# Cleaner Air for Scotland 2

## Strategic Environmental Assessment Environmental Report

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# Table of contents


1. Cleaner Air for Scotland 2 Strategy (CAFS2) ..... 12
1.1. Introduction ..... 12
2. Approach to Strategic Environmental Assessment ..... 16
2.1. Purpose of this Environmental Report ..... 16
2.2. SEA activities to date ..... 16
2.3. SEA Methodology ..... 17
2.4. Alternatives ..... 18
2.5. Risks/ potential limitations of the assessment ..... 18
3. Environmental Objectives ..... 20
3.1. Introduction ..... 20
3.2. Likely evolution of the environment without implementation of CAFS2 ..... 24
3.3. The current regulatory framework ..... 24
3.4. Relationship with other Plans, Programmes and Strategies ..... 25
4. Assessment findings and recommendations ..... 29
4.1. Introduction ..... 29
4.2. Theme 7 - Tackling Non Transport Emissions Sources ..... 29
4.3. Wider policy proposals ..... 33
5. Summary of Assessment findings, Mitigation and Enhancement ..... 38
5.1. Assessment findings ..... 38
5.2. Mitigation ..... 38
5.3. Conclusions and Opportunities for Enhancement ..... 39
6. Monitoring ..... 41
7. Consultation and Next Steps ..... 42
**Appendix A. Environmental Baseline ..... 43**


# Tables


Table 1. CAFS2 Structure ..... 14
**Table 2. Scoping of SEA topics** ..... 17
Table 3. Key environmental pressures by topic ..... 21


# Figures


Figure 1. CAFS2 policy context ..... 15
Figure 2. Main pollutant emissions in Scotland - 1990 - 2017 ..... 44

## List of Abbreviations

| | |
|---|---|
| AQMA | Air Quality Management Area |
| $C_6H_6$ | Benzene |
| CAA93 | the Clean Air Act 1993 |
| CAFS/ CAFS 2 | Cleaner Air for Scotland/ Draft Cleaner Air for Scotland 2 |
| CO | Carbon monoxide |
| EA95 | The Environment Act 1995 |
| EIA | Environmental Impact Assessment |
| GHG | Greenhouse Gas |
| HRA | Habitats Regulations Assessment |
| IPCC | Intergovernmental Panel on Climate Change |
| LAQM | Local Air Quality Management |
| LEZ | Low Emission Zone |
| NAEI | National Atmospheric Emissions Inventory data |
| $NH_3$ | Ammonia |
| NLEF | National Low Emissions Framework |
| NPF3 | National Planning Framework 3 |
| $NO_2$ | Nitrogen dioxide |
| $NO_x$ | Nitrogen oxides |
| NTS/ NTS2 | National Transport Strategy/ National Transport Strategy 2 |
| $O_3$ | Ozone |
| Pb | Lead |
| PfG | Programme for Government |
| $PM_{2.5/10}$ | Particulate matter (2.5/ 10 micrometres (µm)) |
| PPC | Pollution Prevention and Control Regulations 2012 |
| PPS | Plans, Programmes and Strategies |
| SEA | Strategic Environmental Assessment |
| SEPA | Scottish Environmental Protection Agency |
| NatureScot | Scotland's Nature Agency (formerly Scottish Natural Heritage) |
| $SO_2$ | Sulphur dioxide |
| SPP | Scottish Planning Policy |
| STPR | Strategic Transport Projects Review |
| UKCP18 | United Kingdom Climate Projections |

| | |
|---|---|
| UNECE | United Nations Economic Commission for Europe |
| VOCs | Volatile Organic Compounds |
| WHO | World Health Organisation |

# Non-Technical Summary

## Background and Strategic Environmental Assessment (SEA)

This is a non-technical summary of the Environmental Report of the draft Cleaner Air for Scotland 2 (CAFS2).

Strategic Environmental Assessment (SEA) is the assessment of the likely significant environmental effects that a public plan, programme or strategy will have on the environment if implemented. Where possible, it proposes how negative effects can be avoided or reduced and identifies opportunities for positive effects to be maximised. SEA provides an opportunity for the public to express their views on the draft strategy and on an Environmental Report setting out the assessment findings. The Environmental Report has been prepared in accordance with the Environmental Assessment (Scotland) Act 2005.

The SEA focused on **air, population and human health** and **climatic factors** and for completeness a light touch consideration of **water, soil, biodiversity** and **material assets (land)** was also included for Theme 7 as relevant to agricultural emissions proposals. The Environmental Report sets out the assessment findings and makes recommendations for mitigation and enhancement where appropriate.

