported pressure from biofuel production. In Romania, the area of rapeseed and then more recently sunflower production increased by 25% since 2007, whilst Romanian biodiesel production increased 4.5 times from 2007 to 2012. In Germany, biogas subsidies drove a rapid increase in the area of maize (which partly replaced permanent grassland) between 2009 and 2013, after which the rate of increase slowed. Sources are cited in the project report.

[47] For example, maize monoculture, at least partly associated with bioenergy demand, is having negative impacts on Habitats Directive Annex IV species European Hamster (*Cricetus cricetus*) in the Alsace region in France and Hessen in Germany. Also in Hessen, the Annex IV arable weed *Notothylas orbicularis* is affected by intensification of cereal cropping with a second crop due to bioenergy demand. Conversion of arable fallow to maize driven by bioenergy demand is driving continued population declines of Birds Directive Annex I bird species Corncrake (*Crex crex*), and Montagu's Harrier (*Circus pygargus*) in an SPA in northern Germany. Sources are cited in the project report.

Table 1 - Overall assessment of the vulnerability of EU protected habitats and species - to conventional crops (i.e. food and forage crops)

Risk factor	Overall sensitivity of HD habitats	Overall sensitivity of HD and BD species	2015 baseline		2030 projection	
			Exposure level	Overall vulnerability	Exposure level	Overall vulnerability
Conversion of grassland or other semi-natural habitat or fallow to bioenergy feed crop	Very highly negative as all HD habitats are natural / semi-natural and therefore destroyed by conversion	Very highly negative: Vast majority of affected species lost.	Very low: grassland conversion to arable crops is significant, but very small component for bioenergy (c. 0.02%)	Very low vulnerability due to very low exposure	No substantial change anticipated	Very low
Intensification of grassland management – e.g. higher fertiliser and pesticide use, re-seeding of grassland	Highly negative: All semi-natural habitats highly sensitive	Highly negative: Most species decline and some lost	No data available but known to be extremely low	Extremely low	No substantial change anticipated	Extremely low
Crop changes on existing arable land, e.g. cereals to oil-seed rape, crops to maize monoculture	None: as no HD habitats on arable land	Low: impacts are low and variable negative / positive and only affect a few EU protected species that use cereal crops	Low in most of the EU but moderate in some areas	Low	No substantial change anticipated	Low
Crop changes on existing arable land – cereals etc to maize	None: as no HD habitats on arable land	Highly negative, but only affect a few EU protected species that use cereal crop	Low overall, but some areas have high proportions of grassland and arable converted to maize crops (e.g. Germany)	Low overall, but locally high (e.g. Germany)	No substantial change anticipated	Low overall, but locally high (e.g. Germany)
Removal of residues from croplands	None: as no HD habitats on arable land	Unlikely to have significant impacts	Low (c. 0.8% of farmland)	Very low due to insignificant sensitivity	Substantial increase expected to about 7% of farmland	Very low despite increase due to low sensitivity of species

Box 3. Examples of published evidence of impacts on EU protected habitats and species of conventional crops grown for bioenergy

In Germany and Slovakia, there is evidence of impacts on Annex I habitats that have since lessened due to changes in the subsidy programmes for bioenergy:

- In Germany, demand for crop feedstocks for bioenergy, principally the demand from biogas plants, drove Annex I grassland losses from Natura 2000 sites: in nine Natura 2000 sites in Baden-Württemberg surveyed in 2003-4 and again in 2008-9, 15% of the hay meadow area was no longer recorded (NABU, 2014), although there is only anecdotal evidence that this is due to bioenergy demands (Russi et al, 2016).
- In Slovakia there were losses of meadows in SPA Senianske rybníky due to arable expansions for the purpose of growing energy crops (Gúgh et al, 2015).

Evidence of impacts on species protected by the Habitats and Birds Directives:

- Maize monoculture is having significant adverse effects on the hamster (*Cricetus cricetus*) populations in the Alsace region in France (Tissier et al, 2016) and the Hessen region in Germany (Albert, Reiners and Encarnação, 2011), and at least some of this is associated with biogas production (Schumacher and Schultmann, 2017). In Hessen, *Notothylas orbicularis* is under pressure from intensification of cereal cropping with a second autumn crop, partly driven by biogas demands (Drehwald, 2012).
- In the Hellwegborde SPA in northern Germany, conversion of arable fallow to maize cultivation for biogas is reported as one of the main causes of continued population declines of Corncrake (*Crex crex*), and Montagu's Harrier (*Circus pygargus*) (Joest, 2013). A modelling study in Germany also predicted that further increase in maize production would have a significant negative impact on the populations of Red-backed Shrike (*Lanius collurio*) and Woodlark (*Lullula arborea*) (Sauerbrei et al, 2014). The Ortolan Bunting (*Emberiza hortulana)* is reported as under pressure due to ongoing conversion of relatively extensively used habitat to crop fields for biofuel (Birdlife International, 2015).

6.2.2 Impacts of Purpose Grown Energy Crops and Afforestation of Agricultural Land

Although relatively few studies have been carried out of the biodiversity impacts of dedicated bioenergy crops (e.g. Miscanthus and SRC), it is clear that they result in major changes in vegetation structure and composition. Thus, they effectively destroy any habitats that are present if they are grown on grassland or other semi-natural habitats and have highly negative impacts on associated species. Similarly, afforestation of semi-natural grassland and other semi-natural habitats, leads to the loss of HD habitats and their associated species. In some circumstances appropriate small-scale afforestation using native trees can provide benefits for some species (e.g. nesting sites, ecological connectivity) in landscapes where trees have been removed. Where bioenergy crops and afforestation take place on intensively used arable land, the negative impacts on habitats and species of EU interest are likely to be much lower. This is primarily because few species of EU interest occur in these areas; however, birds of EU interest associated with low intensity open farmland, such as Calandra Lark (*Melanocorypha calandra*), can be affected by the introduction of dedicated bioenergy crops[48].

[48] Although during the early breeding season the bioenergy crop may offer similar or higher habitat quality than conventional crops, they rapidly grow too tall and dense for field-nesting species.

It is also clear from the available data that the extent of these bioenergy crops on farmland in the EU was extremely low in 2015, i.e. about 0.005% of farmland. Data on the extent to which afforestation is being carried out and driven by bioenergy demand is lacking, but it is also considered to affect a low proportion of grassland and seminatural habitat (c. 0.05%) and is minimal on cropland. There is a high level of certainty that the use of bioenergy crops will increase greatly (by several thousand percent) over the coming years in the EU. As a result, it is anticipated that approximately 1% of both grasslands and croplands will be affected by 2030. Similarly, afforestation on grasslands and other seminatural habitats is expected to increase tenfold, to affect about 0.5% of such habitats (but with no increase anticipated). Despite this high-level of increase, impacts will probably remain low where bioenergy crops are grown on existing arable land. However, they will be more substantial where they lead to the loss of seminatural grasslands and other seminatural habitats. Furthermore, it is also important to bear in mind that it is anticipated that a high proportion of new areas of bioenergy crop will be located in marginal farming areas, e.g. in areas with poor soils, and therefore a high proportion will be on seminatural habitats.

Consequently, whilst the overall exposure of farmland to these crops is relatively low (c 1%) EU protected habitats and species will be at a disproportionately higher risk of impact, with the potential for significant local losses unless areas with these habitats and species are avoided. In addition, the current and increasing demand for bioenergy feedstocks from conventional and bioenergy crops will also lead to ILUC impacts. Whilst these could not be quantified in this study, an expert evaluation of the potential vulnerability of EU protected habitats and species in agricultural areas was carried out, which suggests that a significant proportion have a medium or high vulnerability to habitat loss or degradation through ILUC (Annex report Figure 4.9).

The analysis presented in the Annex report figure 4.8 indicates the vulnerability of EU protected habitats and species to the combined risk factors associated with bioenergy feedstock production in agricultural areas, both in terms of potential vulnerability (i.e. with no mitigation measures) and residual vulnerability based on assumed full protection within the Natura 2000 network. This indicates that the coverage of most HD agricultural habitats within Natura 2000 network is relatively high. Therefore, if fully protected, the vulnerability of these habitats would drop to very low levels, even under the 2030 projections (from a mean potential vulnerability score of about -0.34% to a residual score of 0.027% with full Natura 2000 protection). The coverage of agricultural species within the Natura 2000 network is not so high, but full protection would still reduce residual impacts. As a result, if fully protected in the network the low potential vulnerability score for 2030 of -0.48% is estimated to fall to a residual level of approximately -0.33% (although the exact level is uncertain due to a high proportion of species having unknown Natura 2000 coverage). Other mitigation measures that could not be incorporated into the analysis (e.g. CAP cross compliance and greening measures) also have the potential to play an important role in reducing impacts if properly designed and implemented.

Table 2 - Overall assessment of the vulnerability of EU protected habitats and species - to bioenergy crops on agricultural land

Risk factor	Overall sensitivity of HD habitats	Overall sensitivity of HD and BD species	2015 baseline		2030 projection	
			Exposure level	Overall vulnerability	Exposure level	Overall vulnerability
Conversion of arable cropland to Miscanthus or other non-food biomass crops or SRC	None: as no HD habitats on arable land	Low-level impacts which are likely to be variable depending on species involved for a relatively small number of cropland species (mainly birds)	Extremely low (c. 0.005% of agricultural land)	Extremely low due to minimal exposure and low sensitivity	Substantial increase expected to (c. 1.1%)	Despite the increase overall vulnerability will be relatively low
Conversion of grassland or other semi-natural habitat to Miscanthus or other non-food biomass crops or SRC	Very highly negative: All semi-natural habitats highly sensitive, i.e. destroyed	Very highly negative - most associated species of semi-natural habitats will be lost	Extremely low (c. 0.005% of agricultural land – as above) but conversion most likely on semi-natural habitats	Very low due to minimal exposure despite high sensitivity, but conversion most likely on semi-natural habitats	Substantial increase expected to (c. 1.3%)	Despite the high increase overall vulnerability will be relatively low, but high local impacts possible, especially if expansion is mainly on semi-natural habitats
Afforestation of grassland or other semi-natural habitat	Very highly negative: All semi-natural habitats highly sensitive, i.e. destroyed	Very highly negative - most associated species will be lost. Some biodiversity benefits possible in certain situations – e.g. if small patches link up fragmented habitats, or on improved grasslands	Very low (c. 0.05%) but conversion most likely on semi-natural habitats	Low due to low exposure despite high sensitivity, but conversion most likely on semi-natural habitats	Expected to increase ten-fold to c.0.5%	Low overall, but high local impacts depending on location, especially if expansion is mainly on semi-natural habitats
Afforestation of cropland	None: as no HD habitats on arable land	Very high negative impacts but on a small number of cropland species (mainly birds)	No data available but known to be extremely low	Extremely low	No change anticipated	Extremely low

6.2.3 Forest biomass from existing forest land

Bioenergy production is difficult to separate from broader forest extraction patterns, as wood-based bioenergy feedstocks are often a product or co-products of integrated production of biomass for multiple end uses. Increasing bioenergy demand, however, can change the economic balance, and as a result forest managers may alter patterns of what is and isn't harvested (i.e. what residues remain in forest, proportion of deadwood, when thinning activities are conducted, which forest stands are extracted from and when in the rotation harvest occurs), resulting in an increased intensity of management and extraction Within Natura 2000 areas, forest management should be in accordance with the site conservation objectives and measures, but there is often still a lack of clarity as to how these translate into specific forest management guidance that forest managers can implement[49]. Outside the network, these restrictions do not exist although sustainable forest management plans may be required to comply with EU funding requirements, national rules or voluntary certification schemes.

The impact of changes in practice will vary according to forest type, species and location; however, as the intensity of forest management increases there is also a general pattern of increasing detrimental impacts on biodiversity. In some circumstances, low levels of forest management can be beneficial for some EU protected habitats and species, for example where selective logging or thinning opens up otherwise undermanaged forests (with an even age structure and low structural diversity) or traditional management practices such as coppicing or wood pasture are resumed in accordance with conservation objectives[50].

More often forest biomass production for bioenergy will entail more intensive and large-scale forestry management which is detrimental for biodiversity, especially EU protected habitats and species (see Section 3.4 of the Annex report). In this respect the removal of deadwood is highly detrimental, and clearcutting of large areas may have negative impacts on some species. Whilst small-scale clearcutting may be less damaging, especially where mitigated through the retention of some dead and live trees, and may even be beneficial in the short term for some species, it is more often damaging for EU protected species.

The review of information on the use of forest products estimates that in 2015 approximately 25% of forest biomass was being used for bioenergy feedstock purposes (figure 2-28 in the Annex report). Therefore, whilst it is difficult to estimate the proportion of EU protected forest habitats and species that occur in areas where forest biomass is being taken for bioenergy feedstocks, it is clear that a substantial proportion are generally exposed to the associated forestry management practices and their associated biodiversity risk factors. It is, however, much more difficult to estimate the exposure of the habitats and species to the individual risk factors associated with the biomass production. This is primarily because

[49] Not all forests inside the Natura 2000 network are being managed in full accordance with their conservation objectives, as recognised in the study published by the European Forest institute (Sotirov, 2017).

[50] The analysis recognises that in some Natura 2000 sites silvi-cultural techniques such as thinning and clearcutting with replanting of native trees of local provenance are used to restore destroyed or badly damaged Annex I forest habitat types to their appropriate forest structure and species composition.

information on the extent to which each of the forestry practices is carried out in forest types that holds EU protected habitats and species is lacking.

It must also be borne in mind that some forestry practices (e.g. thinning) would be carried out to some extent even in the absence of bioenergy demand, to increase timber production. No data could be found to quantify the extent to which these practices occur in the absence of bioenergy demand (i.e. to establish the counterfactual situation). The vulnerability analysis assumed that these practices would not continue in the absence of bioenergy demand. This therefore probably results in an overestimate to some extent of the bioenergy driven impacts in forests. Nevertheless, although the quantification is difficult there is reasonable certainty that several of the more damaging forestry practices are being carried out, and that the demand for bioenergy feedstocks is a potential driver of these practices.

Taking into account the sensitivity of EU protected habitats and species to forestry practices and their exposure to them, there is a high degree of certainty that they are highly vulnerable to the removal of deadwood and clear cutting of large areas, and to a lesser degree other forestry risk factors, resulting from the demand for bioenergy feedstocks in 2015. As indicated in Figure 4-10 in the Annex report, this gives rise to a very high mean potential vulnerability score for 2015 of -46% for HD habitats and -22% for HD and BD species. This almost certainly means that the conservation status of the affected habitats and species is likely to be compromised in the areas where forestry management is being carried out intensively. Furthermore, it is widely anticipated that the demand for biomass from forests for bioenergy will increase, such that by 2030 it is estimated that about 30% of forest biomass will be used for such purposes (Figure 2-1 in the Annex report). Based on this projection the mean potential vulnerability score will increase to approximately -57% for habitats and -27% for species.

It is also necessary to consider additional indirect land-use changes that may occur from the current and projected very high levels of demand for biomass for bioenergy feedstocks from forests. Whilst this could not be quantified in this study, expert assessments suggest that a high proportion of EU protected habitats and species of forests have at least a moderate level of vulnerability to ILUC (Figure 4-11 in the Annex report).

Given the current and projected high vulnerability of EU protected habitats and species to the production of forest biomass for bioenergy, it is especially important to consider the degree to which the potential impacts may be avoided through protection within the Natura 2000 network. Figure 4-10 in the Annex report indicates that, because the coverage of HD forest habitats within Natura 2000 network is very high, the residual vulnerability score of these habitats would be low (-0.49% in 2015 and -0.59% in 2030). Although the coverage of forest species within the Natura 2000 network is not as high (i.e. the proportion of forest species populations that lie within the network is not as high as for habitats), full protection would still reduce residual impacts to about half (-13%. for 2015 and -15% for 2030). However, as was the case with agricultural species, the exact level is uncertain due to a high proportion of species having unknown Natura 2000 coverage. It should also be borne in mind that the residual impact estimates assume full protection, which as discussed in section 9, is not realistic. On the other hand, other mitigation measures are not taken into account, such as

forest certification schemes or forest-environment contracts (see section 7 and 8). The true vulnerability scores probably therefore lie between the potential and the residual estimates. Irrespective of this uncertainty, it is obvious that the protection of the Natura 2000 network has a crucial role to play in reducing the effects of bioenergy feedstock production.

Table 3 - Overall assessment of the vulnerability of EU protected habitats and species to removal of forest biomass from existing forest land

Risk factor	Overall sensitivity of HD habitats	Overall sensitivity of HD and BD species	2015 baseline		2030 projection	
			Exposure level	Overall vulnerability	Exposure level	Overall vulnerability
Selective logging of trees in extensively managed forests	Moderately to highly negative depending on % extracted, methods and forest age and condition; unless required to meet conservation objectives	Moderately negative for most species depending on % extracted, methods and forest age and condition; unless required to meet conservation objectives	Moderate: c. 2.5% forest affected as a result of bioenergy demand	Variable depending on species and methods, but generally moderate	Expected to increase slightly to about 3% exposure	Small increase, but remaining generally moderate
Thinning of small and intermediat e sized successional trees	Low and mostly negative, but beneficial in undermanage d non-natural forest	Low and mostly negative for a few species, but beneficial in undermanage d non-natural forest (if not carried out in nesting season)	High: common practice, c. 19% driven by bioenergy demand	Variable depending on species and forest condition, but generally moderately negative	Expected to increase slightly	Small increase, remaining generally moderately negative
Removal of dead wood	Highly negative	Highly negative, especially for a large proportion of mosses and liverworts, invertebrates and specialist forest birds and bats	High: common practice, c. 16% driven by bioenergy demand	High, due to exposure level and high sensitivity for habitats and many species	Expected to increase slightly	High
Clear cutting of large areas of trees to increase production efficiency	Very highly negative – as leads to habitat destruction, and very slow recovery	Highly negative for most species, especially if at large scale; can create temporary habitat for a few species	High: c. 16% of forest affected as a result of bioenergy demand	High, due to exposure level and high sensitivity for habitats and many species	Expected to increase slightly	High
Stump removal and	Very highly negative – as leads to major habitat degradation	Information lacking, but probably highly negative, especially for a large proportion of	Uncertain, but common practice in some regions (e.g. Sweden and Finland) - overall exposure	Low overall but locally high for some species (e.g. invertebrates)	Expected to increase	Uncertain, but locally high

Risk factor	Overall sensitivity of HD habitats	Overall sensitivity of HD and BD species	2015 baseline		2030 projection	
			Exposure level	Overall vulnerability	Exposure level	Overall vulnerability
whole-tree harvesting[51]		mosses and liverworts, invertebrates	estimated to be very approximately 3%			
Tree planting	Very highly negative – as leads to habitat destruction, and very slow recovery	Highly negative for most species	High: tree planting is a common practice, c. 17% driven by bioenergy demand (but exposure to fertiliser and pesticide use less certain)	Moderate to high depending on species	Expected to increase slightly	Small increase, remaining generally moderate to high
Plantation forestry with dominance of non-native or non-site-typical tree species	Very highly negative – as leads to habitat destruction	Highly negative for almost all species	Low: c. 0.3% of forest affected as a result of bioenergy demand	Moderate, due to very high sensitivity	Expected to increase slightly	Moderate
Construction of forest roads and tracks to support forest management and harvesting.	Low from footprint, but moderate impacts can arise from hydrological disruption for some habitat types.	Low to moderate, due to mortality, disturbance and habitat fragmentation for some	No data, and difficult to estimate but considered to be about 1.25% direct exposure	Low to moderate depending on the species	Expected to increase slightly	Low to moderate

Box 4. Examples of published evidence of impacts on EU protected habitats and species of forest biomass extraction

There is substantial evidence for the sensitivity of certain EU protected species and habitats to forestry interventions, which could be related to bioenergy demands.

Some EU protected species are highly sensitive to interventions in forests and are essentially restricted to undisturbed old growth forest, particularly lichens and bryophytes and saproxylic beetles. For example, *Buxbaumia viridis* is a boreal-montane moss restricted to forests under strict protection (i.e. with no management) (Voncina, Cykowska and Chachula, 2011) or forest remnants in inaccessible areas (Köckinger, 2014). It is infrequent in managed forests because of its dependence on a humid environment under a closed canopy with high levels of dead wood in advanced stages of decay (Söderström, 1988). The beetle *Pytho kolwensis* is restricted to virgin spruce-mire forests with a stand continuity of at least 170–300 years, and a high volume of dead wood (73–111 m3/ha) because it requires long-term continuous availability of suitable host trees (Siitonen and Saaristo, 2000). There is evidence of recent loss of old-growth Annex I forest habitats to clear-cutting in Sweden (Sahlin, 2010), Mediterranean countries (Zaghi, 2008), and Natura 2000 sites in Romania (Knorn et al, 2013).

[51] Whole-tree harvesting can be defined as the removal of most branches and needles from a harvesting site in addition to the stem wood that is removed in conventional harvesting (Forest Research, 1997).

Numerous Member States reported a high pressure from removal of dead and dying trees on EU protected species, particularly bats and beetles. Russo et al (2010) showed that at least small numbers of dead trees must be retained in logged areas to favour population expansion of *Barbastella barbastellus*, corresponding also with the ecological requirements of bat species this includes inter alia *Myotis bechsteinii*, *Myotis nattereri*, *Nyctalus leisleri*, *Nyctalus noctula* and *Plecotus auritus* (Dietz, von Helversen and Nill, 2009). A study has shown that there is a dramatic reduction in occupancy of tree holes by Siberian Flying Squirrel (*Pteromys volans*) after clear-felling even when the actual tree with the hole is not felled, compared to similar unfelled forest (Santangeli et al, 2013). Guidance on estimating the value of forests for bats highlights the importance of critical feeding areas and commuting routes (Kyheröinen et al, 2019).

6.3 Messages emerging from the vulnerability analysis

The vulnerability analysis results suggest that the use of forest biomass (stemwood and forest residues etc) will almost certainly have an impact on most HD forest habitats and many forest species (through its direct impacts as well as indirect land use change). This is because such habitats and species are sensitive to a number of common intensive forestry practices and a significant driver of this is the demand for forest biomass. The literature (see further details in Section 2.3.4 of the Annex report) estimates that approximately 25% of biomass that is extracted from forests is used for energy purposes. Modelling predicts that the demand for forest biomass for bioenergy will increase, with this study projecting that by 2030 30% of extracted forest biomass will be for bioenergy use.

In contrast, the impacts of bioenergy feedstock production from dedicated bioenergy crops (e.g. Miscanthus and SRC) or trees planted on farmland, on EU protected habitats and species are currently low, primarily because very small areas are affected. Furthermore, the afforestation of arable farmland and intensively managed grasslands, or their conversion to bioenergy crops, has relatively low impacts on EU protected habitats and species. This is mainly because HD habitats are absent and few HD and BD species occur in significant amounts on farmland, although there are some areas with low intensity cereal production that are important for some species, mainly birds. However, the afforestation or conversion of seminatural grasslands, and other seminatural habitats, to bioenergy crops has the potential to lead to considerable impacts as a high proportion of such habitats and their associated species are the focus of protection under the Nature Directives. Furthermore, afforestation or the planting of bioenergy crops may also destroy the HD habitats and leads to the loss of most associated species.

The impacts of afforestation and bioenergy crops may be much more significant in future as it is anticipated that a substantial expansion of the production of these crops will occur. Whilst the expansion is currently expected to only affect about 1% of farmland, marginal areas of farmland are anticipated to be targeted. As a consequence, areas of seminatural habitat will be at a disproportionately higher level of risk. This may give rise to significant impacts on some EU habitats and species in some areas.

The use of conventional crops (e.g. oil-seed rape and maize) for bioenergy is also currently considered to be having low impacts on EU protected habitat and species. This is also partly because such habitats and species are largely absent from arable farmland, but also because the proportion of these crops being used for bioenergy is currently low. Furthermore, the crops are principally managed in the same way whether they are used for bioenergy or food

etc, and the impacts of changes in crop type are generally minimal. The only exception to this, which significantly affects EU protected species, is with respect to maize. Some areas of the EU (e.g. Germany) have seen large increases in the growing of maize, in part for bioenergy uses. This has led to the conversion of grasslands for this purpose as well as increases in crop management intensity compared to most arable crops. This has been noted to be associated with noticeable negative effects on some BHD species groups such as amphibians. At the moment no major changes are anticipated in the use of conventional crops for bioenergy purposes up to 2030, so impacts are unlikely to increase, but other drivers (such as changes in the dairy sector) are still contributing to an increasing maize area.