Early comments from the SEA Consultation Authorities (NatureScot, SEPA and Historic Environment Scotland) have been taken into account in shaping how the assessment has been undertaken, what it covers, and the level of detail in the Environmental Report.

# Cleaner Air for Scotland 2 (CAFS2)

In November 2015, the Scottish Government published 'Cleaner Air for Scotland – The Road to a Healthier Future' (CAFS)[1]. This was the first Scottish air quality strategy separate from the rest of the UK and sought to bring together the major policy areas relevant to air quality - climate change, transport, planning, health and energy - within one overarching framework. The strategy set out around 40 actions relating to these policy areas, with the primary focus being on urban air quality, and also covers the Local Air Quality Management (LAQM) system.

In November 2018, an independently led review of CAFS was commissioned. The purpose of the review was to assess progress in implementing the actions contained in CAFS and to identify priorities for additional actions to deliver further air quality improvements. Both the review findings and wider views were used to inform the development of the draft CAFS2.

The draft CAFS2 is centred around 10 themes, reflecting the high level recommendations arising from the CAFS independent review. Each theme is underpinned by actions. The draft CAFS2 structure is set out in the **table** below.

[1] Scottish Government (2015) Cleaner Air for Scotland: the road to a healthier future. Available at: https://www.gov.scot/publications/cleaner-air-scotland-road-healthier-future/ (accessed 12/12/19)

| | | | |
|---|---|---|---|
| **1. Health – a precautionary approach** | Actions that focus on assessing and commissioning research on health impacts associated with air pollution. | **7. Tackling non-transport emissions sources** | <u>Domestic combustion</u><br>Actions that focus on educational incentives and encouraging the reduction of air pollution associated with domestic combustion.<br>Introduction of legislation to control the supply of the most polluting domestic fuels.<br><u>Agricultural emissions, nitrogen deposition and environmental impacts</u><br>Actions to support agricultural emission reduction including a voluntary code of good agricultural practice, as well as review, investigation and monitoring of nitrogen deposition and environmental impacts. |
| **2. Integrated policy** | Actions that focus on existing policy integration across sectors to support the delivery of co-benefits for air quality. | | |
| **3. Placemaking** | Actions that focus on embedding air quality improvements in plans and polices such as the Place Standard. | | |
| **4. Data** | Actions that focus on research to improve current air quality data. | **8. Transport** | Actions to introduce Low Emission Zones into Scotland's four largest cities (Edinburgh, Glasgow, Dundee and Aberdeen), minimise travel and support active travel, as well as ensure public transport provision. |
| **5. Behaviour change** | Actions focus on the development of a public engagement strategy on air quality in Scotland and the undertaking of a baseline survey of current public awareness of air pollution health effects and source contributors. | **9. Governance, accountability and delivery** | Actions focus on effective governance and joined up delivery of the draft CAFS2. |
| **6. Industrial Emissions regulations** | Actions that focus on the continuing application of existing EU air standards and themes and explore potential additional measures (i.e. industrial emissions). | **10. Further progress review** | Action focus on reviewing progress on actions identified by the draft CAFS2 and ensuring further developments, challenges and actions can be identified. |

## Key Environmental Pressures

The following **figure** summarises key pressures relevant to CAFS2 by topic.

### Air Quality

- Key pressures include emissions from industrial, domestic, agricultural, natural and transboundary sources. In urban areas, transport emissions are the biggest source of air pollution.
- Emissions of the majority of air pollutants have declined in recent years, with ammonia declining at a slower rate than other pollutants. Ammonia is recognised as a key air pollutant that can have significant effects on both human health and a detrimental impact on soils, water and biodiversity.
- Poor air quality continues to affect human health and the environment in some areas.

### Soil

- Air and soil quality are linked through common sources of pollution.
- Changes in land use and management can result in change in soil organic matter which impacts on soils' ability to perform its range of functions.
- Soil pollution and contamination can be locally significant and threats to soil can be exacerbated by mis-use of chemicals; waste management; and, recycling operations during development.
- Ammonia deposition can lead to the acidification of soil which can degrade the natural environment leading to excessive nitrogen being supplied to sensitive habitats, negatively impacting biodiversity.

### Population and Human Health

- Key pressures include outdoor air pollution which is known to causes damage to human health. Highly urbanised areas are likely to have higher concentrations of pollution than rural locations.
- Health impacts can be associated with indoor air pollution with sources differing by setting but including emissions from burning fuels for heating and cooking.
- Air pollution and the consequent impacts on human health are not evenly spread and disproportionately linked to more vulnerable groups and deprived areas.

### Biodiversity

- Air pollution can cause damage to plants and animals and other impacts on biodiversity that can result in species loss, habitat change and increased sensitivity to environmental stresses.
- Ammonia is a key pollutant and nitrogen deposition is a key pressure on a wide range of habitats. Nitrogen emissions from combustion plants, intensive agriculture and transport causes acidification, eutrophication and direct tissue damage to plants.
- Key pressures include land use intensification and change, pollution and climate change.

## Climatic Factors

- Air quality and climate change are intrinsically linked and key pressures include greenhouse gas emissions from a range of sectors including transport, agriculture and related land uses, business/Industry, energy, and residential.
- Climate change has the potential to exacerbate key pressures on a range of environmental receptors.
- Climate change could alter current patterns and concentrations of air pollution.
- Key inter-related climate change risks such as shortages in the public water supply, agriculture, energy generation and industry; risk to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity; and new and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals.

## Water

- Key pressures in some areas include changes to water flows and levels, invasive species, poor water quality and overall ecological condition.
- Key pressures on freshwater include man-made barriers to fish migration, physical changes to beds and banks and rural diffuse pollution .
- Similarly to soil, ammonia deposition can lead to the acidification of water, degrading the natural environment and negatively impacting biodiversity, flora and fauna.
- Groundwater quality can be affected by diffuse rural pollution and discharges from industry, whereas groundwater flow and levels can be affected by agricultural irrigation and industry.
- Diffuse pollution as a result of atmospheric deposition can effect both water and air quality and increased nitrogen concentrations can lead to acidification and eutrophication of water bodies.

## Material Assets

- Key pressures include emissions associated with agricultural practices, mostly dominated by ammonia release when slurries, manures and nitrogen fertilisers come into contact with air, leading to diffuse pollution in water and soil.
- Intensive land use/ land management practices are leading to pressure on associated natural resources such as land (and environmental receptors such as soil, water and biodiversity).

## What are the assessment findings?

The draft CAFS2 is likely to have **significant positive effects** on **air quality, population and human health** and **climatic factors.** This is likely to result from new legislative proposals to control the supply of the most polluting domestic fuels coupled with new supportive measures to target domestic emissions. Actions identified to target agricultural emissions, nitrogen deposition and environmental impacts including a code of good agricultural practice for Scotland (theme 7) has potential to further contribute to positive effects on these topics. By drawing together existing air quality improvement polices and proposals in a co-ordinated way across a range of topic areas including health, planning and transport (themes 2, 5, 6, and 8), CAFS2 can also **cumulatively** contribute to **broad positive effects** for **air quality, population and human health** and **climatic factors.**

The potential for effects **in-combination** with other plans, programmes and strategies has also been considered. The draft CAFS2 has the potential to **positively** and **cumulatively** contribute across a wide range of Scottish Government policy areas. Air quality improvement is captured across a range of national plans, policies and programmes (for example placemaking and sustainable transport policy) and these are recognised within the draft CAFS2.

Taking into account the high level nature of the draft CAFS2, there is a degree of uncertainty regarding the environmental impacts that may arise as a result of future actions targeting domestic and agricultural emission reduction (theme 7). The assessment also identifies the potential for **localised positive effects** on the majority of **SEA topics (air, population and human health, water, soil, biodiversity** and **material assets)** as a result of actions undertaken to support the implementation of theme 7. For example, actions focusing on agricultural emissions such as the development of a voluntary code of agricultural practice for improving air quality in Scotland has the potential to realise **localised positive effects on soil, water, biodiversity** and **material assets.** Where any future plans, projects, and proposals are developed as a result of actions identified by CAFS2, these will themselves be subject to consideration in accordance with the requirements of the Environmental Assessment (Scotland) Act 2005.

## What are the conclusions and recommendations/opportunities for enhancement?

The SEA findings support the inclusion of **theme 7** as actions associated with targeting domestic and agricultural emissions, nitrogen deposition and environmental impacts go further than CAFS (2015) which focused on air quality, and particularly transport as the largest source of urban air quality issues. In regard to actions identified to address and support a reduction in domestic combustion emissions, the SEA findings support the introduction of legislation to control the supply of the most polluting domestic fuels. This is because a consistent national approach, as opposed to local approaches, is likely to have a greater impact on reducing domestic combustion emissions.

In regard to actions targeting agricultural emissions, nitrogen deposition and environmental impacts the SEA findings support the inclusion of actions that seek to further consider risks associated with ecological effects from nitrogen deposition such as the development of a voluntary agricultural code and research.

Further, any voluntary code of good agricultural practice could be subject to an early review process to assess its effectiveness and compliance. If the review indicates that insufficient progress was being made, the need for direct regulatory intervention will be considered. This SEA can provide a useful starting point in considering opportunities for realising wider environmental benefits.