SECTION 3 – EUROPEAN POLICIES AND THEIR ABILITY TO PROTECT BIODIVERSITY FROM IMPACTS ASSOCIATED WITH BIOENERGY PRODUCTION

7 INTRODUCTION TO POLICY MAKING IN EUROPE

Bioenergy, promoted as a form of renewable energy, is capable of delivering heat, power and transport fuels (as elaborated in section 1). It is generated by using heterogenous feedstocks primarily from the agricultural and forestry sectors. As such a broad sphere of policies are of importance for protecting (and potentially enhancing) biodiversity from the impacts associated with bioenergy production. As identified in the vulnerability analysis future predicted demand for bioenergy feedstocks is anticipated to focus on woody biomass both from forests, land management and dedicated energy crops. This change is associated with potential, increased intensity of forest management and the conversion of semi natural grasslands and other semi natural habitats for biomass feedstock production. These are considered to be the most significant risks to EU protected habitats and species associated with expanded, future bioenergy feedstock production. These impacts can, however, be mitigated by well targeted policy interventions.

The Birds and Habitats Directives set certain protection and maintenance obligations for Natura 2000 sites (for the species and habitats for which the sites are designated), but this leaves scope for continued agricultural and forestry activities, indeed low intensity forms of use are often important for the maintenance of certain species and habitats. Private landowners are not obliged to follow management restrictions, as management plans are applied on a voluntary basis. Conservation measures are supported by other policies and funding at EU or within the Member State that incentivise and valorise the desired management and disincentivise damaging activities. The Nature Directives provide protection measures for certain species also outside Natura 2000 sites (see Box 1).

Within the study three main classes of policy intervention have been identified as important when mitigating impacts on protected habitats and species associated with bioenergy. These reflect the need to consider nature protection measures and more broadly policy measures driving bioenergy demand and intended to mitigate environmental impacts associated with biomass production[52]. The study analysed EU level policy design and literature on implementation, complimenting this with findings from case study analysis conducted for six Member State countries[53]. This evidence base was used to analyse the extent to which current policy mitigates the risks associated with bioenergy production (see section 8).

[52] It should be noted that policies could contribute to other goals but are organised here based on their primary goal or focus.

[53] Member State case studies were conducted in Estonia, Germany, Italy, Portugal, Slovakia and Sweden, the case studies considered the bioenergy pressures being experienced within the Member States and considered the specific policies being utilised to address the challenges, success and limitations. The analysis involved interviews with key experts on national policy including government officials, NGOs and private businesses. Findings were reviewed by national experts from the relevant Member State's government.

The policy sub classes are set out below and Table 4 presents the detail of the polices analysed within each sub class.

1. Policies promoting renewable energy use i.e. policies that impact on the scale of demand and the standards that bioenergy feedstocks comply with - primarily focused on promoting renewable energy and GHG emission reductions; given bioenergy's potential role in replacing fossil-based energy sources;
2. Policies to protect biodiversity from negative impacts i.e. policies in place to protect biodiversity from changes in supply or demand and associated changes in land use and land management including environmental assessment tools;
3. Policies supporting, determining or influencing approaches to land use and management i.e. policies that influence the nature of feedstock supply, how material is produced and any sustainability conditions mitigating biodiversity impact; and

Policies that establish reporting and monitoring systems i.e. those policies that deliver standardised baseline information to help determine the level of bioenergy demand, feedstock use, feedstock sources and land management decisions associated with bioenergy feedstock production are important in supporting the delivery of policies across all the categories above. In the case of the Regulation on the Governance of the Energy Union and Climate Action, the development of National Energy and Climate Plans and delivery of reporting by Member States under the Regulation will be key to understanding the scale and nature of bioenergy demand up to 2030. While not directly influencing biodiversity protection, national decisions and plans under the Directive, along with associated reporting provide the evidence base for understanding the consequences of decisions to support bioenergy.

Table 4 – EU Policies of importance for protecting EU protected habitats and species from impacts associated with bioenergy production

Promoting renewable energy use i.e. policies that **impact on the scale of demand and the standards that bioenergy feedstocks comply with** - primarily focused on promoting renewable energy and GHG emission reductions; given bioenergy's potential role in replacing fossil-based energy sources
• Renewable Energy Directive (RED) - 2009/28/EC[54] and ILUC amendment EU (2015)1513
• Recast Renewable Energy Directive (RED II) - EU(2018)2001
• EU Emissions Trading Directive (EU ETS) - 2003/87/EC, as amended including by Directive 2018/410/EU
• European Structural & Investment Funds (ESIF)
• Commission communication – Guidelines on use of state aid for energy and environment 2014-2020 (recently extended to apply until 2022)
To **protect biodiversity** from negative impacts i.e. policies in place to protect biodiversity from changes in supply or demand and associated **changes in land use and land management including environmental assessment tools**
• Habitats Directive - 92/43/EEC
• Birds Directives - 2009/147/EC
• Strategic Environmental Assessment Directive - 2001/42/EC
• Environmental Impact Assessment Directive - 2011/92/EU and amendment 2014/52/EU
Supporting, determining or influencing approaches to land use and management i.e. policies that influence the nature of feedstock supply, how material is produced and any sustainability conditions mitigating biodiversity impact
• Common Agricultural Policy
• European Union Guidelines for State aid in the agricultural and forestry sectors and in rural areas 2014 to 2020
• EU Forest Strategy - COM(2013)659
• Water Framework Directive (and associated Directives including the Nitrates Directive) - 2000/60/EC (91/676/EEC)[55]
• Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework (LULUCF) - (EU) 2018/841
Additional policies that **establish reporting and monitoring systems** - Regulation on the Governance of the Energy Union and Climate Action - 2018/1999/EU - Requires Member States to adopt National Energy & Climate Plans (NECPs), determining their national goals for renewable energy consumption, including the future contribution of bioenergy. The Regulation also sets out reporting obligations for Member State on bioenergy use, including on the sourcing of feedstocks.
Voluntary processes and schemes – these are in operation across Europe and at the international level and have the potential to significantly influence both Member State and European Union decision making and those of land users. This includes the **Ministerial Conference on the Protection of Forests in Europe**, currently known as Forest Europe, which is a pan-European voluntary high-level political process for dialogue and cooperation on forest policies in Europe. It develops common strategies for its signatories on how to protect and sustainably manage their forests The EU is a full member of the Forest Europe process. **Voluntary market-based tools**, including certification standards aimed at both more sustainable forest management (in the form of FSC and PEFC and for certifying sustainable biomass feedstocks for energy use are being used with the intention of promoting more environmentally responsible practices. **Funding support** – beyond EU specific funding under the ESIF other support is also available for projects and investments related to bioenergy linked to institutions such as the European Investment Bank.

[54] It should be noted that parallel requirements for the decarbonisation of transport fuels are set out in Directive 2009/30/EC, however, these are not discussed specifically here as the rules on sustainable sourcing relevant to biodiversity are the same as for the RED.

[55] A revision of the fertilisers Directive which will impact on the use of digestate is currently in the process of being finalised.

EU policies as listed in Table 4 are complemented by other voluntary processes and schemes in operation across Europe and at the international level that have the potential to significantly influence both Member State decision making and those of land users. This includes the Ministerial Conference on the Protection of Forests in Europe, otherwise known as Forest Europe, a pan-European voluntary high-level political process for dialogue and cooperation on forest policies in Europe. It develops common strategies for its signatories on how to protect and sustainably manage their forests. Forest Europe has developed approaches to Sustainable Forest Management including maintenance, conservation and appropriate enhancement of biological diversity of forest ecosystems. These general principles and criteria are considered complimentary to rules under the Habitats and Birds Directives. However, they are unlikely to be sufficiently defined and detailed to produce the specific conservation objectives for the Annex I habitats and species present in a particular Natura 2000 site, as required by the Directives (European Commission, 2015b).

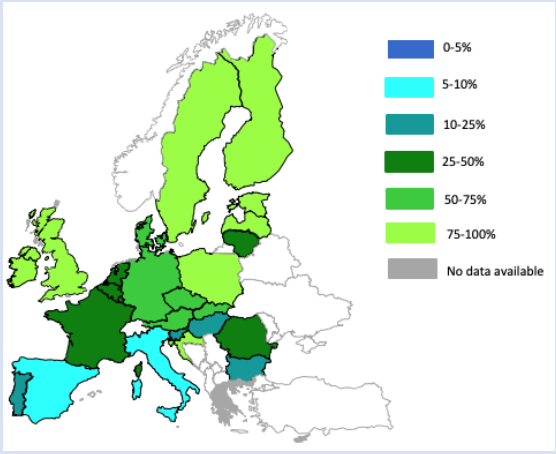
Voluntary market-based tools, including certification standards aimed at both more sustainable forest management (in the form of FSC and PEFC – see case example, Box 5) and for certifying sustainable biomass feedstocks for energy use are being used with the intention of promoting more environmentally responsible practices. Biomass certification schemes are used both to support compliance with existing EU rules, set within the RED for biofuels and bioliquids, and to go beyond the current (at least pre 2020) EU policy baseline. For example, some Member States or industry groups have established compliance systems for solid biomass for energy. The SBP (Sustainable Biomass Program) is a certification system designed for woody biomass, mostly in the form of wood pellets and wood chips, used in industrial, large-scale energy production.

Box 5 - Forest Certification Schemes – Policy Case Example (see Annex I, Box G for further analysis)

Forest Certification Schemes such as FSC and PEFC are being increasingly used in Europe, with PEFC dominating. Coverage differs widely among Member States however, and international standards are adapted to each Member State to fit national policies and specificities. This results in different standards in each country, with specific challenges. Biodiversity conservation is included in all international and national standards in both schemes, which are considered in general rather effective on that matter. Challenges remain however, in particular regarding the effectiveness of standards content and the feasibility of monitoring.

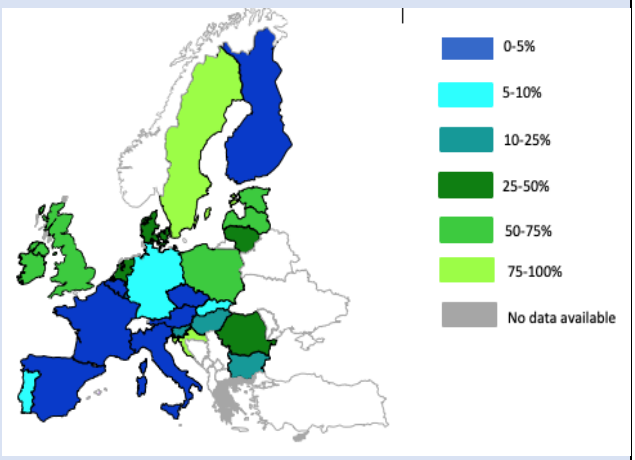
Forest certification criteria (under FSC and PEFC) require the maintenance and/or enhancement of biodiversity and high conservation values in forests, considering the presence of protected species and implementing appropriate measures (e.g. leaving deadwood and old trees in the forest). By requesting compliance with other land-use plans and conservation tools and legislation, they can also contribute to help promoting the conservation objectives set out under the Habitats and Birds Directives. However, such criteria are usually formulated in a very general way (not site-specific). They do not therefore systematically ensure compliance with the site-specific conservation objectives (European Commission, 2015b), but are intended to set the framework for forest managers for their site-specific forest management plans.

Figure B2 – Proportion of forests per Member State classified as PEFC (2015)



Source – PEFC datasets combined with Eurostat data on forest area (own compilation)

Figure B3 – Proportion of forests per Member State classified as FSC (2015)



Source – FSC datasets combined with Eurostat data on forest area (own compilation)

8 UNDERSTANDING NATIONAL LEVEL INTERVENTIONS

6 case studies were completed to support the analysis of policy and the protection afforded to protected species and habitats from the potential impacts associated with the promotion of bioenergy and the production of associated feedstocks. Germany, Estonia, Italy, Portugal, Slovakia and Sweden were selected. The case study analysis included both desk-based research and expert interviews with a range of stakeholders. The interviewees included national forest, environmental or energy authorities, environmental organisations, industry representatives and independent experts, depending on the specific circumstances at national level.

Each case study review identifies and (where possible) comments on the effectiveness of policy instruments that could offer opportunities to mitigate the impact of bioenergy development on species and habitats protected by the Birds and Habitats Directives. Each case studies focuses on the bioenergy impacts on habitats and species protected under the Birds and Habitats Directives within the country in consideration.

Each case study focused on two categories of policy instrument:

- National approaches implementing requirements stemming from EU policies relevant to land use change and agriculture / forestry;
- Nationally initiated policies relevant to limit the consequences of land use change and / or agriculture/forestry land intensification.

It is worth noting a number of limitations in the development of the case studies under this Task. Data and information on policy instruments were not always available at the level of detail necessary to comment on their effectiveness in mitigating impacts on BHD habitats and species driven by bioenergy developments. In addition, the nature of bioenergy feedstock production (i.e. its integration into the wider production of agricultural and forestry products) represented a challenge given the breadth of understanding and expertise needed to comment on the policy context. This made identifying the relevant experts or contact persons within the national-level organisations or bodies a challenge, and also proved a challenge during interviews i.e. experts would commonly only know one part of the story.

8.1 Issue to Note Emerging from Member State Case Study Analysis – A Synthesis

A summary of the findings of each specific case study can be found in Annex II of this report. The following section summaries general messages relevant to policy coverage and implementation. The general and specific findings from the case studies were integrated into the assessment of EU level policies and policy messages set out in sections 8 and 9.

Within all case studies limited evidence was identified to suggest that across Europe, at national level, there is an adequate set of policy responses in place to address indirect and direct impacts of bioenergy developments on the ground. With policy evolving at different speeds and levels in Europe, some Member States are in the process of further developing policy instruments that may help better address impacts of bioenergy on BHD habitats and

species. This includes transposing the sustainability provisions of the Renewable Energy Directive (RED) in the period post 2020 (i.e. all MS selected) or further policy developments on forest management (e.g. Italy).

Despite national legislation implementing the BHD being in place, it is noted in most case studies that the degree of appropriate implementation, assessment and monitoring of the impacts linked to bioenergy developments is limited. Two main elements emerge from the case studies linked to this. First, the level of data required in the formal assessments of the impacts on habitats and species is seldom well, nor clearly defined. In some instances, data or information are not sufficient to provide a thorough assessment on whether any impact has taken place and to which extent. In addition, administrative capacity and relevant expertise available are noted in several Member States to be limiting the effective implementation of the provisions of the BHDs (especially so in the case of Estonia and Slovakia). In some cases, national administrators have limited competence to process the outcome of the appropriate assessment undertaken according to the provisions of Article 6(3) of the Habitats Directive. Moreover, in relation to bioenergy specifically, such analysis tends only to focus on the impact of a new plant, rather than the development and evolution of feedstock supplies.

All the Member States reviewed have in place policies intended to address impacts on protected habitats and species associated with the extraction, processing, and transformation of feedstocks and raw materials for bioenergy. However, many of the policies that address impacts of bioenergy are primarily generic i.e. focused on agriculture, forestry or energy. This includes measures related to agricultural or forestry land management, or to the sustainability of producing renewable energy, including bioenergy. This reflects the way policy has been structured at EU level, and while it makes sense given the overarching interactions between bioenergy provision and wider goals can result in a lack of specific and coordinated thinking about the challenge posed by shifting bioenergy demand.

Other elements emerging from the selected case study policy reviews include:

- The protection of habitats and species as identified by the BHD is mostly a secondary outcome derived from the management, use or protection of other environmental resources or delivering other goals or end points, such as forest management or the protection of forest resources;
- EU level policies that offer more specific protection to the BHD habitats and species considered have been transposed into national legislation in all MS examined. However, in some instances effectiveness is limited by administrative capacity and expertise at national level;
- Protection of agricultural land and forests as environmental resources does not automatically equate to the protection of the habitats and species residing within them. From a policy perspective, these are not necessarily considered one and the same thing. For instance, forest as a whole can be preserved by ensuring sufficient reforestation, but key habitats and bird species may be lost;
- The level of integration of specific rules and requirements for the protection of habitats and species into energy policy is limited. While perhaps not required, it is important to make connections in order to trigger key assessment tools (such as

Appropriate Assessment, EIA and SEA) and protection mechanisms linked to the Habitats Directive in particular. Without these trigger points the ability of such instruments to identify and mitigate impacts is limited.

9 EU Policies – Reviewing their Role in the Promotion of Bioenergy and the Protection of Biodiversity and Identifying Potential Gaps in Policy Coverage

This section examines the EU policies in place that most influence bioenergy use and biodiversity protection, based on the classes of policies identified in section 7. The following sub-sections focus on the policies identified that shape the consumption, sourcing and production of biomass used for energy, and hence have impacts on biodiversity. In all instances both the design of a given policy and the implementation choices of Member States have been considered.

Policy implementation is heterogeneous across EU Member States as a consequence of the interaction between EU laws and national competencies. EU legislation sets out the ambition, the core objectives and goals in the case of agricultural policy (under the Common Agricultural Policy), climate and energy policy (including the RED and its recast) and biodiversity policy (including the Habitats and Birds Directives). Member States then, to greater or lesser extent and depending on the policy and policy instrument, influence the impact of these EU level policies through their implementation choices and governance structures.

Forest activities can be supported within Rural Development Programmes, forest habitats are subject to the EU Habitats and Birds Directives and EU financing mechanisms such as LIFE can be used to support certain forest based activities. To ensure a coordinated and coherent approach to sustainable forest management the EU has had a Forest Strategy since 1998 which was renewed in 2013 with an emphasis on the need for a coherent, holistic view of forest management. EU Member States have competency for spatial planning and zoning, which are of importance in determining how and where certain land use activities are most appropriate.

9.1 Policies that promote renewable energy use

This section analyses EU policies that influence renewable energy use, and hence drive demand for bioenergy. These policies are primarily focused on promoting renewable energy consumption and GHG emission reductions; bioenergy is considered in light of its potential role in replacing fossil-based energy sources. Table 5 presents the analysis of coverage of each relevant policy, the opportunities for promoting mitigation of impacts on protected species and habitats and potential gaps linked to each of the policies assessed.

The analysis of policies promoting renewable energy points to the importance of the sustainability criteria embedded within the Renewable Energy Directive (RED) and the 2018 Recast of the Renewable Energy Directive (RED II). Moreover, it highlights the key evolution in coverage between RED and RED II of these criteria including: the expanded coverage to all the energy uses of biomass (heating/cooling, electricity and transport); the separate and specific consideration of forest biomass and links to sustainable forest management, complementing to criteria on agricultural biomass use and production. It notes the importance of the RED II implementation in supporting EU protected habitat and species conservation.

The analysis also highlights the importance of ensuring consistency in approach across EU policies and then implementation. The RED II is currently within its implementation phase, however the analysis in Table 5 demonstrates the importance of integrating the changes to rules within RED II. In particular, the application of criteria for agricultural biomass and forest biomass and amends to support for renewable transport fuels. This applies all policies that could support biomass use for energy include the EU ETS and support from EU funds and state aid rules.

There are already Member States proactively taking up and applying rules to biomass use across European funding tools to promote better biomass production practices. For example, see box 6 sets out innovations adopted in Slovakia in the 2014-2020 period linked to support from European Structural and Investment Funds.

Box 6 - Policy Case Example - Slovakia: Criteria for the sustainable use of biomass in the regions of Slovakia for programs co-funded by the European Structural and Investment Funds (ESIF) in 2014 – 2020 – For full analysis of the policy see Annex I

In 2017, Slovakia adopted pilot sustainability criteria for the use of forest and non-forest biomass resources in all projects and programs co-funded by the European Structural and Investment Funds (ESIF) over 2014 – 2020. This was a response to the 2014 European Commission (EC) report on the sustainability[56]. The policy was intended to support the unlocking of untapped forest and non-forest resources within the country.

The sustainability framework requires fulfilment of three criteria in relation to the origin of the biomass feedstocks used; their transportation and distribution; and the efficiency of wood biomass energy conversion. The criteria have to be complied with by all projects and programs co-funded by ESIF over 2014 – 2020. These includes projects or programs enacted in the context of the Operational Program Quality of the Environment (OP KŽP) and the Rural Development Program of the Slovak Republic (RDP) (Ministry of Environment of the Slovak Republic, 2016). The Ministry of Environment (MoE), which manages the Operational Programme on Quality of Environment, is the body monitoring the fulfilment of the criteria for each project or program co-funded through ESIF (Zamkovský, 2018). Failure to meet one of the criteria is considered a reason for refusal of the project at stake, or to return financial support received in the inception phase (Ministry of Environment of the Slovak Republic, 2016).

[56] https://ec.europa.eu/energy/sites/ener/files/2014_biomass_state_of_play_.pdf

Table 5 – Analysis reviewing the coverage of key policies relevant to promoting bioenergy demand, assessing gaps and emerging issues relevant to the protection of EU protected habitats and species.

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
Renewable Energy Directive (RED) - 2009/28/EC[57] and ILUC amendment EU(2015)1513	Sets an EU renewable energy target of 20%, translated into national binding targets, and a specific target for renewable fuels in transport. The targets under RED are a key driver of bioenergy demand in the EU. Directive sets out sustainability standards for biofuels and bioliquids, including land and GHG saving criteria. The land-based criteria are intended to avoid direct land use change linked to increased EU demand for biofuel or bioliquid feedstocks. They prohibit sourcing of material from areas including primary forest and other wooded land, designated areas for nature conservation, highly biodiverse grasslands, wetlands, continuously forested areas and peatland[58]. There is an emphasis on protection of habitats and protected areas with the criteria for determining high biodiversity value. Directive 2015/1513 amended RED with the intention of limiting indirect land use change impacts associated with increased demand for biofuel and bioliquid feedstocks[59]. Directive 2015/1513 (among other rules) applied a limit to the contribution made by biofuels produced from crop-based feedstocks to the renewable transport fuel target (capped at 7% of transport fuels). It emphasises the role of advanced biofuels, and thus the feedstocks that support them including	The RED provides rules on sourcing of feedstock material for only a portion of the EU demand for biomass for energy i.e. it applies limits on the land that can be used to source material to produce biofuels (including biogas) for transport and bioliquids for heat and power. Feedstocks for solid biomass used for heat and power and biogas for heat and power are not covered. The 2015 amendments to RED aimed at addressing ILUC impacts associated to conventional biofuels do not specifically impose land use constraints, instead limit the volumes of biofuel material needed. The RED criteria are focused on controlling expansion of agricultural land that supports biofuel and bioliquid production. As a consequence, of all the above only limited protection is offered to habitats and species by the existing criteria set to 2020 with risks, due to intensification of agricultural production and increased intensity of forest extraction.

[57] It should be noted that parallel requirements for the decarbonisation of transport fuels are set out in Directive 2009/30/EC, however, these are not discussed specifically here as the rules on sustainable sourcing relevant to biodiversity are the same as for the RED.