The SEA findings also support:

- The inclusion of **themes 1 and 5** as actions that support research and public engagement and behaviour change can contribute to continued efforts to reduce preventable air pollution and support the delivery of long term sustained change in environmental quality generally, and air pollution specifically.
- The inclusion of **themes 2 and 6** as actions that support strong policy alignment across wider Scottish Government policy objectives. This is because air pollution, climate change, carbon reduction and mobility are strongly interconnected. Effective policy co-ordination across these broad themes, at both central and local government levels, can help to realise multiple environmental benefits.
- The inclusion of **themes 3 and 8** as actions that draw together existing place-making and sustainable transport policy. For example, embedding place-making principles, with a strong focus on nature based solutions, across policy areas can support a cleaner, healthier and more attractive environment. Similarly, sustainable transport policy that promotes active travel has the potential to increase physical activity, significantly reduce cardiovascular incidence and mortality, and has been shown to reduce all-cause mortality. Measures to reduce air pollution from road transport and to increase levels of active travel can therefore amplify benefits to public health.

The following opportunities for enhancement have also been identified:

- To obtain maximum environmental benefits **under theme 7 (Domestic emissions)** a particular focus could be given to urban areas/those outside existing Smoke Control Areas as a means to realise greatest impact.
- To obtain the maximum environmental benefits under **theme 7 (agricultural emissions, nitrogen deposition and environmental impacts),** it is recommended that early and targeted action should be focused on agricultural practices that can realise multiple environmental benefits. This includes a focus on practices which can deliver both ammonia emission reductions and support the recovery of as much

nitrogen as possible. Not only will this reduce agricultural emissions but can contribute to positive localised effects on people, water, soil, biodiversity and material assets.

- To obtain the maximum environmental benefits under **health and integrated policy proposals (themes 1 and 2)** a focus could be given to evidence and research focused on urbanised areas as these are recognised as being more vulnerable to air pollution.
- To obtain maximum environmental benefits across the **wider policy proposals**, there may be further opportunities to identify alignment with other existing Scottish Government policy and to apply lessons learnt from COVID-19 as a means to further support improved air quality.

## What are the proposals for mitigation and monitoring?

A wide range of existing programmes are already in place at the national and local level to report on environmental status and assess performance against relevant environmental indicators. Further, given that the draft CAFS2 draws together existing plans, programme and strategies that will contribute to improved air quality, monitoring of these Plans, Programmes and Strategies will also be relevant.

An annual progress report has been published for each year of the current CAFS (2015 – 2020). An enhanced and strengthened annual performance report has been proposed as part of CAFS2. A CAFS2 Delivery Group will also be convened with a clear remit, including the authority to ensure that the actions in the new strategy are effectively delivered. It is therefore recommended that the monitoring for SEA purposes is an integral part of the monitoring of the strategy.

## What reasonable alternatives have been considered?

The 2005 Act requires the Environmental Report to identify, describe and evaluate the likely significant effects on the environment of reasonable alternatives to a plan, programme, or strategy taking into account its objectives and geographical scope. The extent to which alternatives could be considered reasonable was influenced by the relevant legislative requirements and takes into account those existing policies and actions, the content of which has been set out elsewhere in higher level plans, programmes and strategies.

A ‘do nothing’ scenario was not considered a reasonable alternative because this is considered incompatible with the objective of delivering further air quality improvements while maximising greenhouse gas emission reductions and improving health outcomes in relation to air.

The draft CAFS2 aims to address multiple outcomes based on the above. In addition, the overarching themes were developed by the independent steering group and their underpinning actions are considered collectively in achieving the objectives of the strategy and therefore no single action or an alternative approach

to it can be viewed as a reasonable means to deliver the overarching objective to improve air quality.

Taking this into account we do not consider that there are any reasonable alternatives to the draft CAFS2,

## How to comment on the Environmental Report

Respondents are asked to submit responses to this Environmental Report directly to the Scottish Government by closing date of 7 January 2020.

You can respond:

- Online: You can respond online using the Scottish Government's consultation platform, Consultation Hub, at: https://consult.gov.scot/environmental-quality/cleaner-air-for-scotland-2. Consultation Hub allows you to save and return to your responses while the consultation is still open. A copy of your final response will be emailed to you.
- By email to air.quality@gov.scot.
- In writing to Cleaner Air for Scotland 2, Environmental Quality Unit, Directorate for Environment and Forestry, Scottish Government, Victoria Quay, Edinburgh EH6 6QQ

Following the consultation, a SEA Post-Adoption Statement will be prepared. The Statement will reflect on the comments received on the Environmental Report and the draft CAFS2 and will explain how these have been taken into account in finalising the Strategy.

# 1. Cleaner Air for Scotland 2 Strategy (CAFS2)

## 1.1. Introduction

1.1.1 In November 2015, the Scottish Government published 'Cleaner Air for Scotland – The Road to a Healthier Future' (CAFS)[2]. This was the first Scottish air quality strategy separate from the rest of the UK and sought to bring together the major policy areas relevant to air quality - climate change, transport, planning, health and energy - within one overarching framework. The strategy set out around 40 actions relating to these policy areas, with the primary focus being on urban air quality, and also covers the Local Air Quality Management (LAQM) system.

1.1.2 The majority of these 40 actions, as well as several additional actions not included at the time of publication, have now been completed. Some of these are still ongoing and will be taken forward in parallel with the actions outlined in the draft Cleaner Air for Scotland 2 (CAFS2).

1.1.3 In November 2018, the Cabinet Secretary for the Environment, Climate Change and Land Reform commissioned an independently led review of CAFS. The purpose of the review was twofold - firstly to assess progress to date in implementing the actions contained in the strategy and secondly to identify priorities for additional actions to deliver further air quality improvements.

1.1.4 The review was overseen by a steering group and supported by four specialist working groups covering health & environment, placemaking, agricultural, domestic & industrial emissions and transport. The steering group submitted its final report to the Scottish Government in July 2019 setting out a series of conclusions and recommendations[3]. Between October and December 2019, an online survey allowed individuals and organisations to submit their views on the recommendations. Both the review findings and these wider views were used to inform the development of the draft CAFS2.

1.1.5 The consultation draft CAFS2 recognises that air pollution, climate change, carbon reduction, and mobility are strongly interconnected. Whilst this is evident in CAFS (2015), which focused on air quality and particularly transport as the largest source of urban air quality issues, the draft CAFS2 expands on this to include other sources and the wider issues of air pollution, such as agriculture and domestic combustion. It also emphasises the importance of policy integration and implementation at both the national and local level.

[2] Scottish Government (2015) Cleaner Air for Scotland: the road to a healthier future. Available at: https://www.gov.scot/publications/cleaner-air-scotland-road-healthier-future/ (accessed 12/12/19)

[3] Scottish Government (2019) Cleaner Air for Scotland Strategy: independent review. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/ (accessed 25/10/19)

1.1.6 The draft CAFS2 is centred around 10 themes, reflecting the high level recommendations arising from the CAFS independent review. Each of these are underpinned by specific actions as illustrated in **Table 1** below.

1.1.7 Finally, and notably during the drafting process for CAFS 2, the COVID-19 pandemic has changed the way we work, socialise and travel in Scotland. These unprecedented changes in living and working patterns are likely to have had a significant, but as yet unquantified, effect on air pollution. Monitoring data show that during the main lockdown period ambient nitrogen dioxide ($NO_2$) concentrations were lower than expected for the time year, which is attributed to a decrease in road transport emissions. Since then, concentrations have started to increase again. Further opportunities to support positive environmental changes will help the Scottish Government meet its climate change targets and improve air quality, whilst supporting economic recovery.

**Table 1. CAFS2 Structure**

| | | | |
|---|---|---|---|
| **1. Health – a precautionary approach** | Actions that focus on assessing and commissioning research on health impacts associated with air pollution. | **7. Tackling non-transport emissions sources** | <u>Domestic combustion</u><br>Actions that focus on educational incentives and encouraging the reduction of air pollution associated with domestic combustion.<br>Introduction of legislation to control the supply of the most polluting domestic fuels.<br><u>Agricultural emissions, nitrogen deposition and environmental impacts</u><br>Actions to support agricultural emission reduction including a voluntary code of good agricultural practice, as well as review, investigation and monitoring of nitrogen deposition and environmental impacts. |
| **2. Integrated policy** | Actions that focus on existing policy integration across sectors to support the delivery of co-benefits for air quality. | | |
| **3. Placemaking** | Actions that focus on embedding air quality improvements in plans and polices such as the Place Standard. | | |
| **4. Data** | Actions that focus on research to improve current air quality data. | **8. Transport** | Actions to introduce Low Emission Zones into Scotland's four largest cities (Edinburgh, Glasgow, Dundee and Aberdeen), minimise travel and support active travel, as well as ensure public transport provision. |
| **5. Public Engagement and Behaviour Change** | Actions focus on the development of a public engagement strategy on air quality in Scotland and the undertaking of a baseline survey of current public awareness of air pollution health effects and source contributors. | **9. Governance, accountability and delivery** | Actions focus on effective governance and joined up delivery of the draft CAFS2. |
| **6. Industrial Emissions regulations** | Actions that focus on the continuing application of existing EU air standards and themes and explore potential additional measures (i.e. industrial emissions). | **10. Further progress review** | Action focus on reviewing progress on actions identified by the draft CAFS2 and ensuring further developments, challenges and actions can be identified. |