[58] To note that while the RED does not consider sustainability of biomass for other used than biofuels and bioliquids the European Commission did provide non binding recommendations on the use of biomass fuels on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling

[59] Indirect land use change occurs where biofuel feedstock production takes place on existing arable land and displaces existing production onto other land.

	lignocellulosic material i.e. woody biomass, agricultural, forestry and wood-based residues and wastes.	
Recast Renewable Energy Directive (RED II) - EU(2018)2001	Sets an EU-wide target for renewable energy (32% by 2030) and a target of 14% renewable energy in the transport sector60, thus driving bioenergy demand. In relation to the overarching energy target, Member States are to determine their own contribution within integrated national energy and climate plans, based on rules set out in the RED and Regulation 2018/1999/EU on the Governance of the Energy Union and Climate Action61. The Governance Regulation also contains specific rules in relation to reporting on the impacts and contribution of bioenergy to broader renewable energy delivery. Introduces sustainably standards for all end uses of bioenergy (biofuels, biogas, bioliquids and biomass-based heat and power), including land criteria for both agricultural and forest biomass, GHG saving criteria and energy efficiency requirements for biomass-based electricity only installations[62]. For solid and gaseous biomass used for energy Member States still have the option to establish additional sustainability criteria[63]; for biofuels and bioliquids (as under the current RED) sustainability rules should be consistently applied across Member States.	General - RED II will offer a greater level of protection from direct conversion of land to deliver biomass for energy in the form of agricultural biomass given the extended remit to cover in particular biogas for heat and power production. For bioenergy produced from forest biomass, the Commission will adopt an implementing act by January 2021 at the latest, providing operation guidance on how the new forest biomass criteria will have to be implemented (e.g. which proof of compliance) Agricultural biomass criteria - are intended to limit land use change associated with agricultural production driven by bioenergy demand. The forest biomass criteria focus on sustainable forest management and regeneration of that forest. This creates a potentially grey area where afforestation or expansion in short rotation forestry could take place, potentially on highly biodiverse land. There is, therefore, a need to clarify the bounds of coverage in terms of land use-based criteria to address questions of afforestation and establishment of new forestry systems that are then used to source woody biomass for energy. This is also a wider question of land use

[60] RED II replaces the national requirement placed on Member States to deliver transport fuels from renewable sources with a mandate that Member States ensure fuel suppliers provide 14% of transport fuels from renewable sources by 2030. Important caveats include that only 7% (as a maximum) can be sourced from food or feed-based feedstocks, that a rising proportion (up to 3.5% by 2030) be sourced from specific advanced feedstocks including agricultural and forestry residues and lignocellulosic fuels, and that food and feed crops considered to have 'high indirect land use change impacts' be gradually reduced to 0% by 2030.

[61] The rules mandate no roll back in terms of renewable energy use from 2020 levels, with MS contributions to be based on renewable resource availability among other things.

[62] Efficiency of end use in combination with sourcing strategy is important in the context of scale impacts of biomass sourcing.

[63] Article 29.14 of the REDII states that by 31 December 2026 the Commission shall assess the impact of such additional criteria on the internal market accompanied, if necessary, by proposals for harmonisation

	Land criteria for agriculture biomass are in line with those applied to 2020 i.e. specifying that agriculture biomass feedstocks shall not be made from raw materials obtained from highly biodiverse[64] or high carbon stock lands. These criteria apply to all biomass used for energy grown on agricultural land including crops to supply biogas plants and short rotation coppice (considered an agricultural activity in the EU) used as feedstock for advanced transport biofuels or as solid biomass for power and/or heat. REDII includes also management criteria address soil quality and carbon impacts associated to the extraction of agricultural residues. In addition, REDII prevents the sourcing of agricultural biomass from highly biodiverse forests. Forest biomass (including residues) – the forest sustainability rules are intended to avoid unsustainable production, focusing on sustainable forest management activities and LULUCF emission/removal accounting. They require the bioenergy operator to demonstrate that forest biomass is sourced from a country has laws, and monitoring and enforcement systems in place to: a) ensure inter alia that designated areas are protected, harvested areas are regenerated and harvest is conducted in a way that minimises impacts on biodiversity and soils; and b) that LULUCF emissions/removals associated with biomass harvesting and accounted for. If evidence of compliance with the above mentioned criteria cannot be provided, then forest management systems in the sourcing area must be put in place to meet the relevant criteria including those relating to protection of designated areas and biodiversity impacts during harvest.	change decision making and ensuring protection of habitats and species within such processes. Forest biomass criteria - The criteria's effectiveness will depend on the harmonized implementation across source countries, including the guidance setting out what national laws and proof are considered to comply with the forest sustainability and carbon requirement, including the monitoring and enforcement systems).

[64] Land of high biodiversity value is considered to be: primary forest and other wooded land; highly biodiverse forest and other wooded land which is species-rich and not degraded (this clause is a new addition for RED II, beyond that included in RED), areas designated by law or relevant competent authorities for nature protection purposes/for the protection of rare, threatened or endangered species unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes; Highly biodiverse grassland spanning more than one hectare.

	Please add summary of the GHG saving criteria + energy efficiency criteria	
EU Emissions Trading Directive (EU ETS) - 2003/87/EC, as amended including by Directive 2018/410/EU	Sets GHG reduction targets for EU ETS sectors and establishes an associated trading system to support emission reduction. Bioenergy is considered to be zero rated in emission terms under the EU ETS (with emissions associated with production accounted for within LULUCF accounting and reporting); therefore, bioenergy is on option for delivering emission reductions under the EU ETS potentially contributing to bioenergy demand (albeit limited by certain rules). Within monitoring and reporting guidelines biofuels and bioliquids used to meet the target currently must be produced in line with sustainability criteria set out in RED to quality for the zero carbon rating to apply[65].	Following changes to rules under RED II which expanded sustainability criteria to all biomass energy uses, there is a lack of policy consistency between these clauses. During the implementation of REDII EU ETS rules of biomass for energy should be expanded to all biomass used for energy to ensure consistency with RED II sustainability rules. Failing to do so would potentially allow continued support for investment in biomass use that would be not compliant with RED II rules.
European Structural & Investment Funds (ESIF)	Provide the opportunity for energy funding, including for sustainable biomass production, bioenergy end uses and infrastructure. Under the ESIF Member States and their regions can benefit from support including, for example, under the European Regional Development Fund (ERDF). The ERDF co-finances programmes and projects that might be directly or indirectly linked to forests and the forestry sector, including the possibility of investments in Natura 2000 and the promotion of biodiversity and ecosystem services. It also co-finances cross-border, transnational and interregional cooperation programmes that can support projects which relate to forests and forestry. Compliance with EU legislations, including REDII, is a pre-condition for accessing EU funding.	The significant evolutions in the RED II bioenergy sustainability criteria will need to be fully reflected in all EU financial support mechanisms, capable of directly or indirectly influencing the sustainability of bioenergy uptake and production of biomass feedstocks, it is important that for the post 2020 period the significant evolutions in the RED II criteria are effectively transferred. Moreover, as demonstrated by the existing rules on State Aid for biomass and the linking of rules on sustainable sourcing of biomass to ESIF funds in Slovakia, promoting best practice solutions is a key role of such EU support. RED II clearly sets out that Member States can adopt additional sustainability criteria applicable to solid biomass and biogas post 2020. This opportunity to promote best practice and link this to key EU funded activities is a potentially important route to demonstrate approaches that can deliver bioenergy in a way that effectively mitigates biodiversity impacts.

[65] COMMISSION REGULATION (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council – amends to take account of sustainability criteria for biofuels/bioliquids, translates definitions from the RED to EU ETS - http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02012R0601-20140730&from=EN

Commission communication – Guidelines on use of state aid for energy and environment 2014-2020 (recently extended to apply until 2022)	Specific rules relating to support for biofuel processing facilities and for renewable energy support more generally	

9.2 Policies to protect biodiversity from negative impacts

This section assesses the policies in place to protect biodiversity from changes in supply or demand and associated changes in land use and land management including environmental assessment tools.

The main EU policy instruments that contribute to the EU biodiversity goals are the **Birds and Habitats Directives**. The Directives have two primary approaches to achieving their objectives: firstly, measures for the protection of species wherever they occur; and secondly the protection of sites of particular importance for species and habitats of Community Interest. The latter, designated under the two Directives, are intended to form 'a coherent ecological network' referred to as the Natura 2000 network. It should be noted that protected habitats and species may occur outside of Natura 2000 sites or may be reliant on ecological corridors and other forms of connectivity that sit outside protected sites. This is of particular importance when considering the application of the RED and RED II criteria, which are more focused on protected sites, rather than protected species or habitats more generally. The criteria, therefore, have a more limited scope for mitigation of impacts outside protected areas.

It should be noted that the Habitats and Birds Directives are not expected to be able to conserve and restore biodiversity in the EU in isolation. They set the framework around which land management can be adapted, hence rely on synergies with other policies in this case linked to land management to secure effective implementation (e.g. farming, forestry). The direct funding is also limited, for example the CAP is currently the main source of funding for terrestrial Natura 2000 site management. Therefore, overall biodiversity conservation very much depends on additional support from a range of other interacting policies and instruments, including those that regulate developments. Specifically, this includes the Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) Directives.

The ***EIA and SEA Directives*** are to a large extent complementary: the SEA being 'up-stream' i.e. intended to identify the best options to deal with potential impacts at an early planning stage, and the EIA being 'down-stream' so that it can deal with project-specific impacts at a later stage. Assessments provide environmental reports that should identify and assess significant environmental effects, mitigation measures and alternatives, and consult with relevant authorities and the general public in the process. Within Natura 2000 sites these assessment tools are also complemented by Appropriate Assessment requirements, which are triggered when plans or projects are likely to have a significant effect on any Natura 2000 site but are not directly connected to their management (for nature conservation).

All three impact assessment tools are important in ensuring that consequences for biodiversity are appropriately considered and mitigated against. However, the analysis has identified concerns regarding the implementation of these tools. This relates to inter alia: the protection afforded in forests, specifically associated with the assessment of downstream impacts of developments; the challenges associated with performing an assessment on a

development such as a bioenergy plant when the feedstock may not be specified or may change over time, significantly altering the project's environmental footprint; when and how to effectively trigger assessments of changes in agricultural land management; and finally, how to effectively assess cumulative impacts of bioenergy investments or changing forest management practices when plans and programmes may not exist or may not be detailed enough to fully understand associated consequences.

Table 6 – Analysis reviewing the coverage of key policies relevant to protecting biodiversity and their mitigation of potential threats associated with bioenergy adoption.

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
Habitats Directive - 92/43/EEC and Birds Directive - 2009/147/E	The Habitat's Directive is Intended to protect against activities that have negative impacts on protected habitats and species, and mandates conservation measures; for habitats and species in the Natura 2000 network and if necessary outside it. Interacts with bioenergy demand where this drives changes in the patterns of biomass production, intensity of land use and patterns of land use. The Birds Directive is intended to protect against activities that have negative impacts on bird species, and mandates conservation measures for species in the Natura 2000 network and if necessary outside it. interacts with bioenergy demand where this drives changes in the patterns of biomass production, intensity of land use and patterns of land use. The protection and management of Natura 2000 sites, designated under either the Habitats or Birds Directives, is governed by Article 6 of the Habitats Directive. Article 6 contains three key provisions, the first two aspects will determine management of a given site, the third is intended to protect sites from development. Article 6.3 specifically requires Member States to: introduce an assessment procedure for plans or projects that are likely to have a significant negative impact on a Natura 2000 site. In line with Article 6.3 plans or projects which, individually or in combination with others, are likely to have a significant effect on any Natura 2000 site but are not directly connected to their	Importantly, protected habitats and species may occur outside Natura 2000 sites or may be reliant on ecological corridors and other forms of connectivity that sit outside protected sites. This is of particular importance when considering the application of the RED and RED II criteria, which are more focused on protected sites, rather than protected species or habitats more generally. The management of forest Natura 2000 sites is particularly relevant to questions of bioenergy impacts on biodiversity. The Habitats and Birds Directives do not set an obligation to establish Natura 2000[66]site management plans, but Commission guidance recommends management plans as a good practice to meet the requirements of the Directives. Forest management plans and Natura 2000 management plans do not always have the same purposes and goals, and usually they also differ in their legal basis. The responsibility of drafting Natura 2000 management plans falls on the competent nature conservation authorities, the responsibility for drafting a forest management plan falls on the forest owner or manager. It is desirable that these plans are integrated, but there are several challenges to integration. For example, this may be the case in Natura 2000 sites with multiple small forest properties (many of which may not require a forest management plan) or when the Natura 2000 boundaries and the forest property boundaries do not coincide. A number of Member States have formulated guidelines, rules or other guidance tools to facilitate the integration of Natura 2000 needs into forest management planning (European Commission, 2015b). Coordinated forest management plans, that take fully into account biodiversity priorities, will be important in ensuring that the use of woody biomass resources for energy (and alternative material uses) is sustainable for biodiversity and ecosystem services.

[66] Forest Management Plans are promoted under the EU Biodiversity Strategy and are required for EAFRD funded measures (in both cases for forest holdings above a size threshold to be determined by Member States)

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
	management (for nature conservation), require an 'Appropriate Assessment'. This assessment must consider the implications of the plan or project in view of the site's conservation objectives. An Appropriate Assessment should be triggered by any activity that is likely to have a significant effect on a Natura 2000 site. This also requires consideration of activities downstream that might impact on Natura sites. This includes the intensification of an activity (based on ECJ Case C-127/02) and activities outside the site but likely to have a significant effect on it (Case C-98/03, C- 418/04). The European Commission has indicated that agricultural developments that might be subject to an Appropriate Assessment include ploughing up of permanent grasslands and other semi-natural and natural habitats; and other activities that are likely to undermine the conservation of the Natura 2000 site (European Commission, 2001).	The downstream impacts that could impact on Natura 2000 site, and hence should potentially trigger Appropriate Assessments include activities associated with wood extraction for material and bioenergy uses, or other purposes such as: the construction of a new forest road; a wood storage facility or a saw mill; drainage of the land; afforestation or deforestation; significant clear fellings; important modifications of the silvicultural regime; or significant land use changes (European Commission, 2015b). Evidence suggests that Appropriate Assessments linked to downstream consequences are often not conducted or fully understood as needed. Investments in bioenergy that result in such impacts should at least be subject to a scoping to determine if there may be impacts on Natura 2000 sites associated with changing patterns of wood demand. There is some evidence that Member States have not been adequately applying Article 6.3 requirements to agricultural developments and changes in practice (Alliance Environnement and Thünen-Institut, 2017; Sundseth and Roth, 2013).
Strategic Environmental Assessment Directive - 2001/42/EC	SEA should be applied at a strategic level to assess cumulative impacts of planned bioenergy consumption, once certain thresholds or criteria are met triggering the assessment SEA offers potential in the context of bioenergy to strategically assess some of the key pressures on biodiversity including potential cumulative change in land uses, land management intensity of agriculture and forestry and the deployment of multiple bioenergy plant across a region.	The first stage in a SEA is that national competent authorities must decide if it is required for a given plan or programme, this is based on the fulfilment of four enabling criteria set out in the Directive. However, the analysis has shown that opportunities to complete an effective analysis of impacts of bioenergy cumulative change are limited as often plans or programmes that offer a suitable basis are broad or high level or don't exist in a coordinated way. For example, in the bioenergy sphere such plans might include National Renewable Energy Action Plans exist or forest management plans. However, only a limited number of Member States considered that that all four criteria set in the SEA Directive were fulfilled in relation to their NREP and thus carried out SEA. Others did not consider that NECPs met the four criteria (in particular setting the framework) and thus did not apply the SEA Directive. Into the future RED II does not make reference to SEA but the Governance Regulation does make reference to the importance of public participation in determining integrated national energy and climate plans (NECPs) and the role of SEA in delivering this. Whether an NECPs will require a SEA would be determined by national approaches to implementation. Moreover, INCEPs will have to cover a huge array of issues, hence a SEA at this level would be unlikely to be specific enough to determine and mitigate bioenergy

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
		impacts. Instruments put in place to deal with other RES sources (i.e. non biomass based RED) are often not fit for purpose for the bioenergy sector, which is fundamentally different in terms of its resource use and potential footprint in terms of biodiversity. Hence, there remains a question as to how to apply environmental assessment to enable collective and cumulative impacts of bioenergy to be understood.
Environmental Impact Assessment Directive - 2011/92/EU and amendment 2014/52/EU	Should be applied at project level, as per rules in Annex I and II of the Directive. Energy projects and land-use change (linked to use of uncultivated land or semi-natural areas for intensive agricultural purposes or initial afforestation and deforestation for the purposes of conversion to another type of land use) are included within the Annex I and II definitions. EIA requirements on agriculture and forestry that should trigger an assessment related to bioenergy feedstock production, are set out in Annex II of the Directive. Relevant projects, in the context of bioenergy feedstock deployment, for which an EIA is required include: - Projects for the restructuring of rural land holdings (considered to include the loss of field boundaries); - Projects for the use of uncultivated land or semi-natural areas for intensive agricultural purposes; - Initial afforestation and deforestation for the purposes of conversion to another type of land use. Member States are allowed the flexibility to set thresholds for the application of the above, or to define criteria that trigger an EIA.	This includes potentially differing interpretations of semi natural areas and decisions as to which specific agricultural practices and which types of area fall into Annex II project categories (European Commission, 2015a). The process for the setting of such criteria and thresholds was elaborated and strengthened in the 2014 review of the Directive. As noted in relation to the protection of permanent grasslands, how boundaries are set in terms of when an EIA is required nationally are important in determining the effectiveness of the tool. Moreover, a key factor is whether a process exists by which a competent authority is notified of an activity in order to be able to determine if an EIA threshold is met is key. For example, the extent and coverage of prior authorisation requirements related to the conversion and ploughing of permanent grassland will determine whether or not a competent authority is aware of change. EIA will be required for biomass energy facilities and processing plant managing biomass. However, commonly EIA requirements for such plant do not consider the impacts of the feedstock being utilised during the plant's lifetime[67]. Moreover, even if this were possible, unless specified within the permit for the plant, the feedstock used during its active life could change and evolve.

[67] Evidence from interviews identified that EIA assessments for bioenergy plant were explicitly excluded in Croatia, Slovakia and Czechia

9.3 Supporting, determining or influencing approaches to land use and management

This section analyses policies that influence the nature of feedstock supply, how material is produced and any sustainability conditions mitigating biodiversity impact. EU policies have the ability to influence the use and management of land. To this end they are important tools for securing a baseline for biomass production that limits impacts on biodiversity; and developing positive interventions to support biomass delivery alongside biodiversity. This section focuses on the EU's Common Agricultural Policy (CAP) and the Forest Strategy. The other policies may impact on land management choices depending upon local conditions and implementation choices as briefly discussed in box 7.

The Common Agricultural Policy has a major role to play in supporting the Habitats and Birds Directives through its instruments and measures that aim to mitigate potentially harmful impacts and encourage practices that are beneficial for biodiversity. The CAP is by far the largest source of funding for practical terrestrial habitat management and restoration actions[68]. It should be noted that CAP funding is not only of importance for agricultural systems, but for forestry interventions as well (following changes implemented in the current programming period). The main EU-level funding to implement action related to forestry has been and remains the co-financing of forest measures under the Rural Development Programmes of the CAP[69].

The different elements of the EU's Common Agricultural Policy (CAP) are designed to take account of the diversity of European land management systems. The CAP is structured and defined at EU level; however, its requirements are implemented in a national or regional context. This is intended to provide a locally adapted set of policies delivering EU goals. However, this can result in a significant diversity in the protection afforded under the CAP and the types of management practice supported across Member States (Bowyer and Keenleyside, 2017).

The analysis focuses on both the Rural Development Programmes under the CAP and elements of Pillar I 'greening' measures that importantly seek to protect areas of permanent grasslands. Box 9 sets out examples of projects and activities that have been supported under rural development relevant to bioenergy deployment and the opportunities to support best practice. However, in particular the analysis raises concerns about the effectiveness of support through RDPs for forest measures.

The 2013 EU Forest strategy was a response to a need for an EU policy framework that 'coordinates and ensures coherence of forest-related policies and allows synergies with other sectors that influence forest management'. The Strategy was a response to the need to implement action through a variety of policies (both at the EU and national level), it specifically stresses the importance of sustainable forest management and the importance of forest management measures within the Rural Development Programmes and use of state

[68] Biodiversity evaluation inception report, unpublished
[69] Review of the Forest Strategy, 2018

aids. Box 8 presents a summary of state aid rules relevant to forest support. These are important in that they set the context for national support for forest interventions.

Box 7 – Other EU policies with the potential to influence land management decisions

The Water Framework Directive may be relevant in determining land management or decisions, for example, to afforest degrading lands as an intervention to promote the delivery of good ecological status. It should also be noted that the ploughing of permanent grassland is constrained in some Member States by the way they have applied the Nitrates Directive For example, in the Netherlands, permanent grassland located in vulnerable zones under the Nitrate Directive generally cannot be ploughed over the winter period. Moreover, to receive a derogation to the requirements of the Nitrates Directive, farmers must have more than 80% of their farm under grass (although this does not have to be permanent grassland). This encourages some farmers to maintain or even increase their grassland areas (some of which may be classified as permanent) (Alliance Environnement and Thünen-Institut, 2017).

LULUCF, emphasises the role of land management, the role of forests and agriculture in sequestering carbon; this emerging area will be placed under increasing scrutiny moving into the post 2020 period of implementation. Active implementation of LULUCF rules could, potentially, lead to changes in prioritisation of sustainable forest management[70], levels of forest extraction and afforestation. To date, however, implementation has relied primarily on delivery via existing systems in place at EU and Member State level relating to forest and agricultural land use and management (Paquel et al, 2017). This is anticipated to potentially evolve into the post 2020 period when it will be possible to transfer LULUCF credits to offset emissions from non-EU ETS sectors under the Effort Sharing Regulation EU/ 2018/842[71]. This is anticipated to increase attention on the promotion of LULUCF sinks and the promotion of afforestation and potentially alternative forest management practices.

Box 8 – Relevant extracts of European Guidelines for State Aid for agricultural and forestry[72] relating to the support for forestry in relation to biodiversity protection and bioenergy.

The Forest Strategy specifically highlights the importance of ***State Aid*** in supporting forest management (alongside funding under the RDPs). ***European Commission Guidelines for State aid in the agricultural and forestry sectors***[73] apply rules related to aid for the forestry sector which is co-financed by the EAFRD, granted as additional national financing to such co-financed measures or granted as a pure State aid – hence of broader relevance in determining practice in forestry and afforestation. In the current programming period, some Member States have chosen to primarily use state aids to support their forest systems, including Ireland and Finland. Relevant aspects of the guidelines are presented below. These include clauses that will specifically influence the use of state aids in relation to support for biomass feedstock production for energy.

The Guidelines include inter alia rules on aids for investment in the following areas of interest:

- afforestation and woodland creation – stating that 'the selection of species to be planted, of areas and of methods to be used must avoid the inappropriate afforestation of sensitive habitats such as peat lands and

[70] Progress in the implementation of the EU Forest Strategy 'A new EU Forest Strategy: for forests and the forest sector' COM(2018) 811

[71] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN

[72] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0701(01)&from=en

[73] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0701(01)&from=en

wetlands and negative effects on areas of high ecological value including areas under high natural value farming. On sites designated as Natura 2000 only afforestation consistent with the management objectives of the sites concerned and agreed with the Member State's authority in charge of implementing Natura 2000 must be allowed;

- improving resilience and environmental value of forest ecosystems – stating that 'Investments should be aimed at the achievements of commitments for environmental aims for the provisions of ecosystem services and/or for the enhancement of the public amenity value of forests and wood land in the area concerned or the improvement of the climate change mitigation potential of ecosystems, without excluding economic benefits in the long term';
- investment in forestry technologies and in processing, mobilising and marketing forest products – under this section it is specifically noted that investments in installations whose primary purpose is electricity production from biomass, shall not be eligible for state aid unless a minimum percentage of heat energy is utilised (to be determined by the Member States). Moreover, aid to bioenergy projects shall be limited to bioenergy meeting applicable sustainability criteria cross referenced to those within the RED – although rules on production of biofuels are not as stringent as those under the energy state aid guidelines i.e. Member States are required to establish thresholds for the maximum proportion of conventional crops used in bioenergy production versus compared to rules promoting advanced biofuel production in the energy guidelines.

Table 7 – Analysis reviewing the coverage of key policies supporting or influencing the production of biomass in Europe related to bioenergy feedstock demand.

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
Common Agricultural Policy (CAP) - The CAP sets out the rules for support for land management and as such sets out rules with which recipients should comply with. Current CAP rules enable the retention of certain land uses, such as rules under Pillar 1 related closely to the retention of grasslands (some greening elements including Environmentally Sensitive Permanent Grassland and rules on the retention of permanent pasture) which links strongly to land use change questions associated with increased bioenergy demand. Moreover, targeted support is also possible within Rural Development Programmes for bioenergy development or sustainable biomass production including certain forms of afforestation and support for the management of Natura 2000 sites on both agricultural and forestry land. In the context of the pressures anticipated to be associated with bioenergy expansion there are three elements of the current CAP framework (2014 to 2020) considered of importance. These are discussed below.		
CAP – Cross Compliance	Cross-compliance standards apply horizontally to those receiving direct payments under Pillar 1 and those receiving area based payments under Pillar 2. Within cross compliance standards of **Good Agricultural and Environmental Condition (GAEC)** are set out to be met. All of the 7 GAECs are considered potentially relevant to biodiversity protection, however, GAEC 7 on the retention of landscape features and GAEC 6 on maintaining soil organic matter of particular relevance linked respectively to potential pressure to intensify production and the use/retention of agricultural residues.	As per other elements of the CAP, GAEC is defined and interpreted at the national (or in some cases regional) level, in relation to the exact implementing actions to comply with the standard. This allows Member States to adapt rules to their conditions, however, in relation to GAEC 6 and 7 has led to variable levels of ambition.
CAP – Pillar 1 greening requirements	**Pillar 1 greening requirements** aim at ensuring a broad contribution to environmental objectives. Specifically, requirements linked to the maintenance of permanent grassland[74], designation of environmentally sensitive areas of permanent grassland (ESPG) grasslands and Ecological Focus Areas (EFAs) under which at least 5% of the arable land on farms with more than 15 hectares of arable land should be managed as an EFA. EFAs can include landscape features, hectares	Under both sub measures key decision regarding implementation are left to Member States discretion including: how the percentage change in permanent grassland ratio is calculated i.e. at the national or regional level (just four countries chose to manage the ratio at the regional level which provides a greater resolution and more targeted approach to identification of change (Alliance

[74] Article 45(2) of Regulation (EU) No 1307/2013 states MS shall ensure that "the ratio of areas of permanent grassland to the total agricultural area […] does not decrease by more than 5% compared to a reference ratio [established by each Member State]". Member States may require farmers to maintain permanent grassland at holding level or at regional level. If the ratio does decrease by more than 5%, MS must require land to be converted back to permanent pasture through placing obligations on farmers to do so. This applies unless the decrease in permanent grassland results from afforestation, provided such afforestation is compatible with the environment and does not include plantations of short rotation coppice, Christmas trees or fast-growing trees for energy production.

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
	of agroforestry, areas with short rotation coppice with no use of mineral fertilizer and/or plant protection products, afforested areas that receive or have received support from European Agricultural Fund for Rural Development (EAFRD) in 2007-2013 or 2014-2020. Member States can choose which of the EFA greening measures to offer to farmers. Within **greening** two sets of rules of importance to the **protection of permanent grassland** are set out: a sub-measure on the 'maintenance of the ratio of areas of permanent grassland'; and a sub measure requiring Member States to designate of the most ESPG needing strict protection in Natura 2000 sites and Member states may also designate ESPG outside Natura 2000 sites. Grassland designated as ESPG are protected from ploughing and conversion.	Environnement and Thünen-Institut, 2017); whether and how prior authorisation for conversion or ploughing is required and the triggering of such a scheme in the event that declines in grassland ratio are defined; the definition of criteria on which the designation of ESPG areas outside Natura 2000 areas is based; for ESPG inside Natura 2000 areas, as well as deciding which areas require strict protection, Member States can set management restrictions. This flexibility accorded to Member States has the potential to lead to a wide range of changes in the area and location of permanent grassland. This has implications for the retention of biodiversity value, which depends on the type, location and management of the permanent grassland that is maintained or ploughed.
CAP – Pillar II – Rural Development Programmes (RDPs) - current period 2014-2020	**Rural Development Programmes (RDPs)** are partly funded by the EU budget (the European Agricultural Fund for Rural Development - EAFRD[75]) and partly co-financed by national and/or regional authorities. The stated overall aim of CAP rural development policy is to promote sustainable rural development in a way that complements other EU funds. Member States and regions are required to base their RDPs on the needs of their territories and in doing so must address common EU priorities. Despite the CAP being an agriculture focused policy, the **RDPs** have an important role in supporting **sustainable forest management and afforestation**. The EAFRD Regulation offers a total of 19 different RDP measures from which Member States/Regions may choose, designing sub-measures and operations tailored to local needs or priorities. Of particular relevance to this analysis are two measures (measure 8 and measure 15) that support investments in forest management; agri-environment and climate actions and supporting investment measures (measure 10 and measure 4) and specific support for Natura 2000 on both	The exact scope of the measures applied is left to the discretion of the MS Managing Authorities, at national and/or regional level. These measures are implemented on a voluntary basis by Member States (with the exception of the agri-environment climate measures (M10) and Leader (M19) which are both compulsory) and are taken up voluntarily by land managers. During discussions on the bioeconomy there have been concerns raised over the lack of connectivity in terms of RDP interventions, which would apply equally to questions of bioenergy i.e. projects are not necessarily linked together to support sustainable supply chains or linked to a broader plan related to biomass resource

[75] REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
	agricultural and forest land (measure 12). The EAFRD has a high degree of subsidiarity which enables Member States to choose and tailor measures. RDPs have supported a wide range of projects relevant to the promotion of bioenergy including: support for pellet or product processing plant (including for oil extraction from agricultural commodities); projects intended to develop and coordinate alternative biomass streams including residues from agricultural production, residues from management of protected sites and organic waste; investment in wood extraction from forests including upgrading of machinery, coordinating forest actors, support for wood based biomass supply chains and territorial plans for wood supply[76]. In the evaluation of forest measures in the RDPs (Alliance Environnement and EFI, 2017), improving the resilience and environmental value of forest ecosystems (M8.5) and management for environment and climate services and forest conservation (M15.1) were noted as a key source of EU funding to support sustainable forest management to achieve EU biodiversity priorities. In order to receive support under the RDPs holdings above a certain size (to be determined by the Member States in their Rural Development Programmes) must demonstrate forest is being managed in line with Sustainable Forest Management principles. This is evidenced by the presentation of relevant information from a forest management plan or equivalent. This requirement is important in terms of supporting and prioritising support for sustainable forest management practices in Europe.	availability[77]. The need to define, identify and promote best or good practice consistently in this field under RDPs was also identified. Budgets and uptake targets for M15.1 management contracts are noted to be far below the scale of implementation considered required for MS to meet their legal obligations under the Habitats and Birds Directives to restore and maintain the Natura 2000 habitats and species of forests. EEA data from 2016[78] shows that only 15% of Annex 1 forest habitats are in favourable conservation status and the trends are poor. Both the evaluation of forestry measures in the RDP and analysis on management of Natura 2000 and Forests (European Commission, 2015b) stress the importance of long-term thinking and planning regarding forest policies and measures. This is important in terms of effective implementation, and coordination of interventions. If implemented coherently, effectively and over a sufficiently lengthy time period, the evaluation of forestry measures under RDPs noted that they can contribute significantly to delivering economic, environmental and social benefits in areas where these opportunities can be rare. This makes RDP measures a potentially important tool when considering sustainable forest management delivery including biomass for energy in a way that mitigates biodiversity impacts. However, payment rates for some measures such as M15.1 is often too low to be an incentive enough for forest

[76] This list is compiled based on examples of activities set out in the European Network for Rural Development's database of projects from the 2007 to 2013 and 2014 to 2020 plan periods. See https://enrd.ec.europa.eu/projects-practice_en for further details

[77] Discussions noted took place within the ENRD Thematic Group on Mainstreaming the Bioeconomy, 2018/2019 - https://enrd.ec.europa.eu/sites/enrd/files/tg_bioeconomy_scoping-paper.pdf

[78] https://www.eea.europa.eu/soer-2015/europe/forests

Policy	Relevance to bioenergy and biodiversity protection	Analysis, gaps and potential issues identified relating to coverage
		holders change their management practices or even production system. In addition, the FM budget share is also often too small to achieve targets set in the RDPs and at EU policy level.
EU Forest Strategy - COM(2013)659	The EU forest strategy was developed to provide a coherent framework for both EU forest-related policies and the national forestry policies of the individual EU countries. The 2013 strategy was a response to a need for an EU policy framework that 'coordinates and ensures coherence of forest-related policies and allows synergies with other sectors that influence forest management'[79]. It aims at promoting the concept of sustainable forest management, which aims to safeguard and achieve the balanced development of the multiple functions of forests and efficiency use of resources. The strategy, while non-binding, seeks to set out the strategic direction and priorities for forestry in Europe with the intention of better coordinating activities in the EU. The Strategy favours preventive approaches to ensure forests' provision of ecosystem services and contribution to biodiversity; in this respect, it highlights the potential of Forest Management Plans (FMPs) or equivalent instruments for a balanced delivery of goods and services (European Commission, 2015b). EU Forest Strategy has 'forest protection and enhancement of ecosystem services' as one of its priorities, stating that Member States "should achieve a significant and measurable improvement in the conservation status of forest species and habitats by fully implementing EU nature legislation and ensuring that national forest plans contribute to the adequate management of the Natura 2000 network by 2020'.	The European Commission's progress reporting considering the implementation of the EU Forest Strategy (COM(2018)811)[80] noted the importance of RDPs, the CAP and State Aids in the delivery of forest management[81]. It concluded that the 'integration of biodiversity into forest management plans has progressed. Member States and forest owners and managers make use of RDPs and LIFE funding to support the implementation of their commitments, and some have promoted initiatives for protecting and promoting forest genetic resources'. However, critically it is stated that despite the action taken so far, 'the implementation of the EU biodiversity policy remains a major challenge. The reports on conservation of forest habitats and species show no improvement so far'. The progress report noted that 'further efforts are needed to enhance the role of forest management plans in achieving biodiversity targets and to support the provision of ecosystem services. It also noted that the development of a proposed Forest Information System for Europe (as a reference for data and information on forests and forestry in Europe) still requires 'significant work on system development, data collection and harmonisation'.

[79] Forest Strategy 2013 – introductory text

[80] https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/forestry/documents/report-progress-eu-forest-strategy-com-2018-811-f1_en.pdf

[81] Four Member States addressed their forestry needs through State aid

Box 9 – Policy Case Example – Examples of the use of RDP funding to support relevant to bioenergy deployment

The following table summarises examples of projects supported using EAFRD funding within the 2007-2013 funding period. These are not set out here as examples of good practice per se, but the table is intended to demonstrate the breadth of project types that have historically been funded within RDPs relating to bioenergy across Member States.[82]

Project Title	Description	Relevance to Bioenergy	Member State
Improving sustainability of Slovak forest	Climate change, fires, pests and diseases are noted to be a threat to Slovakia's Volovec mountain's spruce forest. Project supported new seedlings of more diverse species to promote a healthier more resistant forest and new road development to support forest access for harvesting and to combat forest fire	Retention and management of forest resource, ensuring the long-term viability of the forest and production potential to support both biodiversity and supply of forest products and energy feedstocks	Slovakia
Biomasa	Purchasing of equipment, a mobile wood chipper and pellet facilities linked to wider revitalisation of an industrial site	Promotion of infrastructure for biomass use for energy	Slovenia
Briquette production at ECODOMANI	Establishment of a wood briquette production plant that utilises wood dust and energetic willow	Development of local supply sources	Romania
Biomassalland Cooperative biomass chain	Developing a supply chain for woodchips from primarily landscape residues, Analysis of regional logistics, an inventory of expected demand and supply of woodchips, establishment of a cooperative, establishment of coordinated supply management including woodchip drying, transportation onwards to local users.	Development of local biomass supply chains	Netherlands
Producing and packaging biofuel (pellet) from olive harvesting residues	Establishment of a biomass pellet production and packaging line in an olive farming region of Greece. Waste residues were utilised to produce the pellets. Approximately 20,000 tonnes of residues from oil harvest was identified as being destroyed or remaining unused.	Development of biomass energy streams from agricultural residues	Greece
Conservation of natural heritage – biodiversity and wood fuel	The project in the districts of Teltow-Flaming and Uckermark looked at the use of landscape maintenance residues from the management of a variety of non-agricultural land intended to protect habitats from succession of shrubs and preserve flora and fauna on grasslands, heaths and dunes.	Coordination of nature conversation management goals with biomass production	Germany
Upgrading of forest machinery to produce biomass	Purchase of a shredder and other new machinery to turn forest residues and logging waste into biomass fuel.	Production of biomass fuels	Czechia
Territorial supply plans for French forestry	French rural areas use a tool know as a territorial supply plan to develop and coordinate opportunities from woodland areas. This project co-financed the Lorraine region's plan. Data was collated on quality and quantity of wood stocks, options for harvesting, mechanisms for improving capacity.	Development of a wood supply plan linked in part to extraction for biomass for energy	France
Setting up a biogas plant	Installation of a biogas plant to deliver on farm electricity and generate additional farm income to diversify and stabilise farm income streams based on manure on farm and maize grown for silage	Biogas deployment	Czechia

[82] Data extracted from materials from the ENRD data base and detailed summary descriptions of RDP projects.

10 Policy Needs - Delivering Bioenergy Solutions that Better Protect EU Biodiversity

This analysis focuses on comparing the policies at EU level, and where relevant national or market based alternatives, to the risks identified related to specific pressures facing habitats and species protected under the Habitats and Birds Directives. As set out in the introduction to the methodological approach (section 1), this study involves first identifying risks, identifying the policies in place and then undertaking a gap analysis. Finally, the risks to protected habitats and species that remain, taking into account the policy framework, are presented. This is the purpose of this section. The subsequent analysis is organised into four sections focusing on limitations and challenges identified:

- implementing impact assessment tools to effectively mitigate risks associated with bioenergy feedstock production;
- mitigating potential impacts linked to semi natural habitat loss and land use change;
- mitigating potential impacts associated with pressure to intensify land management with a focus on forestry;
- facilitating better practice to secure sustainable supply chains; and
- ensuring policy coherence and clarity of understanding.

10.1 Implementing Impact Assessment Tools to Effectively Mitigate Risks Associated with Bioenergy Feedstock Production

This study considered the three models of environmental impact assessment that exist in EU law; i.e. under the SEA and EIA Directives and Appropriate Assessment under the Habitats Directive (when triggered in relation to Natura 2000 sites). All are noted as important instruments in terms of their potential ability to identify and strategically manage risks associated with bioenergy feedstock production. All have the ability, albeit at different scales, to identify and mitigate impacts. However, ***all are failing to be consistently triggered or effectively used by Member States in relation to bioenergy risk factors[83].***

SEA is a potentially powerful tool for assessing the integrated impacts of bioenergy at the planning stage and avoiding negative impacts. Cumulative impacts are of particular importance when considering the potential consequences of bioenergy use on biodiversity, SEA is a key tool for understanding them and a basis for decision making to mitigate both direct and downstream impacts. Cumulative impacts can arise from:

- Additive change - additive change to semi natural habitats linked to parallel demand for energy crops, afforestation and conventional crops;
- Demand multiplication - the multiple potential end uses of biomass feedstocks to electricity, heat and transport uses and as a resource for the wider bioeconomy; and
- Resource demand concentrated in a given area - the potential for multiple plants to be established in a given region or area drawing cumulatively on a given resource.

The first stage in a SEA is that national competent authorities must decide if it is required for a given plan or programme, this is based on the fulfilment of four enabling criteria set out in

[83] Based on studies and implementation reports for the European Commission and case studies completed for this study, full references in the main report

the Directive. However, the analysis has shown that opportunities to complete an effective analysis of impacts of bioenergy cumulative change are limited as often plans or programmes that offer a suitable basis are broad or high level or don't exist in a coordinated way. For example, in the bioenergy sphere National Renewable Energy Action Plans exist or forest management plans. For example, however, only a limited number of Member States considered that that all four criteria set in the SEA Directive were fulfilled in relation to their NREP and thus carried out SEA. Others did not consider that NECPs met the four criteria (in particular *setting the framework*) and thus did not apply the SEA Directive.

To effectively manage impacts associated with biomass for energy and other potential uses within the broader bioeconomy, Member States need to identify sourcing strategies at the national and regional level, assess the cumulative risks, where necessary mitigate these risks and adapt approaches to facilitate effective protection of habitats and species applying SEA principles. This assessment should be integrated by Member States into estimates of bioenergy current and future use, associated feedstock demand and sourcing in their forthcoming national energy and climate plans.

EIA rules on land use change were strengthened in the 2014 revision of the Directive. Projects that result in the use of uncultivated land or semi natural areas for intensive agricultural purposes (as set out in Annex II Directive) should be subject to an EIA. However, the approach to implementation was found to be inconsistent across the case studies, supporting conclusions in other studies. In light of the changes to EIA rules and to understand better the consequences of the different implementation strategies, ***a review of the application of EIA rules relating to land use change by Member States would now seem important. This could be followed by Commission guidance to define and support the adoption of best practices*** in the context of protecting against inappropriate land use change***. Separately it is considered helpful to provide support to Member States on the evidence to be used in EIA assessments relating to projects that might increase demands for biomass feedstock***; this was a source of uncertainty among Member State officials interviewed within the project case studies.

Appropriate Assessment, as defined under Article 6.3 of the Habitats Directive, requires scoping processes to identify if an assessment needs to be undertaken based on whether or not there is likely to be a significant impact on a Natura 2000 site's conservation objectives. Appropriate Assessment requires consideration of activities on site and downstream of the development that might impact on Natura sites including, for example, a wood storage facility or a new saw mill and modifications to silviculture regimes that might impact on forest management downstream. ***The Member State case studies suggest that Appropriate Assessment is not being used strategically to assess downstream impacts.*** To effectively take account of impacts associated with all bioenergy end uses a ***new approach to assessment of facilities requiring additional biomass feedstock inputs is needed i.e. to identify the catchments from which they will draw materials and the environmental risks associated, including whether this would have downstream impacts on Natura 2000 habitats or species.***

Box 10 - Policy Case Example - Germany: Facilitating multi-stakeholder dialogue to manage natural resources for biomass cultivation - Measures for coordinating biomass cultivation in the Wendland-Elbetal bioenergy region

The Wendland-Elbetal pilot bioenergy region facilitated interests among different stakeholders along the value chain through soft policy tools such as mapping of species and habitats of conservation interest, advice and communication with farmers and joint selection of objectives (bees, grassland birds). As one of 25 winning regions of a national competition initiated by the German Federal Ministry for Food, Agriculture and Consumer Protection, the study region used parts of its pilot funding between 2009 – 2015 to implement extensification measures in biomass cultivation through wild plant cultivation for biogas use as well as flower strips next to farming areas. Farmers and Biogas owners played a proactive role in implementing extensification measures and enjoyed positive publicity from awareness raising and educational activities. Awareness raising and educational activities played a decisive role as biogas plant owners enjoyed the positive press coverage and expert visits. The project covered costs for the seed mix and additional costs occurring from land management. Specific hurdles were the logistics of harvest and fermentation as well as the lower energy value of alternative crops. More so than financial aspect, concerns were raised and tackled with regard to integrating new technologies into the daily processes, such as new equipment and harvesting techniques.

10.2 Mitigating potential impacts linked to semi natural habitat loss and land use change

There are gaps in relation to the ability to protect semi natural habitats, but these relate primarily to implementation gaps as opposed to policy design. As noted ***SEA, EIA and Appropriate Assessment do offer a potential opportunity to mitigate these pressures; however, this depends on whether they are applied consistently i.e. competent authorities identifying the likely significant impacts on environment at an early stage of plan, programme or plan making, and integrate the outcomes into decision-making.***

The notification of loss of permanent grassland required under the greening provisions of the CAP has been identified as a potential tool to help competent authorities determine if there is a potential risk. Member State implementation of rules on permanent grassland loss differ significantly. The European Commission study evaluating the Greening measures under the CAP[84], noted that protection is more effective if linked to authorisation procedures. In turn, having an authorisation process could also facilitate the triggering of impact assessment procedures; however, this is not the norm. ***Without notification or permitting processes, competent authorities lack information to know that land use change is occurring and to trigger an assessment of impacts.***

The designation of Environmentally Sensitive Permanent Grassland (ESPG) under the CAP is a potentially strong mechanism for the protection of sensitive grassland from land use change. However, analysis for the European Commission evaluating Greening measures

[84] Details of the evaluation of the greening of direct payments can be found at https://ec.europa.eu/agriculture/evaluation/market-and-income-reports/greening-of-direct-payments_en

under the CAP identified that the majority of Member States designated ESPG only within Natura 2000 sites and have not made effective use of the tool to protect sensitive permanent grassland in the wider landscape. To date inconsistent application and a focus only on limited areas of Natura 2000 areas reduce protection afforded and this measures ability to support the delivery of sustainable biomass production in line with RED and REDII[85].

Box 11 – Policy Case Example – Utilising EU Rural Development Funding to Promote Hedgerow Management and Use of Residues for Bioenergy – Developing a certification scheme for hedgerow biomass (France) – for full case analysis see Annex I, Box H

France has about 600.000 km of hedgerows in agricultural areas. With an average of 93m^3 of wood per km, this represents about 65 million m^3 of wood in total (Pointereau, 2002). This hedge wood offers a potentially useful resource for both biomaterial and bioenergy production in particular in regions where forest resources are scarce. Despite hedgerows representing a potential resource (and performing wider ecosystem based environmental and cultural services), there has been a decline in retention rates since the seventies, with hedgerows perceived by some land managers as impeding cultivation or representing a burden (in terms of maintenance demands). Farmers commonly do not currently benefit from these hedge wood resources and certification schemes to recognise sustainable hedge wood management are not in place, potentially limiting access to market for wood materials. Moreover, there is currently a lack of emphasis on sustainable long-term management of the hedgerows and management often comes at a low profit rate or represents a cost to farmers.

The hedgerow certification scheme aims to address two sets of concerns: the need for the sustainable management of hedgerows; and the lack of valorisation of hedge wood for farmers. The scheme is meant to be participative and to lead to multi-actor governance. A digital cartography tool will ensure traceability of the hedge wood and assist land owners in the sustainable management of the hedgerows. The scheme is supported by private, national and European funding (EAFRD). It should lead to increased availability of sustainable biomass resources from agricultural land management for use in both the bioenergy and materials sectors.

10.3 Mitigating potential impacts associated with pressure to intensify land management with a focus on forestry

Woody biomass is anticipated to be a key resource moving beyond 2020 both for biofuels and solid biomass for heat and power[86]. The Recast of the Renewable Energy Directive (known as RED II) takes a step forward, setting out sustainability criteria that cover the full range of energy end uses for biomass (hence covering large-scale heating/cooling and electricity production from solid biomass and biogas, in addition to biofuels and bioliquids[87]) and

[85] Under RED and REDII agricultural biomass should not be sourced from land considered to be highly biodiverse grassland.

[86] As identified in parallel studies modelling solid biomass use and biofuels for energy including the RECEBIO and IRENA studies (see Annex report for further information)

[87] Sustainability criteria under the RED only cover biofuels and bioliquids used to meet renewable energy targets to 2020

applying dedicated sustainability criteria to forest biomass[88]. This is important as it recognises the potential impacts of bioenergy feedstock demand on the intensity of forest management and biomass extraction. ***To facilitate the harmonised implementation of the RED II by Member States, the European Commission is required to adopt operational guidance in the form of an implementing act to determine the evidence to be used when demonstrating compliance with the forest biomass criteria[89] by 31 January 2021.*** Within this implementing act, rules will be set out on the evidence to ensure that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands and peatlands, are protected and that harvesting is carried out considering maintenance of soil quality and biodiversity with the aim of minimising negative impacts, thus contributing to the aim of protecting habitats and species of EU interest.

The RED II criteria for forest biomass contain provisions requiring 'areas designated for nature protection to be protected'[90]. The Habitats and Birds Directives requires protection of species of EU interest wherever they occur i.e. coverage is broader than purely protected sites. Moreover, the mid term review of the Forest Strategy (2018) and guidance on Natura 2000 and Forests (EC, 2015) both suggest that connectivity of forest habitats is particularly important in securing the coherence of forest biodiversity and favourable conservation status of habitats and species within protected sites, as defined in the Habitats and Birds Directives. At present, there is a risk that the RED II criteria will only partially mitigate the potential risks posed to EU protected habitats and species, leaving a gap in biodiversity protection linked to bioenergy deployment.

The progress report on the implementation of the EU Forest Strategy[91] notes explicitly that ***further efforts are needed to enhance the role of forest management plans in achieving biodiversity targets and to support the provision of ecosystem services in the EU***. There is also extensive evidence that the majority of forest habitats in protected sites are in unfavourable condition[92]. This indicates that more effort is needed by Member States to promote forest biodiversity, at a time when bioenergy, other end uses, are likely to increase their demand. Annex I lists three examples of policies being put in place by Member States to address different aspects of the challenges experienced in terms of forestry regulation. This includes: the development of a consolidated text on forestry and the forest sector in Italy to support regional administration approaches to forest management; the development of Forest Intervention Zones in Portugal to promote cooperation among land owners and

[88] In relation to biodiversity the RED II sustainability criteria require that either the country in which forest biomass was harvested has national or sub-national laws applicable in the area of harvest as well as monitoring and enforcement systems (Article 29 6.1) in place or where this evidence is lacking this is completed at a forest sourcing level to ensure that: areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands and peatlands, are protected; and that harvesting is carried out considering maintenance of soil quality and biodiversity with the aim of minimising negative impacts. Additional criteria apply to protect against other risks.