1.1.8 The draft CAFS2's high level policy context is included in **Figure 1** below. Further detail of the relationship between CAFS2 and other relevant Plans, Polices and Programmes is also included in Section **3.4.**

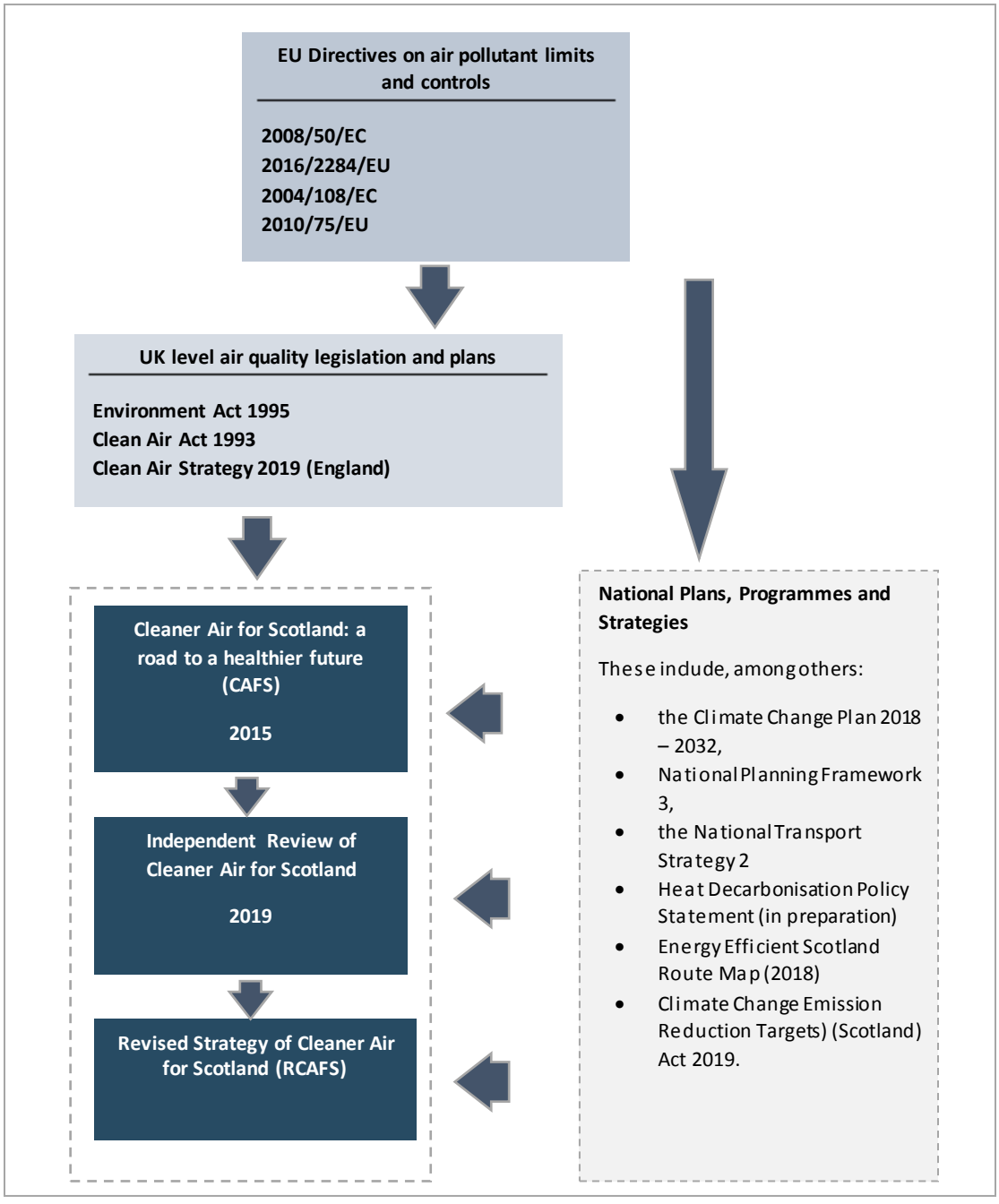


**Figure 1. CAFS2 policy context**

# 2. Approach to Strategic Environmental Assessment

## 2.1. Purpose of this Environmental Report

2.1.1 As part of the preparation of the draft CAFS2, the Scottish Government is carrying out a Strategic Environmental Assessment (SEA) of its proposed content. SEA is a systematic method for considering the likely significant environmental effects of certain plans, programmes and strategies. SEA involves the following key stages:

- **Screening** – determining whether the strategy is likely to have significant environmental effects and whether an SEA is required;
- **Scoping** – establishing a method for assessment and setting out the consultation period for the strategy;
- **Environmental Assessment** – assessing the emerging content of the strategy and setting out its likely significant environmental effects and proposing, where possible, how negative effects can be avoided or reduced and how positive effects can be maximised; the Environmental Report is published alongside the consultation draft strategy;
- **Post Adoption Statement** – preparing and publishing a post-adoption statement outlining how the SEA has influenced the final strategy.

2.1.2 This report has been prepared in accordance with the Environmental Assessment (Scotland) Act 2005 ("the 2005 Act") and sets out the findings of the environmental assessment stage. The Cleaner Air for Scotland 2 strategy is considered a qualifying plan under section 5 (4) of the 2005 Act.

## 2.2. SEA activities to date

2.2.1 Screening and Scoping was undertaken in August 2019 and a combined screening and scoping report was submitted to the SEA gateway inviting views from the SEA statutory consultation authorities (SEPA, NatureScot and HES). This determined that an SEA was required due to the potential for significant positive effects for population and human health, air and climatic factors.

2.2.2 Based on the comments received from the consultation authorities, water, soil, biodiversity and material assets (land) were subsequently scoped into the iterative assessment process (Table 2). This was because it was considered that proposals targeting agricultural emissions, nitrogen deposition and environmental impacts had the potential for positive effects across these topics. However as the assessment progressed, an early finding of no likely significant effects for these topics was identified and therefore more detailed assessment work was not progressed. For completeness however, a light touch consideration of these topics is included.

**Table 2. Scoping of SEA topics**

| | |
|---|---|
| **Air Quality** | ✓ |
| **Population and Human Health** | ✓ |
| **Climatic Factors** | ✓ |
| **Soil** | ✓ |
| **Water** | ✓ |
| **Biodiversity, Flora and Fauna** | ✓ |
| **Material Assets** | ✓ |
| **Cultural Heritage** | ✗ |
| **Landscape** | ✗ |

## 2.3. SEA Methodology

2.3.1 The finalised assessment approach has been developed to reflect the high-level nature of the emerging draft CAFS2 which is shaped around 10 themes focusing on Health; Integrating policy; Place-making; Data; Public engagement and Behavioural Change; Industrial Emission Regulation; Tackling Non-Transport Emissions Sources; Sustainable Transport; Governance, Accountability and Delivery; and, Further Progress Review (**Table 1**).

2.3.2 Early assessment work considered key environmental pressures associated with air quality on the scoped in SEA topics. This included the consideration of a range of environmental information including outputs from a Plantlife workshop held in November 2019.

2.3.3 Not all of the themes were considered likely to have significant environmental effects. Themes 4, 9, and 10 concerning data, governance & accountability, and on review arrangements, were scoped out of the assessment because they relate to administrative or procedural matters. .

2.3.4 The finalised assessment takes the form of a broad narrative analysis of themes 1, 2, 3, 5, 6 and 8 (hereafter referred to as "the wider CAFS 2

policy proposals") together with a more focused analysis of Theme 7 - Tackling Non Transport Emissions Sources, because this theme includes new proposals for legislation to address domestic combustion emissions as well as other measures to target domestic combustion and agricultural emissions, nitrogen deposition and environmental impacts.

2.3.5 Potential cumulative and in-combination effects have also been considered and opportunities to enhance environmental benefits have also been included where identified.

## 2.4. Alternatives

2.4.1 The 2005 Act requires the Environmental Report to identify, describe and evaluate the likely significant effects on the environment of reasonable alternatives to a plan, programme, or strategy taking into account its objectives and geographical scope. The extent to which alternatives could be considered reasonable was influenced by the relevant legislative requirements and takes into account those existing policy and actions, the content of which has been set out elsewhere in higher level plans, programmes and strategies.

2.4.2 A 'do nothing' scenario was not considered a reasonable alternative because this is was considered incompatible with the objective of delivering further air quality improvements while maximising greenhouse gas emission reductions and improving health outcomes in relation to air.

2.4.3 The draft CAFS2 aims to address multiple outcomes based on the above. In addition, the overarching themes were developed by the independent steering group and their underpinning actions are considered collectively in achieving the objectives of the strategy and therefore no single action or an alternative approach to it can be viewed as a reasonable means to deliver the overarching objective to improve air quality.