[89] This guidance is specifically required under Article 29.8 of the REDII

[90] Article 29 6.1.iii and 6.2.iii state that ' that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands and peatlands, are protected';

[91] https://ec.europa.eu/agriculture/sites/agriculture/files/external-studies/2018-eu-forest-strategy/final-report_en.pdf.pdf - The EU Forest Strategy was adopted in 2013 and sets out 8 priorities for the forest sector until 2020

[92] The EEA monitors status of protected habitats, and in 2015 only 15% were considered in favourable condition.

managers; the development of environmental considerations for the extraction of forest residues in Sweden.

The RED II criteria require that the country in which forest biomass was harvested has national or sub-national laws applicable in the area of harvest as well as (related) monitoring and enforcement systems, i.e. there are not only paper requirements, but they are enforced***. Delivery of the REDII criteria on forest biomass offers an opportunity to avoid unsustainable forest management; hence indirectly support the implementation of the Habitats and Birds Directive.*** The upcoming European Commission implementing act on forest biomass should consider the evidence needed to ensure that relevant laws are not only in place on paper i.e. the Habitats and Birds Directive are transposed in national law but are supported by appropriate monitoring and enforcement mechanisms. Making the link to effectively enforced policies is particularly important in ensuring that application of the REDII criteria deliver their goal in terms of minimising the risk of using forest biomass derived from unsustainable production.

There is a lack of consistency in the application of sustainable forest management across both Member States and policies. There are often different tools and processes operating at the national or regional scale. For example, there is variation in national approaches to forest management planning including whether Natura 2000 management plans for forest habitats and species have been developed and implemented, and whether the latter have been integrated into or designed in collaboration with broader forest planning processes[93]. ***There is a need for better integration of the processes and goals that determine forest management, current fragmented approaches constrain the effective implementation of sustainable forest management; and hence the delivery of biodiversity protection and the RED II goals on sustainable biomass sourcing.***

Further investment is needed to support the development and delivery of sustainable forest management (Alliance Environnement and EFI, 2017). This includes developing best practices and dedicating further support for forest management within key policies such as future CAP strategic plans and support under ESIF. This should recognise the timescales needed to adapt forest cycles and ensure a budget for forest priorities is coherent with present and future needs. Bioenergy has the potential to support the valorisation of forest biomass, hence support reinvestment. An integrated approach to sustainable forest management to delivery biodiversity, social and economic functions, is needed.

The European Commission and Member States should consider whether a dedicated study looking at the achievement of sustainable forest management goals in the EU would help facilitate a more transparent discussion on this topic. Such an assessment would be key to understanding the policy and management baseline into which the REDII criteria can be integrated. At present it is challenging to find comparable, consistent and independent

[93] The Commission document 'Natura 2000 and Forests' (European Commission, 2015b) states that 'Natura 2000 management plans can be specifically designed for the site in question or integrated into other development plans, such as forest management plans, provided that the Natura 2000 conservation objectives are clearly included within such plans'

analysis on the implementation of forest management approaches used in Member States and their success in terms of best practice protection of forest habitats and species.

10.4 Facilitating Better Practice to Secure Sustainable Supply Chains

Implementation challenges are noted across all the policy spheres examined. The analysis of the Member State case studies points to a need for more effective coordination of actors in determining feedstock demand, sourcing and bottom up delivery of feedstocks for energy to effectively mitigate biodiversity impacts. The need to coordinate bottom up is noted particularly in the forest sector related to the delivery of sustainable forest management approaches that take account more fully of Natura 2000 sites, requirements for assessment under Article 6.3 of the Habitats Directive, species protection and the connectivity of protected sites.

Bottom up coordination to support sustainable feedstock supply chains will become more important in the future, *given an emerging demand for residues whether from agriculture* (including from crops or landscape management) or maximising opportunities from land management for nature conservation. ***The resource base used for bioenergy is anticipated to become more heterogeneous and similarly more challenging to regulate, necessitating a more effective approach to ensuring sustainable land use and management. Appropriate institutional and support measures need to be put in place to facilitate this, this might include guidance to determine when agricultural and forestry residues and wastes are considered to be sustainably extracted.***

Box 12 - Policy Case Study - Germany: The untapped regional potential of landscape management residues for biogas - Facilitators, contracts and subsidy criteria as part of the DVL MULLE project[94] - detailed material included in Annex I, Box A

In Germany, Biogas plants receive subsidies for using landscape residues, which have been defined as arising from landscape management or management that is undertaken primarily for nature conservation[95]. Landscape material differs from green cutting as it is directly targeted to manage landscapes in a way that it maintains or benefits habitats and species and thus to protect biodiversity and functionality of natural capital in the long term. Landscape management programs create added value for biogas plants and ensures extensive land use, decentralised supply chains and contributes to added regional value. Direct benefits of using landscaping material for energy production include the reduced competition for arable land and the securing of ecologically valuable areas without the use of fertilizer and pesticides. Several challenges however arise in the uptake of landscape residues by biogas plant owners, mostly with regard to the transport and suitability of the available landscape residues.

[94] The content of the cases study is largely sourced from an interview with the DVL

[95] defined by law in 2012 (Biomasseverordnung (BiomasseV), Anlage 3 Nr. 5): „Als Landschaftspflegematerial gelten alle Materialien, die bei Maßnahmen anfallen, die vorrangig und überwiegend den Zielen des Naturschutzes und der Landschaftspflege im Sinne des Bundesnaturschutzgesetzes dienen und nicht gezielt angebaut wurden. Damit wird Mais, Getreide und Raps ausdrücklich vom Landschaftspflegebonus ausgeschlossen."

The German umbrella organisation of landscape care organizations (DVL) as part of the MULLE project works to facilitate the use of residues from landscape management in biogas plants. Specifically, the DVL provides guidelines in a recently published manual, which points to current regulatory and implementation challenges and possible solutions. Furthermore, in several cases, municipal utilities have started attempts to act as a regional facilitator.

10.5 Ensuring Policy Coherence and Clarity of Understanding

The RED II text provides a reinforced sustainability framework for bioenergy production and use post 2020, with the view to minimise the risks of unsustainable raw material production, including biodiversity impacts. ***When transposing the RED II sustainability criteria (by 2021), it is important that they are also integrated into rules applicable to biomass use for energy in other EU polices including the EU Emissions Trading Scheme and the EU state aid guidelines.*** This is important given that these parallel instruments will also determine future bioenergy investments into the post 2020 period. This would ensure consistency, given rules on biofuels and bioliquids were already transposed, for example into monitoring and reporting guidelines under the EU ETS, during the implementation of RED.

Clear indicators and reliable data sources, which build towards effective monitoring and reporting, critically inform policy makers' ability to target action. This analysis has identified a lack of data and clear indicators to monitor use of feedstocks, and specifically linking feedstock use to land management impacts. This includes specifically a lack of information specifically on the interrelationship between intensity of forest management and how this relates the habitats and species of EU interest. This is important in terms of being able to understand the different approaches to policy making across Member States and the opportunities for sharing best practices and their limitations, particularly in relation to forest management. Moreover, the case studies identified that the lack of reliable data is impacting on assessment processes specifically in relation to the implementation of Article 6.3 of the Habitats Directive and EIA assessments. These gaps were noted in some Member States to be compounded by a lack of guidance on what parameters need to be reviewed and assessed to deliver best practice assessment of impacts.

To deliver sustainable bioenergy solutions, and the broader circular bioeconomy, it is necessary to understand the detailed sourcing of biomass and the land use and land management consequences. To some extent, the reporting by Member States under the Governance Regulation can provide data to this effect[96]. This can then inform decision making about impacts and interventions to avoid and limit them. ***More effort and support should be focused on linking information on sourcing of biomass to actual land condition and defining the parameters to monitor to achieve this. This should be designed alongside guidance on how to use this knowledge to support the more coordinated governance of biomass resources into the future.***

[96] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action

11 EMERGING POLICY MESSAGES

Taking into account existing policies to promote renewable energy to 2020 and 2030, and associated sustainability criteria for bioenergy, continued expansion in biomass demand from energy is anticipated. Over the period to 2030 demand is expected to evolve towards feedstocks from woody or lignocellulosic biomass for biofuels and solid biomass and use of agricultural residues and wastes for biogas. In this context there are two particular trends relevant to the habitats and species protected under the Habitats and Birds Directives:

- the potential ***cumulative land use change impact on semi natural habitats outside protected areas*** linked to an expanded areas of lignocellulosic energy crops (including short rotation coppice and active afforestation); and
- the ***intensification of existing forest management including the extraction of forest residues***.

The latter point is of particular importance, given that the majority Habitats Directive Annex I habitats in EU forests are currently considered to be in unfavourable conservation status.

The study highlights the important role that the Natura 2000 network has to play in the protection of EU protected habitats and species from the potential impacts of bioenergy feedstock production. This is because a very high proportion of the area of most types of Habitat Directive agricultural and forest habitat occur within the network, and, probably, a substantial proportion of most protected species. Thus, the proper and full implementation of the Habitats Directive's Natura 2000 site protection and management measures, in combination with other policy measures (e.g. CAP regulations and funding), should be sufficient to avoid many of the potential impacts. In this respect it is important to emphasise that bioenergy feedstock production within Natura sites should be compatible with the site conservation objectives for its respective habitats and species.

However, EU protected habitats and species also occur outside the Natura 2000 network to some extent, and may therefore be at risk of impacts from bioenergy production, particularly in forests, and in semi-natural habitats that may be targeted for afforestation or conversion to bioenergy crops. Other mitigation measures will therefore be needed to avoid and reduce impacts to acceptable levels in these areas.

The study has identified the following policy needs to further promote sustainable biomass use for energy and habitat and species protection in the EU. These needed were identified taking into account current policy heterogeneity and the ability of the EU and Member States to act. These should be addressed to enable biomass use for energy (and other end uses) that supports the conservation of protected habitats and species in the EU. They are to:

- Ensure that existing environmental assessments (EIA, SEA procedures as set out in their respective Directives and Appropriate Assessment, as foreseen by article 6.3 of the Habitats Directive) are implemented effectively and in a way that identifies and mitigates impacts associated with bioenergy feedstock production and use;
- Ensure that policies to protect against inappropriate land use change on agricultural land i.e. specifically loss of semi natural habitats are effectively implemented, taking into account the effective implementation of requirements under Article 6.2 of the Habitats Directive relating to the deterioration of habitats and disturbance of species.

This includes rules under the current CAP greening provisions and associated rules on impact assessment;
- Strengthen the implementation of sustainable forest management at EU and national level and the ability to consistently and effectively mitigate potential impacts associated with an increase in demand for woody biomass including emphasising the assessment of 'downstream' impacts of new facilities utilising woody material within environmental assessments, where applicable;
- Facilitate, support and enable 'better and best practice' to secure sustainable supply chains, emphasising bottom-up, coordinated action; and
- Strengthen policy coherence and the coverage and coherence of data sets (in particular the relationship between biomass demand and land use and land management change) to facilitate understanding and enable informed dialogue on risks and impacts on biodiversity.

It should be noted that the above needs are considered to be of importance, not only in terms of limiting potential impacts associated with bioenergy. There are also emerging policies that are seeking to promote the use of biomass in society beyond energy, including the 2018 Revision of the EU Bioeconomy Strategy (COM(2018)673)[97]; such initiatives may increase further demand for biomass and hence pressure on species and habitats. The policy needs identified here are also relevant to the broader context of delivering a sustainable bioeconomy.

The scope of the analysis conducted in this report focused on habitats and species protected by the Habitats and Birds Directives within the EU. Policy decisions in the EU related to biomass sourcing for energy will also have potentially significant impacts on biodiversity in third countries. While this was not in the scope of this analysis, it should be noted that studies modelling the future biomass demand for energy identify that a reduction in biomass sourced domestically within the EU, will not necessarily alter demand for bioenergy feedstocks. This then translates into additional import demand for biomass material from third countries. The solutions proposed for biodiversity protection within the EU, therefore, need to continue to provide a biomass resource from EU domestic supplies but in a way that more coherently and consistently considers and mitigates impacts on protected habitats and species. Such an approach will become increasingly important as the use of biomass becomes more diversified with the expansion of the EU (and global) bioeconomy.

[97] These policies are not analysed here, as they are not specifically driving bioenergy deployment, although bioenergy is indeed part of the bioeconomy.

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12 ANNEX I – EXAMPLES OF POLICY SOLUTIONS – MITIGATING POTENTIAL NEGATIVE IMPACTS ON PROTECTED HABITATS AND SPECIES AND PROMOTING SYNERGIES

Box A – Policy Case Example – Germany: The untapped regional potential of landscape management residues for biogas - Facilitators, contracts and subsidy criteria as part of the DVL MULLE project[98]

- The MULLE project in Germany promotes regional value chains of landscape residue use in biogas plants by disseminating knowledge on good practice examples and facilitating cooperation between stakeholders along the value chain
- Challenges relate to the uptake of materials by biogas plant owners depending on origin and composition as well as the inaccessible requirements of the current landscape residues subsidy scheme

Introduction: In Germany, biogas plants receive subsidies for using landscape residues, which have been defined as arising from landscape management or management that is undertaken primarily for nature conservation[99]. Landscape material differs from green cutting as it is directly targeted to manage landscapes in a way that it maintains or benefits habitats and species and thus to protect biodiversity and functionality of natural capital in the long term. Landscape management programs create added value for biogas plants and ensures extensive land use, decentralised supply chains and contributes to added regional value. Direct benefits of using landscaping material for energy production include the reduced competition for arable land and the securing of ecologically valuable areas without the use of fertilizer and pesticides.

Summary of the scheme and approach: The German umbrella organisation of landscape care organizations (DVL) as part of the MULLE project works to facilitate the use of residues from landscape management in biogas plants. Specifically, the DVL provides guidelines in a recently published manual, which points to current regulatory and implementation challenges and possible solutions. Furthermore, in several cases, municipal utilities have started attempts to act as a regional facilitator. The project MULLE is funded by the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), and channelled through the Agency for Renewable Resources e.V. (FNR), on the basis of a resolution of the German Parliament (Bundestag).[100]

According to the DVL, in an ideal case scenario, biogas plant owners take up landscape materials from farmers in their area based on a long-term financial agreement, such as the assumption of transport costs by the biogas plant owner. This is for example feasible with regard to a large meagre flat mowing meadow where the fermentability of the landscape residues barely differs compared to intensively used meadow grass.[101] These materials are interesting to biogas plant owners as shredders or cutter wagons can easily process them.

Several challenges however arise in the uptake of landscape residues by biogas plant owners, mostly with regard to the transport and suitability of the available landscape residues. The available materials are generated across many small and geographically dispersed small farm areas, which are not mowed necessarily at the same point in time. Moreover, landscape conservation material is heterogeneous, which may require additional efforts by the biogas

[98] The content of the cases study is largely sourced from an interview with the DVL

[99] defined by law in 2012 (Biomasseverordnung (BiomasseV), Anlage 3 Nr. 5): „Als Landschaftspflegematerial gelten alle Materialien, die bei Maßnahmen anfallen, die vorrangig und überwiegend den Zielen des Naturschutzes und der Landschaftspflege im Sinne des Bundesnaturschutzgesetzes dienen und nicht gezielt angebaut wurden. Damit wird Mais, Getreide und Raps ausdrücklich vom Landschaftspflegebonus ausgeschlossen."

[100] https://mulle.lpv.de/mulle.html

[101] Interview, DVL

plant owner to process the materials or are not at all compatible with the technology of the biogas plant.[102] This needs to be seen together with the fact that Germany currently hosts many large plants (e.g. average 500 kW performance in lower Saxony) (Fachzeitschrift für den Garten- und Landschaftsbau, 2015) that are aligned to homogeneous materials such as corn silage that is chopped between 0.5 and 1 cm.

Additional hurdles relate to the regulatory requirements surrounding the existing subsidy scheme. In 2009, the so-called "Landscape Care Bonus" (Landschaftspflegebonus) was introduced for the use of landscape conservation materials in biogas plants (as part of the Renewable Energy Sources Act (EEG)), in which the DVL was significantly involved. The bonus covers 2 cents per kilowatt-hour of electricity, decreasing by 1% annually and covers the entire electricity output of a plant. Even though the 2012 EEG revision lead to significant changes, the 2009 regulation with the landscape care bonus applies to all biogas plants which were put into operation before 2012 (around 7.175 of the 7.710 biogas plants in Germany). In the EEG 2009, the term "landscape care material" was originally quite broad, also including green cutting of communal land and biomass of arable crops if agri-environmental measures were carried out at the same time, both of which is now excluded. The requirement to receive the subsidy is a minimum 50% supply of landscape care material on an annual average which can rarely be met. With an average biogas plant size between 300 kW and 500 kW in Germany, large areas would be required to supply sufficient materials (Fachzeitschrift für den Garten- und Landschaftsbau, 2015).

Conclusion - In summary, several regulatory and implementation challenges occur in the uptake by biogas plant owners. This is due to the lower energy value, the additional costs of collecting and transporting, the necessary processing of residues and the specific requirements of the landscape residues subsidy scheme. Due to the mentioned challenges, landscape care materials currently only reach a share of 2% supply for biogas plants (Fachzeitschrift für den Garten- und Landschaftsbau, 2015). According to the DVL, landcare residual use must be subsidised in a more accessible way, as the current preconditions can rarely be met. An additional suggestion appears to be the use of green cut materials (e.g. from sports ground or grass strips next to streets) which can easily be fermented in a biogas plant and is available in large quantities. This is currently not legally possible as it is covered by the Biological Waste Ordinance (Bioabfallverordnung).

[102] Interview, DVL

Box B – Policy Case Example - Germany: Facilitating multi-stakeholder dialogue to manage natural resources for biomass cultivation - Measures for coordinating biomass cultivation in the Wendland-Elbetal bioenergy region

- The Wendland-Elbetal pilot bioenergy region facilitated interests among different stakeholders along the value chain through soft policy tools such as mapping of species and habitats of conservation interest, advice and communication with farmers and joint selection of objectives (bees, grassland birds).
- Farmers and Biogas owners played a proactive role in implementing extensification measures and enjoyed positive publicity from awareness raising and educational activities
- Whereas flower strips receive public funding in 15 German regional states, there is currently no economically viable, long-term perspective for planting wild plants for biogas use, especially since a crediting linked to greening under the CAP was rejected in 2014.

Introduction: Extensification of farming is the process of decreasing the use of capital and inputs (e.g. fertilisers, pesticides, machinery) relative to land area. As one of 25 winning regions of a national competition initiated by the German Federal Ministry for Food, Agriculture and Consumer Protection, the study region used parts of its pilot funding between 2009 – 2015 to implement extensification measures in biomass cultivation through wild plant cultivation for biogas use as well as flower strips next to farming areas. Flower strips are used commonly across Germany as they receive public funding through the CAP greening in almost all German regional states. Wild plants are currently without public funding, but pilot areas exist on 1000 hectares of land across Germany.[103] They offer high biodiversity benefits due to a lush, partially open vegetation over the growing season, providing shelter and food for field birds and other wildlife.

Summary of the scheme and approach: The projects in the field of bioenergy and nature conservation were realised by improving the cooperation of the various interest and network groups to reach regionally compatible, nature-friendly solutions for biomass cultivation. Extensification measures were implemented in the villages Quickborn and Zernien. In Zernien, for example, wild plant seed mixtures have been handed out for 6 areas of 1- 1.5 hectares as an alternative to maize and other grazers for biogas plants.[104] The seeds were developed specifically for the project by the state agency for horticulture and vineyards and was funded by the project.

Challenges occurred both in mediating the use of flower strips and wild plants. Specific hurdles were the logistics of harvest and fermentation as well as the lower energy value of alternative crops. More so than financial aspect, concerns were raised and tackled with regard to integrating new technologies into the daily processes, such as new equipment and harvesting techniques. Clear success factors in the cultivation measures of both plants was the trust building between environmental and agricultural interest stakeholders. This led to the fact that long-standing confrontations between ecologists and farmers were overcome. A concrete example of the cooperation between several actors was the joint position paper on biogas, which was signed by the German Biogas Association, the farmers' association of north-east Lower-Saxony and the AbL (via campesina member), which was presented at a press conference in August 2013 as a joint statement against land speculation and a call for small-scale farming support. For both cultivation methods, awareness raising and educational activities played a decisive role as biogas plant owners enjoyed the positive press coverage and expert visits. The project covered costs for the seed mix and additional costs occurring from land management. Whereas wild plants are economically not viable, flower strips

[103] https://www.bioenergie-wendland-elbetal.de/fileadmin/downloads/Abschlussberichte/Abschlussbericht_2012-2015.pdf

[104] Interview Bioenergy Region Wendland-Elbetal

become profitable through public funding, especially where the soil quality unfavourable and thus opportunity costs of other land use are low.[105]

Conclusion: Through the promotion of flower strips by the Lower Saxony Ministry of Agriculture and the CAP greening support as ecological compensation, continuation of this measure is given. The flower strips find enthusiastic supporters, both among biogas plant operators and farmers, as well as citizens.

For the time being, there is no economically viable, long-term perspective for planting wild plants, especially since a crediting in greening in 2014 was rejected. The fact that the wildflower areas are not eligible for greening led to some disappointment among the farmers involved. The use of wild plants resulted in yield losses compared to corn at 40-50% and could not be compensated in the project. Nevertheless, in the Wendland-Elbetal region, alternative energy crops have existed for some years, although not economically viable, because there are regular visits from guests and experts.[106] The energy region's project manager has initiated discussions with the agriculture ministry of lower-Saxony for a payment scheme to compensate financial loss in the use of wildflowers for biogas plants. A hurdle in the experience of the bioenergy region is the current legal framework favouring large-scale land investment. Based on experience in the study region, foreign investors that do not own the acres were rarely interested in its sustainability and willing to participate in extensification measures. The political framework thus needs to favour small, regional landowners who have a vested interested in the ecological and cultural preservation of their home region. The experience in the study region showed that the described trust building measures are most feasible among regional value chain actors.

[105] Interview Bioenergy Region Wendland-Elbetal

[106] https://www.bioenergie-wendland-elbetal.de/fileadmin/downloads/Abschlussberichte/Abschlussbericht_2012-2015.pdf

Box C – Policy Case Example – Italy: Consolidated Text on Forestry and the Forest Sector

- The Consolidated Text on Forestry and the Forest Sector is aimed at rationalising forest governance, while ensuring economic, social and environmental maintenance of forest resources in Italy;
- The Consolidated Text allows Italian regional administrations to produce forest management plans. These may be designed to include requirements in relation to the need for ecological corridors and maintenance of forest ecosystem services and associated habitats and species;
- One of the main challenges highlighted in the relation to the Consolidated Text is the voluntary basis upon which regions may determine the requirements included in forest management plans and limited monitoring systems in place to secure sustainable forest management.

Introduction: Over the last decades, total forest land has increased by almost 30% in Italy, moving from 8.7 million hectares in 1985 to just above 11 million ha in 2015. The rate of increase is approximately 54,000 ha per year and is mainly driven by natural regeneration and afforestation. However, only 15.7% of Italian forests (equivalent to 1.3 million ha) is subject to a multi-year management plan, seen as a key component to ensure the provision of ecosystem services while providing commercial products from forests (i.e. timber for industrial use and firewood) (Rete Rurale Nazionale, 2017).

According to the latest statistics, extraction of wood material from forests, including for energy production, is limited by a variety of factors in Italy. These include the high management costs, orographic limits, small size of private properties which account for 67% of total forest area, and wood cutting extending on average within one hectare (Rete Rurale Nazionale, 2017). Despite the limiting factors, impacts driven by the use of woody biomass resources for energy (among others) can affect both local and long-distance species. Specific local impacts are those on birds (e.g. woodpecker, sparrow-hawk and goshawk) and insects (e.g. *Rosalia alpina*). There are also impacts related to species that have a wide range and need ecological connection and ecological corridors to live. Examples include bears and wolfs, especially in regions such as Abruzzo, Marche and Molise, but also over Laga Mountains and the Gran Sasso (interview with WWF Italy).

Consolidated Text on Forestry and the Forest Sector: The Consolidated Text came into force in May 2018. While the Italian Government had not previously intervened in regulating forestry and forest use to such extent, the Consolidated Text aims to create a streamlined governance approach to forestry and a dedicated Directorate General on forestry within the Ministry of Agricultural, Food and Forestry Policies[107].

In order to ensure the protection of forest areas and their maintenance, Article 6 of the Consolidated Text leaves open to the regional administrations the possibility to produce forest management plans. These could be targeted, among other priorities, to the maintenance, preservation and valorisation of silvo-pastoral resources. Italian regional administrations are also encouraged to support voluntary certification of forest management and traceability of forest products within the wider bioeconomy sector. Nonetheless, such decisions remain on a voluntary basis[108].

Despite the potential role of the Consolidated Text to maintain forest ecosystems, it was noted that the main aim of the text is to increase active forest management in light of the increasing difficulties in getting access to funding through regional Rural Development Programmes (RDPs (interview with WWF Italy). This is particularly relevant to the creation of multi-functional value chains, even beyond the energy use of forest resources. Limited use of RDP

[107] Testo unico in materia di foreste e filiere forestali (2018) Decreto Legislative 3 April 2018. http://www.pdc.minambiente.it/sites/default/files/news/dl_n34_del_03_04_2018.pdf

[108] Testo unico in materia di foreste e filiere forestali (2018) Decreto Legislative 3 April 2018. http://www.pdc.minambiente.it/sites/default/files/news/dl_n34_del_03_04_2018.pdf

forestry funding in Italy is linked to the fact that it is difficult to manage forests due to a very complex normative framework, which differ from one regional administration to another (interview with WWF Italy).

Monitoring of forest resource use and resilience is to be ensured by the creation of an annual report on the status of forest resources, as well as by enhanced coordination among regions and local authorities. Such light approach to monitoring forest management is considered to be a limiting factor in the implementation of the provisions of the Consolidated Text, as it would not allow for in-depth monitoring of the impacts of woody biomass extraction on habitats and species (interview with WWF Italy). Concerns have also been raised by academics and a wide number of associations and non-governmental organisations in relation to the absence of dedicated forest zoning beyond the establishment of Natura 2000 areas. The Text, on the other hand, foresees a system distinguishing between protected, productive and degraded forests to be restored. This may lead to extend productive activities, including the extraction of forest biomass for energy production, in any forest area beyond those protected by EU legislation (Piovesan, 2018).

Conclusions: The Consolidated Text on Forestry and the Forest Sector is aimed at rationalising forest governance, while ensuring economic, social and environmental maintenance of forest resources in Italy. The Text may be instrumental to consolidate the use of forest management resources across multiple governance levels in Italy. However, one of the main concerns in relation to its implementation are the potential adverse impacts due to the absence of zoning approaches distinguishing forest areas that can be used for productive management and extraction of material, from those that require protection for cultural and environmental reasons. In addition, WWF Italy stressed that it is of primary importance that the Italian regional administrations design their (voluntary) forest management plans by making clear reference to the need for maintenance of ecological networks and ecosystem services in forestry. WWF Italy also highlighted that it is necessary that forest management in Natura 2000 sites or other areas of conservation interest in Italy is reoriented towards biodiversity conservation, ecological upgrading and conservation of ecosystem services (interview with WWF Italy).

Box D – Policy Case Example - Portugal and the Forest Intervention Zone (ZIF) model

- The Forest Intervention Zone (ZIF) model was created to tackle forest management fragmentation in Portugal and promote cooperation among land owners and managers as a response to the increase of fire occurrences in the country.
- Forest operations under the ZIF model can result in the exploitation of wood resources, where the involvement of Forest Owners Associations is seen as essential for its implementation.
- Some progress has been made in landowner identification and participation under this model and it is expected that it will lead to an increase in the sustainable exploitation of forests.
- The main challenges faced by the ZIF model are that low market prices for forest products do not promote forest association and cooperation between owners, the scarcity of public funds, as well as the long process involved in approving the mandatory Forest Management Plan by the forest authorities.

Introduction: The Portuguese paper industry includes several biomass power plants and is the major player in the biomass market in Portugal. Currently, the available biomass allows a national grid of 12 dedicated thermal power plants and nine cogeneration plants (Cardoso, Silva and Eusébio, 2018). According to owners of these plants, the scarcity of biomass is presently a major concern. Recently the wood pellet industry has started to supply the market for domestic and industrial biomass heating. ZIF Forest Management Plans activities such as wood material clearance and management can be responsible for the removal of a considerable amount of flammable vegetation and harvest residue. However, there is high variability in the composition of this residual biomass, which sometimes exhibits a low energy density due to its reduced calorific value (Nunes, Matias and Catalão, 2017). In fact, it is normally assessed if the residual biomass has enough energy value to justify the environmental and economic costs of transportation to biomass power plants since this biomass can instead be used to prevent local erosion (Bento

and Vieira, 2013). The Portuguese government is aware of this problem and recently the Energy Secretary of State announced that for now the government will promote only smaller power plants, mainly thermal, and dispersed in the Portuguese territory near biomass sources[109].

The Forest Intervention Zone (ZIF) model: The Forest Intervention Zone (ZIF) model is a governmental approach established in 2005 (DL 15/2001[110]), with subsequent legislative amendments, and integrated into the Nation Plan Against Forest Fires - Plano Nacional de Defesa da Floresta Contra Incêndios (PNDFCI) (RCM 65/2006[111]). There are more than 200 ZIFs representing approximately 10% of the territory[112]. The main objective is to promote cooperation between smallholders to create a joint intervention for forest management and protection[113], mainly as a response to the devastating effect of the increased occurrence of fires in the country. The unique forestry ownership pattern in Portugal was identified as one of the main causes, with an estimated 80% of Portugal's forests not being managed and 97% of the forest areas being privately owned (Novais and Canadas, 2010). In total, 20% of eucalyptus stands in Portugal are managed by pulp companies, while the remaining area is managed by individual landowners[114].

The Institute for Nature Conservation and Forests (ICNF) is in charge of approving ZIF plans, as well as monitoring and support activities. Each ZIF has a Forest Management Plan (PGF), where forestry operations are defined according to the guidelines of the Regional Plan for Forestry Management and Planning (PROF), and a Specific Plan to Forest Protection (PEIF). Besides fire prevention procedures, this model includes integrated strategies on the promotion of sustainable management, conservation of biodiversity, protection of soils and water resources. ZIFs are managed by a single entity, usually a Forest Owners Association that administers the ZIF territory and is responsible for defining the plans. Each ZIF must include at least a contiguous area of 500 ha, a minimum of 25 landowners and 50 forest plots (DL 67/2017[115]). In addition, recent legislation (P 19/2019[116]) defines the minimum areas that should not be divided in order to promote competitive and feasible forest management. However, this has been criticized as being too ambitious since minimum areas are relatively large, which encourage owners to sell the land at low prices[117].

Conclusion: The ZIF model is expected to increase forest productivity allowing for better management and land use that can lead to increasing the exploitation of wood products. It could also allow for the implementation of integrated and global measures to prevent fire and restore burnt areas, protecting and recovering degraded soils with high erosion risk in case of fires and support biodiversity. The main challenges that the ZIF model faces are: a) the fact that the reduced price of the economic value of forest products does not promote forest association and cooperation amongst owners, b) the scarcity of public funds to manage forests in some areas (e.g. small areas, areas with high number of landowners per area, less accessible areas and less favoured rural areas), and c) the long process involved in approving the mandatory PGF by ICNF. The capacity and location of the power plants in the country is a major factor for the success of the ZIF model to utilize biomass in a way that is compatible with biodiversity protection.

[109] https://www.publico.pt/2019/02/06/economia/entrevista/concessoes-electricas-nao-vao-mina-ouro-municipios-1860842#gs.e13Q08qt

[110] Decreto-Lei n.º 15/2009, de 14 de Janeiro. https://dre.pt/application/conteudo/397362

[111] Resolução do Conselho de Ministros n.º 65/2006, de 26 de Maio. https://dre.pt/application/conteudo/286680

[112] http://www2.icnf.pt/portal/florestas/gf/zif/resource/doc/zif/zif-cartogr-nac/ZIF-constituidas-31dez2018.pdf

[113] http://www2.icnf.pt/portal/florestas/gf/zif

[114] http://www.in-tree.org/uploads/images/conference/presentations/Silva.pdf

[115] Decreto-Lei n.º 67/2017 de 12 de Junho. https://dre.pt/application/file/a/107507283

[116] Portaria n.º 19/2019 de 15 de Janeiro. https://dre.pt/application/conteudo/117821817

[117] https://www.vidarural.pt/producao/cna-diz-que-areas-minimas-indivisas-sao-muito-altas/

Box E – Policy Case Example – Sweden: Minimum and recommended environmental considerations in the extraction of forest residues

- Minimum and recommended environmental considerations in the extraction of forest residues were created as a response to increasing extraction rates in Sweden. These considerations were based on evidence-based research on the environmental implications of extracting residues from Swedish forests undertaken by or on behalf of the Energy Agency;
- According to the Forestry Agency the instruments have been assessed at regular intervals and through formal evaluations. As a result, across the country the level of compliance with existing rules is high; however, it is understood that a certain portion of private owner do not take into account the environmental considerations set when managing their forests;
- One of the limitations of the voluntary considerations in the extraction of forest residues is that currently monitoring is done on the basis of random sampling of fellings. This may limit comprehensive assessments of the impacts occurring on the ground. In addition, enforcement mechanisms are primarily used in the cases where damage to the wider forest landscape is caused by machinery operations.

Introduction: In Sweden, approximately 84% of forested land is classified as productive forested land (Swedish University of Agricultural Sciences (SLU), 2018), which is a considerable source of biomass material for the production of building material, paper, cardboard and hygiene products , among other uses. Rest pieces and matter from the forest industry, used and disposed wood-based products and rest biomass from the harvested sites are currently used to produce bioenergy. Altogether, 138 TWh of bioenergy was used in Sweden 2017, whereof 80-85% from its own forest. Swedish forest resources deliver approximately 5 % of the world's consumption of forest industrial products (written input from the Energy Agency).

According to the Swedish forest management reference levels submitted to the UNFCCC, use of forest residues and stumps for biomass energy is projected to increase, from 8.6 TWh in 2010 to 13.3 TWh in 2020 (Brack, Hewitt and Marchand, 2018). However, according to the Energy Agency, stumps are currently hardly used (>5% of clearcuttings) today based on latest evidence (Swedish Energy Agency, 2019).

The unregulated intensification of residual forest biomass extraction may be responsible for impacts on environmental forest resources, including on forest habitats and species. More specifically, intensive extraction of coarse woody debris from forests would result in the loss of habitat for deadwood specialists and have knock-on impacts. Stump removal causes soil disturbance. Between 2008 and 2015, the Swedish University of Agricultural Sciences has developed a programme to monitor the harvesting of stumps from forests. In order to prevent such impacts, the Forestry Act 1979[118], alongside the Ordinance for Forestry Management 1993[119], set out rules on the extraction of forest biomass residues on the basis of evidence-based research on the environmental implications of such operations (written input by the Energy Agency, including references from (de Jong et al, 2014) and (Egnell, Ahlgren and Berndes, 2018).

Environmental considerations in forest management: In order to ensure environmental considerations are taken into account when managing a forest, Section 30 of the Forest Act required a delegated authority (hereafter the Forest Agency) to issue a set of environmental requirements for forest management and an enforcement mechanism attached to it. To this end, the Forest Agency has defined a minimum (compulsory) and a recommended

[118] *Skogsvårdslag (1979:429) [Forestry Act]*. http://www.notisum.se/rnp/sls/lag/19790429.HTM

[119] Skogsvårdsförordning (1993:1096) [Ordinance for Forestry Management]. http://www.notisum.se/rnp/sls/lag/19931096.htm

level of environmental considerations. The recommendations can be seen as the Forest Agency's interpretations of the more generally formulated parts of the Forest Act. As such, they could be interpreted at as compulsory, although they have never been tried in a law case. Environmental considerations are to be taken into account in all forestry operations.

Minimum environmental considerations are set in relation to the net income of felling. In practice, landowners must inform the Forest Agency prior to extracting forestry residues, and any extraction is allowed to begin at the earliest six weeks after the Agency has been informed. If branches and treetops (herewith called 'GROT') is extracted, 20% of the material must be left in the forest. If deciduous GROT is extracted during late spring (when red listed species might have laid their eggs in the piles of GROT), the top layer of the pile must be removed and left in the forest (interview with a Forest Agency representative). Furthermore, methods to extract forestry residues should not significantly damage biodiversity or the soil's long-term nutrient balance and acid / base status. Ash recycling is the recommended way to accomplish this. Other general requirements include that valuable trees are to be spared in harvesting, measures taken to create dead wood habitats and soil damage is to be avoided, in particular close to water courses (Forest Industry, 2018).

According to the Forest Agency, there is a high level of compliance of existing rules, as the forestry industry is particularly concerned about reputational damage (interview with a Forest Agency Representative). On the other hand, one of the limitations of this framework is that the decision on whether to extract GROT for bioenergy production is rarely determined by its potential impact on protected habitats or species in Sweden. The need to protect certain species and habitats play a significant role in the decision whether to log in the first place; linked to the creation of protected areas, species action plans, the requirements for environmental considerations under the Forestry Act and the conservation requirements in forestry certification schemes (interview with a Forest Agency representative). Linked to the increased use of subcontractors in Swedish forestry, it is increasingly difficult and costly for forestry companies to provide the appropriate training to those performing forestry work (interview with a Forest Agency representative).

Conclusions: The environmental considerations issued in compliance with Section 30 of the Forest Act are aimed to set specific minimum requirements in relation to extraction rates of forest residues in Sweden. According to the Forestry Agency the instruments have been assessed at regular intervals and through formal evaluations, which show high levels of compliance. However, one of the limitations of the voluntary requirements set out is that currently monitoring is done on the basis of random sampling of fellings, which may limit comprehensive assessments of the impacts occurring on the ground. In addition, enforcement mechanisms are primarily used in the cases where damage to the wider forest landscape is caused by machinery operations.

The Swedish Society for Nature Conservation (SSNC) stressed the need to establish clear legal provisions about what is the lowest acceptable level of environmental considerations in forestry and thereby introduce the opportunity to impose more severe sanctions in case of non-compliance (SSNC, 2014). In order for the set of environmental considerations to be effective in contributing to manage forest resources in a way that is compatible with the protection of habitats and species, compliance and enforcement mechanisms needs to be properly implemented.

Box F – Policy Case Example - Slovakia: Criteria for the sustainable use of biomass in the regions of Slovakia for programs co-funded by the European Structural and Investment Funds (ESIF) in 2014 – 2020

- In 2017, Slovakia adopted pilot sustainability criteria for the use of forest and non-forest biomass resources in all projects and programs co-funded by the European Structural and Investment Funds (ESIF) over 2014 – 2020.

This was a response to the 2014 European Commission's (EC) Communication on the sustainability of forest biomass use, and had the objective of unlocking untapped forest and non-forest resources within the country;

- According to the Ministry of Environment, which is in charge of monitoring the fulfilment of such criteria, the sustainability framework requires fulfilment of three criteria in relation to the origin of the biomass feedstocks used; their transportation and distribution; and the efficiency of wood biomass energy conversion;
- According to the Forest Protection Movement, one of the main limitations of such a framework appears to be the overestimation of forest and non-forest biomass resources and the underestimation of wood biomass consumption. Such considerations would increase the possibility of adverse impacts on forest and non-forest resources and their associated habitats and species.

Introduction: In Slovakia, just above 40% of overall total area is covered by forests, which is a considerable source of biomass for the production of bioenergy and other material uses. The annual biomass potential for energy production in the period between 2020 to 2035 is considered to be in the range of 2.77 to 2.9 million tons, while the potential of non-forest biomass extracted is projected to be between 0.7 at 0.75 million tons.

Despite its increased use, the Ministry of the Environment highlighted that biomass extraction has not yet achieved its full potential (Ministry of Environment of the Slovak Republic, 2016). This was partly attributed to the lack of a harmonised approach at EU level on the sustainable use of biomass for the production of electricity, heating and cooling.120 Following the European Commission's (EC) recommendations outlined in its 2014 Communication (European Commission, 2014), Slovakia developed a set of sustainability criteria for projects and programs funded through the European Structural and Investment Fund (ESIF) in the 2014 – 2020 as the EU's main investment policy tool. Biomass extraction and use from forests and non-forest land is conditional upon demonstration of its sustainability.

A set of criteria for the sustainability of forest and non-forest biomass resources: In order to ensure that forest and non-forest biomass is extracted and used according to sustainability parameters in Slovakia, as well as to track the origin of biomass feedstocks and their overall potential, a set of criteria have to be complied with by all projects and programs co-funded by ESIF over 2014 – 2020. These includes projects or programs enacted in the context of the Operational Program Quality of the Environment (OP KŽP) and the Rural Development Program of the Slovak Republic (RDP) (Ministry of Environment of the Slovak Republic, 2016).

The criteria for the use of forest[121] and non-forest biomass[122] resources include the following requirements:

I. Proof of origin of the forest feedstocks;
II. Transportation and distribution;
III. Efficiency of woody biomass energy conversion.

With regard to the protection of forest habitats and species, the most relevant criteria are (i) on the proof of origin of the feedstocks, and (ii) on the parameter set for transportation and distribution. According to criterion (i), no extraction of wood biomass from high biodiverse land areas should be permitted. Confirmation of the supply of raw materials from areas that do not fall within the limits of the criterion needs to be provided by end suppliers and,

[120] At the time of designing the sustainability framework in Slovakia, in 2017, there was no EU legislative framework in place on the sustainability of solid biomass use for the production of electricity, heating and cooling.

[121] In the case of forest land, the biomass must come from planned deliberate and accidental harvesting of timber, which is governed by the conditions laid down in the applicable management plans for forests, by the provisions of Act no. 326/2005 Coll. on Forests and Act no. 543/2002 Coll. on Nature and Landscape Protection as amended by later transcripts.

[122] The origin of in the case of non-forest is evidenced by the submission of a valid permit of the nature protection authorities under the Act no. 543/2002 Coll. on Nature and Landscape Protection as amended.

only exceptionally, by forest owners. Criterion (ii) establishes requirements in relation to the distance between the place of origin of feedstocks extracted and the place of consumption. These are defined as follow: Maximum transport distance in case of construction of new energy installations for the use of fuel wood biomass is 50 km, while maximum transport distance in case of renovation or upgrading of existing energy equipment to be used for energy production from woody biomass is 100 km (Ministry of Environment of the Slovak Republic, 2016).

The Ministry of Environment (MoE), which manages the Operational Programme on Quality of Environment, is the body monitoring the fulfilment of the criteria for each project or program co-funded through ESIF (Zamkovský, 2018). Failure to meet one of the criteria is considered a reason for refusal of the project at stake, or to return financial support received in the inception phase (Ministry of Environment of the Slovak Republic, 2016).

The criteria are currently implemented as a pilot approach over the 2014-2020 period, on the basis of which they will be confirmed or discontinued in the following programming period. Official information on the effectiveness of such approach will only be available at the end of the programming period. However, the Forest Protection Movement have criticised the use of such criteria for managing forest and non-forest biomass resources. The Movement highlighted that the untapped stock of wood biomass available for extraction and use is overestimated, while current consumption of such wood is artificially underestimated. According to the Forest Protection Movement the criteria overestimate the annual amount of available wood biomass in Slovakia to the level of 4.5 million tons per year. According to other available sources the overestimation is equal to approximately 2.2 million tons. While official estimates provided by the Ministry of the Environment refers to 2.4 million tons of wood consumed every year, a number of independent sources report up to 4 million tons used up, which is approximately 40% higher (Forest Protection Movement, 2018).

Conclusions: The pilot criteria approved by Slovakia in 2017 to encourage and track the origin of forest and non-forest biomass use have been operational only for more than one year. Effectiveness of such approach is therefore to be further assessed upon completion of the 2014 – 2020 programming period. According to the Ministry, such sustainability framework aims to encourage the use of untapped wood biomass resources and, at the same time, ensure that their use is done according to sustainability considerations. However, one of the main limitations appear to be the overestimation of forest and non-forest biomass resources available for use and the underestimation of its consumption across the country, as claimed by the Forest Protection Movement. The latter would increase the likeliness of adverse impacts on habitats and species associated with forest and non-forest land.

Box G – Policy Case Example - Forest Stewardship Schemes: Examining FSC and PEFC Implementation in Europe

- FSC and PEFC schemes are both widely used in the EU and coverage continues to increase, however, there are significant large differences in coverage between Member States
- Standards include biodiversity conservation, national schemes are assessed for compliance with the standards and benchmarks set but differ at national level to take into account national conditions and priorities
- Challenges remain in defining efficient standards and effectively monitoring their implementation at the local level

Introduction: The Forest Stewardship Council (FSC) and the Programme for Endorsement of Forest Certification (PEFC) are by far the most used forest certification schemes in Europe and in the world (Stupak et al, 2007). They both aim at promoting responsible management of forests but differ in the way in which they deliver this. Both PEFC and FSC are global forest certification systems with globally applicable principles and criteria. PEFC, originally developed in Europe in 1999 in response to the specific requirements of small and family forest owners. The FSC - created in 1993 - initially addressing tropical forests (PEFC UK, 2018) - dominates in the EU. Both schemes are voluntary, market-driven mechanisms, and can be applied simultaneously. FSC has a set of global generic standards defining a well-managed forest, while PEFC focuses on sustainably managed forest and defined International Sustainability Benchmarks (van Kuijk, Putz and Zagt, 2009), setting principles and criteria. These standards

have then to be adapted to national conditions; each country develops its own sets of national FSC / PEFC standards[123], which have to be approved by the organisation. PEFC standards are reviewed every 5 years. Both schemes include numerous requirements referring to biodiversity and habitat conservation.

EU coverage: In 2015, 54.9% of the EU's total forest and other woodlands area was certified under PEFC and/or FSC. As mentioned, PEFC dominates, with 36% of total EU forest area covered in 2015, compared to 19% for FSC. Overall, there was a 9% increase in certified forest cover in the EU between 2015 and 2018, with some countries driving the change and other lagging behind. It is important to note however that double-certification remains a challenge for collecting accurate data on total coverage.

Biodiversity protection in Swedish and Portuguese FSC/PEFC standards: Standards are adapted to local conditions and national policies, and our analysis shows significant differences in requirements between Sweden and Portugal.

Standards highlighted in the case studies included High Conservation Values (HCV), considered as a highly efficient tool in Portugal to raise awareness on the importance of nature conservation[124]. Management of HCV, classified in six categories such as 'species diversity' and 'ecosystems and habitats' (principle 9), is defined in international FSC standards. Identification of HCV Forests is adapted to national policies; while the Swedish FSC refers to 'forest areas of national interest' and the Forest Act, the Portuguese FSC refers to a National HCV Framework. In Sweden, FSC certified companies cannot cut or sell timber from the HCVF identified by the Forest Agency[125]. HCV are also particularly significant in electing forest for certification in Portugal, with 70% of all FSC certifications given to land containing HCV in 2017[126]. PEFC does not use the term HCV but does apply specific safeguards to protect ecologically important forest areas, defined as Forest areas

a. Containing protected, rare, sensitive or representative forest ecosystems;
b. Containing significant concentrations of endemic species and habitats of threatened species, as defined in recognised reference lists;
c. Containing endangered or protected genetic in situ resources;
d. Contributing to globally, regionally and nationally significant large landscapes with natural distribution and abundance of naturally occurring species

Another tool highlighted in both cases studies was 'set aside areas', which identification as a requirement under international PEFC criteria (a similar clause is applied under FSC). While this is incorporated in the Swedish PEFC standards as a requirement to set aside at least 5% of the productive forest land for conservation purposes, no quantitative indicator is given in the Portuguese PEFC standards; nevertheless, set-aside areas are mentioned multiple times in various indicators.

Implementation: Monitoring is coordinated by national FSC / PEFC agencies, while compliance is assessed by independent certification bodies. In Portugal, oversight is carried out by AGFR **(**Associação para uma Gestão Florestal Responsável) through FSC Portugal, normally every year; however longer time cycles are adopted when justifiable**[127]**. In Sweden, FSC certified forestry companies are subject to a full evaluation audit every five years and an annual surveillance audit annually. Results of the full evaluation reports are made publicly available (similarly to PEFC rules)**.** Regular national forest inventories also contribute to follow-up, as well as the Swedish bird inventory and the various inventories conducted by Artdatabanken (Swedish Species Information Center)[128].

In general, the data collected shows that application of forest certification schemes in the EU is increasing and already at a relatively high level of adoption. Certification schemes for eco-labelling were identified as a major driver for social and environmental change in Swedish forestry[129]. Analysis in Sweden concluded that forest certification created added value to

[123] The process applied for this national adaption process differs between the schemes. PEFC requires national standards to be developed in multi-stakeholder, consensus driven processes.

[124] Portugal Case Study

[125] Sweden Case Study

[126] Portugal Case Study

[127] Portugal Case Study

[128] Sweden Case Study

[129] Sweden Case Study

forests by introducing additional measures to increase habitat diversity. However, the level and efficiency of FSC contribution to biodiversity conservation depends on the standards, and how they are implemented locally (Birdlife International, FSC and The Alliance for Beverage Cartons and the Environment, 2013).

Challenges remain on both these aspects. The efficiency of FSC and PEFC standards was questioned by interviewees, in particular regarding set-aside areas. The minimum standard of 5% is considered too low by several studies, and FSC and PEFC certified forest owners in Sweden were found to set aside only slightly more land than non-certified owners (Norden, Coria and Villalobos, 2016). Moreover, studies argue that connectivity of set-aside areas should be considered as important as size (Elbakidzel et al, 2011). Regarding standards implementation, in Portugal, FSC certifications are found to be more effective in the case of large land estates than for smallholdings – yet it is the latter which constitute most of the certified area. This is due to a lack of financial incentives to conserve biodiversity coupled to high costs and lack of necessary knowledge to assess presence of relevant species and habitats. In general, data regarding species diversity is difficult to collect (Elbakidzel et al, 2011). Finally, in Sweden, despite certifications, the Forest Agency estimates that about 200 ha of key biotopes – which certified companies have agreed not to fell – are clear-cut each year, with no signs of decline over time[130].

Opportunities to overcome these challenges are starting to be identified. In Portugal for instance, additional efforts are made to increase engagement of small landowners in the FSC scheme[131]. Specifically, PEFC was set up to address the question and needs of smallholder, therefore perhaps a more targeted use of schemes may support improvements. In general, there is a need to adapt the implementation of the schemes to the specific needs of individual owners – including information activities and support in carrying out forest sustainability assessments.

Conclusions: Forest Certification Schemes such as FSC and PEFC are being increasingly used in Europe, with PEFC dominating. Coverage differs widely among Member States however, and international standards are adapted to each Member State to fit national policies and specificities. This results in different standards in each country, with specific challenges. Biodiversity conservation is included in all international and national standards in both schemes, which are considered in general rather effective on that matter. Challenges remain however, in particular regarding the effectiveness of standards content and the feasibility of monitoring.

Box H – Policy Case Example – Utilising EU Rural Development Funding to Promote Hedgerow Management and Use of Residues for Bioenergy – Developing a certification scheme for hedgerow biomass (France)

- The hedgerow certification scheme aims to address two sets of concerns: the need for the sustainable management of hedgerows; and the lack of valorisation of hedge wood for farmers.
- The scheme is meant to be participative and to lead to multi-actor governance. A digital cartography tool will ensure traceability of the hedge wood and assist landowners in the sustainable management of the hedgerows.
- The scheme is supported by private, national and European funding (EAFRD). It should lead to increased availability of sustainable biomass resources from agricultural land management for use in both the bioenergy and materials sectors

Introduction: France has about 600.000 km of hedgerows in agricultural areas. With an average of 93m^3 of wood per km, this represents about 65 million m^3 of wood in total (Pointereau, 2002). This hedge wood offers a potentially useful resource for both biomaterial and bioenergy production in particular in regions where forest resources are scarce. Despite hedgerows representing a potential resource (and performing wider ecosystem based environmental and cultural services), there has been a decline in retention rates since the seventies, with hedgerows

[130] Sweden Case Study

[131] Portugal Case Study

perceived by some land managers as impeding cultivation or representing a burden (in terms of maintenance demands). Farmers commonly do not currently benefit from these hedge wood resources and certification schemes to recognise sustainable hedge wood management are not in place, potentially limiting access to market for wood materials. Moreover, at present hedges and trees on farm are often cut by private contractors, there is currently a lack of emphasis on sustainable long-term management of the hedgerows and management often comes at a low profit rate or represents a cost to farmers.

Certification label for the sustainable management of hedgerows: The hedgerow certification scheme aims to address two sets of concerns: the lack of valorisation of hedge wood for farmers; and the need for the sustainable management of hedgerows to ensure material can be extracted without risking overexploitation of this resource and retaining wider ecosystem value. As such, the hedgerow certification scheme aims at fostering a renewed interest in hedgerows through their economic valorisation while ensuring their long-term sustainability in the landscape through adequate management practices. The main utilisation of the wood is for bioenergy purposes. Other options such as timber are currently limited but could be developed.

The scheme is intended to be national but was initiated in three regions: Normandy, Britany and Pays de la Loire. It originated as a contribution to the national agroforestry development plan which was launched in December 2015 by the French Ministry of Agriculture. The project will be officially introduced to the Ministries of Ecology and Agriculture in June 2019 and the first certified wood is expected in December 2019. In terms of financing, it is supported at European level through the European Agricultural Fund for Rural Development (EAFRD). The total budget is of €439,631 (of which €178,459 from EAFRD, €130,610 from national/regional funding, €85,818 from private funding and €44,743 from other sources) (ENRD, 2019).

Actors: The scheme operates with the help of different organisations and groups, each working at different levels. Four "pilot" organisations operate at regional level (one from Normandy, two from Britany and one from Pays de la Loire). Their role is to identify and bring together interested stakeholders and farmers willing to participate in the project. They play a key role as they make the link between farmers and further operators along the chain, which are thus also part of the project. For 2019-2020, the expectations are to work with about 300 farmers. By 2024, this number should rise to 3,500 farmers, around 60 supporting technicians and 35 traders. The coordination of the project at national level is ensured by the French agroforestry organisation Afac-agroforesteries, which liaises with the pilot organisations and with national-level institutions and stakeholders[132].

Participative scheme: The setting up of the scheme is to be participative and to lead to multi-actor governance. A decentralised management system and self-control mechanism (audits will be performed by peers) will allow producers and consumers to co-manage the scheme. Two distinct certification schemes are put in place: one for producers/farmers and one for traders. This is important as no farmer will fully benefit from hedge wood as a potential income source if others in the supply chain are not guaranteed an adequate resale price (ENRD, 2019).

Traceability: A digital cartography traceability tool will allow retailers and consumers to trace the origin of the wood throughout the entire chain. It will allow to geolocate the specific origin of the hedge wood and verify the sustainability of its management practices. Furthermore, it will also serve for farmers on the ground to establish sustainable management plans; it will provide assistance in terms of the necessary interventions to support hedgerow management and serve as a monitoring system[133].

Outcomes: The aims and expected outcomes of the scheme are to promote the sustainable management of hedgerows through guidelines and a document of good practices while simultaneously providing improved access

[132] https://afac-agroforesteries.fr/les-acteurs-du-projet/
[133] https://afac-agroforesteries.fr/cadre-outils-label/

to market and ensuring transparency and traceability of materials produced. On the one hand, it is hoped improved management, linked to improved valorisation, will result in increased hedgerow retention and positive outcomes for biodiversity and reduced risk of erosion. On the other hand, it will lead to a potential economic opportunity for farmers/land managers and increased availability of sustainable biomass resources from agricultural land management for use in both the bioenergy and materials sectors. By 2024, it is expected that 175,000 tonnes of wood will be certified.

13 Annex II - Case Study Analysis – A review of relevant national policies and measures in place to mitigate impacts of bioenergy developments on habitats and species under the Birds and Habitats Directives in 6 Member States

Germany, Estonia, Italy, Portugal, Slovakia and Sweden were selected in consultation with the European Commission for investigation. This was intended to represent a range of national situations and potential challenges associated with bioenergy feedstock generation.

The case study analysis included both desk-based research and expert interviews with a range of stakeholders. The interviewees included national forest, environmental or energy authorities, environmental organisations and independent experts, depending on the specific circumstances at national level. Industry representatives were contacted but, in most cases, declined to be interviewed.

In order to provide a comprehensive picture of policy developments and geographical coverage across the EU, the following criteria were used to select the cases studies:

- Specific bioenergy developments observed or potentially significant impacts on BHD habitats and species;
- A range of EU and national policies applicable to a diverse range of bioenergy developments;
- Potential for transferability to other EU Member States;
- Overlap with the MS selected for detailed analysis in Task 1 of the study, so as to discuss bioenergy developments in light of the wider renewable energy context;
- Sufficient level of information available for the study review.

Each case study focused on two categories of policy instrument:

- National approaches implementing requirements stemming from EU policies relevant to land use change and agriculture / forestry;
- Nationally-initiated policies relevant to limit the consequences of land use change and / or agriculture/forestry land intensification.

This Annex contains a summary of each of the 6 case study findings.

13.1 Case study: Germany

13.1.1 Country context

Germany covers an area of 357,000 km², of which the majority (48%) is forest land followed by arable land (25%) and grassland (28%). In Germany, 92 habitat types are listed in Annex I and 281 native plant and animal species - in Annexes II, IV and V of the Habitats Directive. As for the native plant and animal species, 138 are listed in Annex II, 134 – in Annex IV, and 103 - in Annex V. (NB some species are listed in several annexes at the same time). Nearly 100 bird species of Annex I of the Birds Directive occur in Germany.

Germany is the leading EU producer of biogas, biodiesel and bioethanol, and leads for production of heat from biomass (mainly from wood residues and waste) (AEBIOM, 2017). Arable crop feedstocks for bioenergy occupy between 14% and 21% of the agricultural area in Germany (Gehrlein et al, 2017), and there was a notable increase in maize cultivation due to biogas subsidies between 2009 and 2013 (FNR, 2018). The land use change due to bioenergy crop cultivation is very regionally focused, mainly in the intensive dairy farming regions. Since 2013, however, the increase in maize area for biogas has slowed.

Wood production has doubled since 1990, and a quarter of harvested wood from primary forest sources (roundwood and residues) is used for energy (PwC et al, 2017). Current wood extraction for energy does not seem to be negatively affecting forest biodiversity at present (Ewald et al, 2017). Although forests in Germany are still insufficiently structurally rich in diversity of native tree species, tree ages, open spaces and deadwood to achieve favourable conservation status (BfN and BMUB, 2014), the situation has improved over the last decade in terms of structural diversity, proportion of deciduous native trees, dead wood levels and old trees (BMEL, 2013).

13.1.2 Assessment of impacts of bioenergy on habitats and species

Germany reported hay meadows, bats, European Hamster, amphibians, and some other freshwater species as being under pressure from biofuel or bioenergy production in the period 2007 to 2012[134]. There is evidence that the demand for crop feedstocks for bioenergy, principally the demand from biogas plants, has driven Annex I grassland losses from Natura 2000 sites, particularly hay meadows, between 2004 and 2008-9 (Dieterich and Kannenwischer, 2012) and (NABU, 2014). The protected arable weed *Notothylas orbicularis* is under pressure from intensification of cereal cropping with a second autumn crop, partly driven by biogas demand (Drehwald, 2012), and conversion of arable fallow to maize cultivation for biogas was reported as one of the main causes of continued population declines of Corncrake (*Crex crex*) and Montagu's Harrier (*Circus pygargus*) in a Natura 2000 site (Joest, 2013). Maize monoculture has had significant adverse effects on the hamster populations in Hessen in the decade to 2010 (Albert, Reiners and Encarnação, 2011).

[134] Federal Ministry of the Environment (2017) Report by Germany under the Habitats Directive for the reporting period 2007-2012.

13.1.3 Policy review: opportunities and challenges

Germany has subsidised bioenergy since the year 2000, but the bioenergy feedstock mix has shifted due to a series of significant policy changes in the main energy laws (Renewable Energy Law and Renewable Energy Heat Law) and subsidiary regulations. The bonus subsidy for the use of renewable natural resources (NaWaRo bonus) strongly incentivised the construction of small and medium sized biogas plants until 2012 and, while not specifically supporting maize as the feedstock, this was the primary input. Since the removal of this subsidy, growth in new plants using maize as main feedstock has slowed considerably (Statista, 2017). The existing plants originally funded under the scheme retain their NaWaRo subsidy to use maize and other crops throughout their payment guarantee period (set out in the subsidy regime) of 20 years.

A bonus subsidy for the use of residues from nature conservation management (Landschaftspflegebonus) was introduced in 2009. It has, however, only truly been used for residues from nature conservation since 2012, when a legal definition ruled out its use for maize or other arable feedstocks. The shift in subsidies since 2013 away from crop-based feedstocks and towards manure /slurry and landscape residues has resulted in a sharp decrease in the construction of new biogas plants and a change in feedstocks being used by the new plants. Most new plants are now small plants using at least 80% manure as feedstock, and some existing plants have increased their intake of landscape residues and decreased maize use (Statista, 2017). Biofuel production grew until 2010 but has stagnated since, and currently the available production capacity is greater than the actual fuel produced (Statista, 2017). Biofuel plants are increasingly making use of imported feedstocks and decreasing use of domestic feedstocks (Statista, 2017).

Other recent policy changes that have contributed to mitigating negative impacts include the revision of **permanent grassland protection regulations** at the federal state level to make conversion subject to Environmental Impact Assessment (EIA). This was linked to the greening rules for permanent grassland in the Common Agricultural Policy (CAP) reform in 2013. Germany exceeded the 5% limit for permanent grassland loss under the CAP rules for the 2007 to 2013 period and was therefore obliged to implement stricter rules to protect permanent grassland area. In contrast, the environmentally sensitive grassland protection (part of greening) only covers permanent grassland within SACs/SCIs, not SPAs, and does not provide any additional protection for grassland outside Natura 2000 sites (Alliance Environnement and Thünen-Institut, 2017).

Water pollution problems had been noted, associated with the inappropriate application of biogas digestate on arable fields (in particular maize). These have been addressed by the change in the Fertiliser Ordinance (BMJV, 2017). Since January 2018, the total field limit of 170 N/ha per year includes biogas digestate and is combined with the ban on autumn applications (except a few crops). This is expected to reduce water pollution problems caused by excessive nutrient inputs, particularly in autumn.

Mitigation opportunities under the **Environmental Impact Assessment Act** (EIA and SEA) are small as the regulation only applies to large biogas and biofuel plants, whereas most new

plants are small (75 kW) and therefore exempt. 'Good practice' agricultural and forestry activities and associated constructions are also exempt from EIA and SEA. This means that any current agricultural activities that do not contravene the German cross-compliance regulations under the CAP and other general regulatory restrictions on agriculture do not trigger an EIA.

13.1.4 Policy instruments for further exploration

The bonus subsidy for the use of landscape residues provided by the Renewable Energy Law (EEG) is an increasingly important economic incentive to increase the use of these feedstocks for biogas. A number of initiatives are promoting and creating networks for supplying landscape residues from nature conservation to biogas plants for facilitating the use of landscape residues in biogas plants (and ensuring that this contributes to nature conservation at the same time). However, in future the EEG subsidies will be assigned through annual quotas which are likely to progressively reduce capacity (Statista, 2017).

The new fertilisation limits in the Fertiliser Ordinance may also start to drive change in the uses of the digestate from biogas plants, incentivising alternative uses and decreasing applications to arable soils (BMJV, 2017).

Some protected areas are developing strategies and policy tools (particularly protected landscape areas) to steer and restrict bioenergy production within their areas, but there is scope for much more proactive management by protected areas. There is also evidence that, although grassland protection from arable conversion has improved, there are still illegal conversions in Natura 2000 areas and loss of Annex I grassland through intensification of management, which EIA and appropriate assessment (Habitats Directive Article 6(3)) are failing to address (Alliance Environnement and Thünen-Institut, 2017).

13.2 Case study: Estonia

13.2.1 Country context

Out of a total land area of 45,228 km^2, around 50% of Estonia's territory is classified as forest, alongside agricultural land (22.2%) – of which arable land is 14.9%, permanent pasture 7.2% and permanent crops 0.1% - and other land uses (25.7%). Estonia hosts a wide range of protected habitat types. These include forests, rocky habitats, bogs, mires & fens, grasslands, sclerophyllous scrub, heath & scrub, freshwater habitats, dunes habitats and coastal habitats[135]. Estonia has 51 Annex II, 58 Annex IV and 23 Annex V BHD species. It has 253 bird species present, out of which 9 are globally threatened[136]. Overall, Estonia is home to 12% of Europe's threatened species[137].

Most of Estonia's final renewable energy consumption is produced from solid biomass. The main bioenergy feedstock produced in Estonia is wood pellets, being the EU's 4th biggest wood pellet producer with over 1 million tons of pellets produced domestically every year. Virtually little or no production of crops for transport biofuels takes place in Estonia (BirdLife and T&E, 2016).

13.2.2 Assessment of impacts of bioenergy on habitats and species

As there is little or no growing of crops for transport biofuels, impacts from bioenergy demand are likely to be limited to the extraction of forest biomass. Overall Estonia harvests about 11-12 million cubic meters (mcm) of wood annually to be used for several end uses including bioenergy. A note of warning from experts points out that this volume may be unsustainable (interview with Estonia Fund for Nature) and that Estonia lost 205,000 hectares of tree cover between 2001 and 2015 (Global Forest Watch, 2019). The Nature Conservation Commission of the Estonian Academy of Sciences claimed that 'today's forest management as a whole is unsustainable in its present form, does not guarantee biodiversity conservation, takes little account of ecosystem services and therefore needs to change' (Nature Conservation Commission of the Estonian Academy of Sciences, 2018). However, this statement is not expressively related to the extraction of forest resources to be used exclusively for bioenergy, whereas it applies to a wider suite of end uses.

13.2.3 Policy reviews: opportunities and challenges

Currently there is no legislation in Estonia that is specifically aimed at mitigating the impacts of bioenergy on BHD habitats and species. The two most relevant pieces of legislation aimed to support this purpose are the Nature Conservation Act and the Forest Act, as well as the Forestry Development Plan contained in the latter.

[135] Government of Estonia (2012) National Summary for Article 17 – Estonia.

[136] Government of Estonia (2012) National Summary for Article 17 – Estonia.

[137] IUCN (2013) Estonia's biodiversity at risk. IUCN factsheet. https://cmsdata.iucn.org/downloads/estonia_s_biodiversity_at_risk_fact_sheet_may_2013.pdf

Based on the interviews undertaken with national authorities, the two Acts appear to offer relatively good protection to BHD habitat and species within protected areas. However, no evidence was provided for this. Other stakeholders differ in their assessment of the effectiveness of these pieces of legislation outside of protected areas. The lack of wildlife corridors between protected areas and the lack of safeguards from overexploitation of forests outside protected areas are issues that might require further legislative action in the future (interview with the Estonian Environmental Board). The Estonian Fund for Nature reckons that several forest species are in decline and habitat types are in an unfavourable state, i.e. that are directly suffering from forest harvesting that is partly associated with the bioenergy policy (interview with the Estonian Fund for Nature).

Article 6(3) of the Habitats Directive was implemented in Estonia through the provisions set out by the Environmental Impact Assessment and Environmental Management System Act and the Nature Conservation Act. The Act sets up the mechanism according to which the Natura 2000 network is established in Estonia, as well as the permit procedures and requirements for appropriate assessments of actions and activities within and beyond Natura 2000 sites. The designation of protected areas, on the basis of the Nature Conservation Act, is the primary instrument contributing to achieving the objectives of the EU Nature Directives. According to the Environmental Impact Assessment and Environmental Management System Act no separate procedure other than EIA or SEA is foreseen in national laws for cases where the project or activity should be subject to appropriate assessment within Natura 2000 sites.

However, due to the burden (mainly costs and time) related to the EIA procedures, legislation had led to a practice where quite often the appropriate assessment is terminated at the stage of screening, i.e. the appropriate assessment is not fully carried out. This is often done based on rather vague justifications which mostly relate to the distance of the Natura 2000 site from the location of planned activity rather than scientific and substantive analysis of impacts of the project and how it may affect habitats/species that are protected in the sites. Sometimes, the screening decisions also conclude, that if certain (mitigating) measures are taken, significant effects on Natura 2000 sites can most likely be avoided[138].[139] In summary, although the EIA screening is at least carried out for all of the projects that have generally wider-scale environmental impacts, many activities that may have lower overall impacts but at the same time 'significant' impacts on Natura 2000 sites' conservation objectives (such as forest notification, i.e. permits to cut forests), are not subject to appropriate assessment that would correspond to the requirements established in EU legislation. There is also no need for management plans for privately-owned forests, therefore logging may be carried out without an appropriate assessment. This can apply to forest resources, either primary forest wood or residual material, extracted for producing bioenergy. In 2017, the Environmental Inspectorate

[138] Evidence gathered by Estonian Environmental Law Centre under a Nature Action Plan support contract to DG Environment

[139] Factoring in possible mitigation measures already at the stage of screening for appropriate assessments is in direct contradiction with the EC guidance on the issue (Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (2001)) as well as the latest CJEU case law (ruling in case C-323/17, pp 35-40)

registered 277 forest related complaints and after supervision activities 39 violations were found. There were a total of 605 forest control inspections and misdemeanour proceedings were started 64 times (Environmental Inspectorate, 2018). According to interviewees from national authorities, however, the Nature Conservation Act is helping to minimise the exploitation of protected areas and species from economic activities including from bioenergy demand.

The **Forest Act** aims to ensure the protection and sustainable management of the forest as an ecosystem, it is relevant here given that forest is the main ecosystem being impacted by bioenergy sourcing in Estonia. Under the Act a forestry development plan must be prepared for every ten years, which sets limits on the volume of wood that can be harvested. The current plan does not include specific rules applicable to the rate of extraction of wood or residues for bioenergy specifically, although this may allow coverage of a broad set of extractive activities. In addition, a Forest Survey is carried out; this is intended to gather data on the condition of forest and the volume of growing stock, support advice to forest owners and support the planning of long-term forest management activities. With regard to the effectiveness of the Forest Act in mitigating impacts of bioenergy on BHD habitats and species, interviewees have mixed views. According to the national authorities, the Act is well implemented and enforced. On the other hand, the Estonian Fund for Nature suggested that several forest species are in decline and habitat types in an unfavourable state. It is claimed that these habitats are directly suffering from forest harvesting, which is partly associated with the bioenergy policy. It was reported that harvesting negatively affecting the forest is made possible by loose logging regulations and poor accuracy in the planning of their protection. However, no empirical evidence was provided for this view.

13.2.4 Emerging policy developments

According to the interviewed government agency, there are currently no further policy instruments or support mechanisms with relevance to mitigating bioenergy impacts on BHD habitats and species that are in draft form or in the process of being approved in Estonia. Currently the government does not foresee a revision of the Forest Act or the Nature Conservation Act. However, the forthcoming National Forestry Strategy Plan is currently in its early stages of preparation in Estonia and will be ready in 2020. The government agency points out that it could include additional measures aimed at mitigating bioenergy impacts on BHD habitats and species, if the outcome of stakeholder consultation shows that this is required (interview with the Estonian Environmental Board). Finally, the sustainability requirements of the EU Renewable Energy Directive recast (REDII) still need to be implemented into Estonian law. They could offer support in mitigating impacts on BHD habitats and species driven by logging for the production of bioenergy.

13.3 Case study: Italy

13.3.1 Country context

Italy covers an area of 301,338 km^2, of which major land uses include forest land (33%), agricultural land (25%) and grassland (21.7%). Within the Natura 2000 network, Italy hosts 1997 SCI sites, 335 SCI/SPA sites and 1674 SAC sites.

Bioenergy production is well established in Italy. It accounts for 8.5% out of the total share of renewable energy in gross energy consumption in 2016. Bioenergy supplied the highest renewable energy share (8 Mtoe) in the heating and cooling sector and contributed to a sizable extent (1.66 Mtoe) to the electricity sector in 2017. Equally, biofuels were the largest renewable energy source (76% - 1.06 Mtoe) in the transport sector in 2017, and the use of biogas on farm is increasing (Benedetti, 2018).

13.3.2 Assessment of impacts of bioenergy on habitats and species

The main impacts driven by the bioenergy sector in Italy appear to be related to the extraction of biomass from forests and the cultivation of dedicated crops for energy, with the consequent impoverishment of soil organic matter and wider impacts on habitats for local and long-distance species (Ciccarese, Cascio and Casciona, 2006). An interview noted the removal of branches and foliage from forests for bioenergy production in the country may have impacts on soil carbon content and nutrients. The latter may drive indirect impacts on birds (e.g. woodpeckers, sparrow-hawk and goshawk), insects (e.g. *Rosalia alpina*), and species that have a wide range and need ecological corridors to live, including bears and wolves (interview with WWF Italy).

The use of agricultural crops, especially maize and wheat, for the production of biofuels may have impacts on local species affected by the use of pesticides, such as the spadefoot toad (*Pelobates fuscus insubricus*) (ISPRA, 2015). In addition, the production of biogas is associated with low quality of the aquatic ecosystem on farm. Fast-growing plants, such as willow, could have an impact on the water reservoirs within soil or nearby forest habitats, due to the high water demand. The use of alien plants, such as eucalyptus, may pose twofold risks. On the one hand, they offer limited shelter to native fauna, while on the other, they may contribute to deteriorating underground water reservoirs due to substantial water demand. According to the report by ISPRA, however, the contribution of energy crops to national energy demand is still modest, although increasing, in Italy in recent years (Bianco et al, 2014).

13.3.3 Policy reviews: opportunities and challenges

Italy has a number of policy instruments in place that may contribute to address impacts of bioenergy developments on BHD species and habitats. The most relevant ones include the implementation of Article 6(3) of the Habitats Directive through Regulation n.357 and the rationalisation of forest management through the adoption of a Consolidated Text on Forestry and Forestry Sectors.

Article 6(3) of the Habitats Directive has been implemented in Italy through provisions set out by Presidential Decree n. 357 on the Regulation implementing Directive 92/43/EEC on the

conservation of natural habitats and of wild flora and fauna. Article 3 of the Regulation set up the mechanism according to which the Natura 2000 network is established in Italy, as well as the permit procedures and requirements for appropriate assessments of actions and activities within and beyond Natura 2000 sites. The designation of protected areas, on the basis of the Regulation, is the primary instrument contributing to achieving the objectives of the EU Nature Directives. However, according to a number of interviewees and further evidence[140], mitigation or compensation measures enclosed in the Regulation transposing the Habitats Directive are not sufficiently implemented, nor appropriately monitored, in Italy. In 2011, Italy has also been confronted with case law by the European Court of Justice for failure of proper implementation of conservation measures for wild bird based on the Birds Directive (European Commission, 2011). One interviewee considered that Italy still lacks proper implementation of the provisions enclosed in the Birds and Habitats Directives, with potential negative impacts on BHD habitats and species driven by bioenergy. The interviewee claimed that monitoring activities seldom take place in the case of plans or projects undertaken within Natura 2000 sites, nor is monitoring of the impacts occurred undertaken after mitigation actions have been put in place (interview with WWF Italy).

The **Consolidated Text on Forestry and Forestry Sectors** entered into force in May 2018 and aims to establish a legal framework, rationalise governance and regional competence in relation to forest management in Italy. It aims to contribute to streamlining forest management across the country, which is highly parcelled out. Article 7 of the Consolidated Text sets out the requirements related to forest management, especially the set-up of forest management plans. According to Article 7(4) of the Consolidated Text, forest management needs to be coherent with the requirements in relation to the conservation of habitats and species, including within the Natura 2000 network. Municipalities are not required to ask for prior consent to private forest owners in case they want to undertake a management project in public areas (including the use of wood for energy production) where private forest land is enclosed. Given the Consolidated Text has recently been approved, evidence on the effectiveness of the instrument to support the conservation of habitats and species within the BHD are yet to be assessed.

13.3.4 Emerging policy instruments

The 2018 Consolidated Text on Forestry and Forestry Sectors is a recently adopted measure, as mentioned above. Therefore, the degree of effectiveness needs to be further investigated. The Text makes reference to the maintenance of ecological networks and conservation of ecosystem services in the definition of forest management plans. Interviewees highlighted that there is a need to further specify what 'maintenance of ecological networks and ecosystem services' requires in practice. The National Forest Strategy, which is due to follow the publication of the Consolidated Text, may provide more specific indication in relation to the safeguards linked to the protection of relevant habitats and species.

[140] Evidence gathered by Communita Ambiente under a Nature Action Plan support contract to DG Environment

13.4 Case study: Portugal

13.4.1 Country context

Portugal extends over an area of 92,212 km^2 and is characterised by a range of land cover types. 35% of the country is covered by forest land, 32% by bushes and pasture land and approximately 24% by agricultural land. Of the habitat types listed under Annex I of the Habitats Directive, 99 are present in Portugal, 16 of which are of EU priority. Portugal has 201 species listed on Annex II of the Habitats Directive, 31 of which are of EU priority. A total of 175 species are listed on Annex IV and nine species on Annex V.

The level of agriculture and forest management linked to bioenergy production is currently moderate in Portugal, though projected to intensify in the future (Eurostat, 2016). Overall, 24.2% of final energy consumption comes from renewable energy sources, of which 12.4% is constituted by solid biomass, liquid biofuels and biogas (Eurostat, 2018b). The main feedstocks and technologies used in the country for bioenergy production are combustion of domestic forest residues and wood pellets, and biodiesel production based on feedstocks imported from Brazil and Argentina, such as soya. These are mainly used for, respectively, electricity production in co-generation plants and fuels for transport (DNFF, 2010).

13.4.2 Assessment of impacts of bioenergy on habitats and species

The most important habitats in Portugal include coastal, dune and freshwater habitats, heath and scrub, sclerophyllous scrubs, grasslands, rocky habitats and forests. The habitats that could suffer particularly from bioenergy production are the *Quercus spp forest*, *Salix alba* and *Populus alba galleries*, as well as alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*. Moreover, in the areas where bioenergy is highly developed, other habitats could also be impacted including Dehesas hosting evergreen *Quercus spp.* (the so-called Montado habitat) (Proença et al, 2010).

Bioenergy developments appear to have a range of impacts on habitats and species in Portugal. As reported by a study, the extraction of biomass contributes to reducing refuge, breeding and feeding areas for various species, such as *saproxylic* beetles, birds and bats, and fragmenting the habitat required for some fauna species, such as ungulates and carnivores. Also to be noted is the destruction and disturbance of shelters, particularly severe in critical periods such as breeding and hibernation for birds and bats. Afforestation by tree species can also be a pressure for flora species (e.g. *Anarrhinum longipedicelatum*, *Centaurea vicentina*) and natural habitats, especially when involving land use change driven by bioenergy production. Studies show that the relationship between forest species and plants living in oak patches that is considered their habitat is stronger than the same relationships between forest species in plantations in Portugal (Proença et al, 2010).

13.4.3 Policy reviews: opportunities and challenges

Portugal has several instruments in place that may serve to mitigate the impacts of bioenergy production on habitats and species protected by the Birds and Habitats Directives (BHD).

Notably, the transposition of Article 6(3) of the Habitats Directive into national legislation, the Forest Stewardship Council (FSC) Certification scheme, the establishment of Forest Intervention Zones (ZIF), and Action 2.3.3.3 of the 2014 – 2020 Portuguese Rural Development Programme.

The transposition of **Article 6(3) of the Habitats Directive** into national legislation by Royal Decree n. 140/99 offers opportunities to mitigate impacts of bioenergy developments on habitats and species in Portugal. An assessment of the potential impact on habitats and species in Natura2000 sites is required to be carried out for any plan or project likely to have significant impacts. This requirement applies also to plans or projects that involve timber production and processing facilities (e.g. pulp and pellets) for commercial purposes and the use of wood residues for the production of energy in co-generation plants, although it is not explicitly referred to in the transposition Decree.

The conservation of habitats such as *Quercus spp* forest, *Salix alba* and *Populus alba galleries*, as well as alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, and their associated species, could be impacted by wood exploitation of native tree species used for the production of bioenergy. However, the effectiveness of the measures in mitigating impacts on habitats and species could not be assessed given limitations in the literature and access to lead officials responsible for the dossier.

The **FSC Certification scheme** (along with similar instruments such as the Program for Endorsement of Forest Certification (PEFC)) was considered by interviewees to be making an important contribution towards increasing the area subject to sustainable forest management in Portugal outside the Natura2000 network. The voluntary certification scheme issued throughout the country; it currently covers around 14% of the total forested area in Portugal. Interviewees noted that within FSC the concept of High Conservation Value (HCV) areas is of particular relevance (interview with WWF Portugal).

Certification is only granted to forest areas in which the presence or likely presence of rare and threatened species and their habitats, within or adjacent forest management units, is assessed as positive. The effectiveness of such scheme in mitigating the effects of bioenergy activities on species and habitats protected under the BHD in Portugal is generally considered adequate. However, the certification scheme appears to be more effective in the case of large land estates compared to small holdings, corresponding to the largest share of certified areas. This is primarily due to the relatively high costs involved. Additional efforts are being made to increase engagement in this scheme (interview with WWF Portugal).

The creation of **Forest Intervention Zones (ZIFs)** in Portugal has emerged as a means to create forest management plans at a larger scale. The main objective of this instrument is to decrease the occurrence of fires, which are often linked to the spread of fast growing exotic species such as Eucalyptus (*Eucalyptus spp*). In fact, around 20% of Portuguese forests are part of ZIFs (ICNF, undated). This is a particularly relevant instrument in the case of Portugal, as owners of small holdings are not required to produce specific forest management plans and can apply for additional economic support to plant native tree species such as Cork Oak (*Quercus suber*) (interview with WWF Portugal).

However, the effectiveness of this instrument is generally reported as insufficient to significantly reduce the occurrence of fires and protect habitats and species. The main cause reported is that data are not updated regularly, which hampers the efficiency of land use planning and tree planting. In addition, uptake has been relatively low, with some land owners not sufficiently motivated or incentivised to participate in ZIFs (interview with WWF Portugal).

Action 2.3.3.3 of the 2014 – 2020 Rural Development Programme provides funding to reduce the impacts of biomass production on native tree species and associated flora and fauna in (i) critical areas, (ii) areas with declared problems of ecological stability and (iii) Natura 2000 sites that are not covered by Integrated Territorial Interventions. In particular, the action aims to reduce risks caused by harmful biotic agents such as pests and disease related to sustainable forest management. The extraction of coarse woody debris from forests coming from exotic tree species can have a high impact on EU native species and habitats through the spread of harmful biotic agents. This can result in damage of native tree species such as Cork Oak (*Quercus suber*) and Holm Oak (*Quercus rotundifolia*) populations in Montado habitats, as well as chestnut populations. In addition, the effect derived from the introduction of pine wood nematodes can be significant. This instrument provides economic support that ranges between 60 and 80% of the total costs of the required actions. However, the effectiveness of the measures in mitigating impacts on habitats and species could not be assessed given limitations in the literature and access to lead officials responsible for the dossier.

13.4.4 Emerging policy developments

The possibility to introduce positive fiscal incentives towards the planting of slow growing tree species are currently on the agenda in Portugal (interview with WWF Portugal). This type of measure would aim at preventing the further spread of fast growing tree species such as Eucalyptus, which have been highlighted as a key factor in the incidence of fires in the country and the associated biodiversity loss.

13.5 Case study: Slovakia

13.5.1 Country context

Out of the total area of 49,035 km^2 in Slovakia, agricultural land covers 49.7%, while 40.84% is forest land. Agricultural land is composed of around 71% arable soils and 28% permanent grassland. Slovakia is located in two biogeographical regions and has a very diverse landscape, rich in biodiversity. Overall Slovakia hosts 66 habitat types listed in Annex I and 133 species listed in Annex II of the Habitats Directive, as well as 81 species of birds listed in Annex I of the Birds Directive.

Biomass has the largest energy potential among all renewable energy sources (RES) in Slovakia. In 2014, wood and other solid biofuels, liquid biofuels, biogas and renewable waste accounted for 70.40% of primary production in the country (Gavurova, Perzelova and Bencoova, 2016). Slovakia is set to increase the use of RES to 14% of gross final energy consumption in 2020, with its contribution via biomass use reaching 630 Ktoe in the heating and cooling sector and 73 Ktoe in the electricity sector (Ministry of Economy and Construction of the Slovak Republic, 2010).

13.5.2 Assessment of impacts of bioenergy on habitats and species

In Slovakia, the data upon which the impacts of bioenergy production on BHD habitats and species could be assessed are of poor quality or missing (interview with WWF Slovakia). Comprehensive assessments of the impacts of bioenergy developments are unavailable and it is, therefore, not possible to provide indication of the specific BHD habitats and species impacted by bioenergy developments within the country.

13.5.3 Policy reviews: opportunities and challenges

> Slovakia has a limited number of policy instruments in place that may contribute to address impacts of bioenergy developments on BHD habitats and species, whilst there is no systematic instrument in place to that aim. The most relevant instruments include the implementation of Article 6(3) of the Habitats Directive through Act n. 543/2002, Act n.309/2009 on the promotion of renewable energy sources, a set of criteria for the sustainable use of the biomass, and the Forest Stewardship Council (FSC) certification scheme. PEFC is also applied widely in Slovakia.

Article 6(3) of the Habitats Directive was implemented in Slovakia through provisions set out by Act n. 543/2002. The Act set up the mechanism according to which the Natura 2000 network is established in Slovakia, as well as the permit procedures and requirements for appropriate assessments of actions and activities within and beyond Natura 2000 sites. The designation of protected areas, on the basis of the Regulation, is the primary instrument contributing to achieving the objectives of the EU Nature Directives. A report from the Slovak authorities indicates that, in addition to the quality of the assessments of plans and projects within Natura 2000 sites, there are number of shortcomings which hinder the effectiveness of the Natura 2000 framework. These are lack of experiences with implementation of the appropriate assessment methodology prepared by the relevant authorities and insufficient

knowledge on consequences of different development activities on particular species and habitats. In some cases, appropriate assessments were not conducted[141].

Act n. 309/2009 is the main legal source promoting the use of RES in Slovakia. It defines specific options for support for renewable electricity, including the timeframe of guaranteed price of purchase. The Act defines the conditions for supporting of RES and high efficiency CHP production (mostly electricity and biomethane production), rights and duties of electricity producers, distribution network operators and producers of biomethane. The Act has contributed to drive changes to forest management in Slovakia due to increased demand for low-quality wood (fuel wood) for bioenergy production. As a consequence, it is reported that forests are being cleared from residual wood, which has an important role for decomposition, natural regeneration of the forest and its structure (interview with an independent expert). The changes on agricultural land due to the production of dedicated crops for bioenergy have negative impact on several bird species, which use these habitats for nesting and forage. Small forest patches, hedges and bushes on agricultural land are also important for living and the activity of several insects' species (and secondarily also for other insect species dependent on plant species present on these habitats) (interview with WWF Slovakia). On farmland, inappropriately localized tree removal may cause endangerment of some bird species that are subject to the protection of individual Special protected areas (SPAs). On the other hand, the removal of woody species for bioenergy in non-forest types of habitats can lead to an improvement in their status as well as the status of species that are bound to these habitats (interview with WWF Slovakia). The Act does not specifically include mitigation measures for the protection of BHD habitats and species.

The development of bioenergy projects in Slovakia has increased demand for woody biomass, resulting in increased logging and decreased biodiversity (Zamkovský, 2018). Therefore, several environmental NGOs advocated for the establishment of a task force for biomass sustainability. In 2017 such initiative adopted a set of **criteria for the sustainable use of the biomass**. These include proof of origin of feedstock (Criterion 1); transport and distribution (Criterion 2), and effectiveness of wood biomass energy conversion (Criterion 3). These criteria have to be fulfilled in all calls for proposals for any biomass or bioenergy projects funded by European Structural and Investment Funds (ESIF) in 2014 – 2020 in Slovakia.

Fulfilment of the criterion on the declaration of the place of origin of biomass may mitigate the impacts on BHD habitats and species. In the case of forest land, the biomass must come from planned deliberate and accidental harvesting of timber, which is governed by the conditions laid down in forest management plans as set out by the provisions of Act n. 326/2005 on Forests and Act n. 543/2002 on Nature and Landscape Protection. The relevant criteria proposed in this document are recommended to be applied as pilot for the 2014-2020 programming period. Therefore, information on their effectiveness on mitigating impacts on BHD habitats and species are not yet available.

[141] Evidence gathered by Daphne under a Nature Action Plan support contract to DG Environmment

The **Forest Stewardship Council (FSC) Certification** scheme could provide useful tools to mitigate adverse effects of bioenergy production on forest habitats in the form of criteria and indicators requiring assessment and minimisation of negative effects of forestry activities (including on habitats and species), protecting High Conservation Values (HCVs), maintaining sufficient amount of wood biomass in the forest for decomposition, as well as allowing limited or no use of fertilisers. In April 2018 FSC certified forests in Slovakia represented (April 2018) 146,415 ha, which is 7.26% of total forest cover (the total area designated for forest growth represents 1,944,123 ha) (FSC, 2019). In addition to FSC, PEFC is highly adopted in Slovakia covering 1,223,070 ha.

13.6 Case Study: Sweden

13.6.1 Country context

Sweden is one of the largest countries in Europe extending onto a total area of 450,295 km^2. Over half of its territory is covered by forest land (58%), 85% of which are productive forests, alongside mires (13%), mountain areas (12%) and arable land (7%). Sweden hosts 89 Annex I Habitats, of which 24 are of EU priority, and 108 Annex II species, of which 6 are of EU priority.

Over the past 40 years, domestic bioenergy production has increased significantly becoming approximately a third of Sweden's total energy use (Black-Samuelsson et al, 2017). This is primarily a result of more efficient use of residues from, for instance, forestry and forest industries. Domestically, bioenergy is primarily used by industry and the heat sectors (Thomson, 2014). The use of biomass for electricity is comparatively lower, accounting for approximately 10% of overall renewable electricity generation in 2016, the use of domestic agricultural biomass use for energy or biofuels in so far is limited (or at pilot stage) in Sweden (Brack, Hewitt and Marchand, 2018).

13.6.2 Assessment of impacts of bioenergy on habitats and species

The main impacts driven by the bioenergy sector is Sweden are related to the extraction of forest residues. While increased use of bioenergy from residue products has helped several Swedish sectors heavily reduce their CO_2 emissions (Ericsson et al, 2004), domestically there is an active debate about trade-offs between policy objectives and in particular what constitutes a sustainable level of biomass extraction from forestry from a biodiversity perspective. A recent study estimates stump harvesting on 20% of all clear-cuts to be the highest extraction level possible without negatively impacting the achievement of Swedish forest biodiversity targets (de Jong et al, 2018). Other publications noted that no nationally red-listed species were associated primarily with logging residues of Norwegian spruce (Dahlberg et al, 2011) and that removal of clear-cut slash had a negligible impact on abundant saprotrophic fungi (Allmér, Stenlid and Dahlberg, 2009). According to the 2017 Swedish reporting under Article 22 of the Renewable Energy Directive (RED), bioenergy production has not caused a change in land use during the reporting period (2015-2016), based on evidence that the majority of feedstocks are sourced from waste- and residue-based products with few alternative uses.

13.6.3 Policy reviews: opportunities and challenges

Sweden has a number of instruments in place to address impacts of bioenergy developments on BHD species and habitats mostly in a forest context. Designation of protected areas is seen as the primary way of mitigating potential impacts from forestry, together with environmental considerations in forestry regulated or recommended based on the Forestry Act and indirectly through the sustainability criteria for biofuels, which are based on the criteria stipulated in the EU RED.

The Birds and Habitats Directives (BHD) have been implemented in Sweden through the **Swedish Environmental Code** and individual statues issued on the basis of the Code.

However, the primary pressure to set aside forest land for conservation is currently exercised by a number of (voluntary) certification schemes (referenced below). Around 10-13% of productive forest land in Sweden is currently under some type of formal protection, however, according to the latest Swedish Article 17 reporting, BHD forest habitats exhibit an alarming 73% unfavourable-bad status. Further, a 2015 evaluation showed that only 1-2% of permits or exemptions given for projects and plans in protected areas with support of the Code required ecological compensatory measures for impacts imposed (SEPA, 2015).

About 60% of Swedish productive forest land is certified either according to the **Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC)**. Both schemes include principles and criteria related to the conservation of species and habitats, thereby indirectly impacting also the sustainability of bioenergy produced from residues of forestry in these forests. For instance, certified forest owners must set aside at least 5% of their productive forest for conservation and certified forest companies (i.e. all larger Swedish forest companies) are bound by the certification standard to not cut or sell timber either from registered or un-registered 'key biotopes' identified by the Forest Agency. Each certification scheme has its own rules on control, monitoring and enforcement, and certificates can be withdrawn if identified shortcomings are not corrected, or in the case of numerous, serious and recurring shortcomings. Nevertheless, the Forest Agency estimates that about 200 ha of key biotopes – which certified companies have agreed not to fell – are clear-cut each year, with no signs of decline over time. Finally, key biotopes that have not been formally registered are damaged every year from logging (Swedish Government, 2017).

The Forestry Agency has issued binding implementing regulations based on the **Forestry Act (1979:429) and the Ordinance for Forestry Management (1993:1096)**, and recommendations for additional measures. The Act includes rules on the extraction of forestry residues, for instance, and requires 'environmental considerations' in all forestry. The Swedish Forest Agency has defined a minimum (compulsory) and a recommended (voluntary) level of environmental considerations. In practice, the decision whether to extract residues for bioenergy production is rarely determined by its potential impact on protected habitats or species. The need to protect certain species and habitats play a significant role in the decision whether to log in the first place due to protected areas, species action plans, the requirements for environmental consideration under the Forestry Act and the conservation requirements in forestry certification schemes. However, 20% of clearcuttings still have a major negative impact on biotopes that require special consideration and logging of old-growth forests continues to take place, posing a threat to the species adapted to those habitats (Sandström et al, 2015). Forests in general are important for 40% (about 1,800) of the species on the Swedish national red-list of threatened species – 900 of which are categorised as 'threatened' and 700 as 'near threatened'. Logging has had large negative impact on over 1,300 of these species, and the occurrence of many of the species is strongly fragmented (Sandström et al, 2015). The Swedish Forestry Agency may enter into dialogue with land owners to ensure rules and recommendations are complied with and inspections are conducted on a random sample of fellings. However, in practice, compliance is rarely enforced and interventions tend to focus on cases of soil/land damage caused by forestry machines.

The **Law (2010:598) on sustainability criteria for biofuels and liquid biofuels** stems from the criteria stipulated in the EU RED. It stipulates that biofuels and bioliquids are not to be considered sustainable if they are produced from feedstock from protected areas, unless such extraction can be done without jeopardising the conservation objectives of the site. Bioenergy producers must apply for and retrieve a sustainability clearance from the Energy Agency in order to categorise their product as sustainable and thereby be eligible for tax reductions and other benefits.

13.6.4 Emerging policy developments

The potential for substantially scaling up bioenergy production in Sweden has been discussed for many years and the impacts of forestry in particular on Swedish biodiversity is a frequent topic for public debate. Nature conservation NGOs call for a revision of the current Forestry Act and the establishment of rules to ensure biodiversity, ecosystem services and social values are not adversely impacted by an increased bioenergy production. Representatives from the industry have meanwhile expressed that existing environmental goals related to forestry already are too ambitious and crude. In 2018, the Swedish National Audit Office reviewed the long-term protection of high-nature value forests, concluding that the current protection is not effective, primarily due to a lack of measures, knowledge and coordination. Specifically, the study concludes that Sweden's protection of forests so far has focused on fulfilling area and coverage targets at national level, recommending that more focus is placed on the quality and function of protected areas.

The Swedish Forestry Agency is currently revising their recommended interpretations of the Forestry Act with regard to bioenergy extraction and compensation measures. However, the revisions are not expected to include any major changes to the current interpretations.

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