2.4.4 Taking this into account we do not consider that there are any reasonable alternatives to the draft CAFS2.

2.4.5 Opportunities for enhancement have been identified throughout where appropriate and the development of any subsequent policy or proposals that set out actions or measures to meet the Strategy's objectives will themselves be subject to consideration under the 2005 Act.

## 2.5. Risks/ potential limitations of the assessment

2.5.1 As the assessment progressed, the approach was refined to best reflect the emerging content of the draft CAFS2 and to provide clear assessment findings.

2.5.2 A degree of inherent uncertainty was recognised where actions (such as further research and assessment) have the potential to result in future proposals, and where the detailed implementation of actions identified in

the draft CAFS2 is yet to be determined The focus of the assessment therefore was on actions which sought to implement new legislation targeting domestic emission reduction and supportive measures to improve air quality.

# 3. Environmental Objectives

## 3.1. Introduction

3.1.1 The 2005 Act requires that the Environmental Report includes a description of the relevant aspects of the current state of the environment and its likely evolution without implementation of the draft CAFS2. It also requires a description of existing environmental problems along with relevant established environmental protection objectives.

3.1.2 The following table provides a high level summary of the key environmental pressures for each of the SEA topic areas. A more detailed environmental baseline is provided in **Appendix A.**

**Table 3. Key environmental pressures by topic**

| Topic | Key Environmental Pressures |
|---|---|
| **Air** | • Key pressures on air quality include emissions from transport, industrial, domestic, agricultural, natural and transboundary sources outwith Scotland.<br>• In urban areas, transport emissions are the biggest source of air pollution.<br>• Emissions of the majority of air pollutants have declined in recent years, with ammonia declining at a slower rate than other pollutants.<br>• Ammonia is recognised as a key air pollutant that can have significant effects on both human health and a detrimental impact on soils, water and biodiversity.<br>• Poor air quality continues to affect human health and the environment in some areas. |
| **Population and human health** | • Key pressures on population and human health include outdoor air pollution which is known to cause damage to human health across a wide range of conditions.<br>• Highly urbanised areas are likely to have higher concentrations of pollution than rural locations.<br>• Early deaths and other health impacts can be associated with indoor air pollution with sources differing by setting but including emissions from burning fuels for heating and cooking.<br>• Air pollution and the consequent impacts on human health are not evenly spread and are disproportionately linked to more vulnerable groups and deprived areas.<br>• Climate change has the potential to exacerbate poor air quality and associated health problems. |
| **Climatic factors** | • Air quality and climate change are intrinsically linked as they both arise from broadly the same sources.<br>• Key pressures include greenhouse gas emissions from a range of sectors including transport (37%), agriculture and related land uses (24%), business/Industry (22%), energy (15%), and residential (15%).<br>• Climate change has the potential to exacerbate key pressures on a range of environmental receptors<br>• Climate change could alter current patterns and concentrations of air pollution.<br>• Key inter-related climate change risks include: |

| Topic | Key Environmental Pressures |
|---|---|
| | - flooding and coastal change risks to communities, businesses and infrastructure<br>- high temperature-related risks to health, well-being and productivity<br>- shortages in the public water supply, agriculture, energy generation and industry<br>- risk to natural capital, including terrestrial coastal, marine and freshwater ecosystems, soils and biodiversity<br>- risk to domestic and international food production and trade<br>- new and emerging pests and diseases and invasive non-native species, affecting people, plants and animals |
| **Soil** | • Air and soil quality are linked through common sources of pollution.<br>• Changes in land use and management can result in change in soil organic matter which impacts on soils ability to perform its range of functions.<br>• Soil pollution and contamination can be locally significant and threats to soil can be exacerbated by misuse of chemicals; waste management and recycling operations during development.<br>• Ammonia deposition linked to modern agricultural practice can lead to the acidification of soil negatively impacting biodiversity.<br>• Key pressures on soil can also be compounded by the effects of climate change which can contribute to both erosion and compaction. |
| **Water** | • Key pressures on water in some areas include changes to water flows and levels resulting from land use change, invasive species, poor water quality and overall ecological condition.<br>• Atmospheric deposition associated with activities such as fertiliser use can have an effect on both air and water quality.<br>• Key pressures on freshwater include physical changes to beds and banks and rural diffuse pollution.<br>• Similarly to soil, ammonia deposition can lead to the acidification of water, negatively impacting biodiversity, flora and fauna. |

| Topic | Key Environmental Pressures |
|---|---|
| | • Groundwater quality can be affected by diffuse rural pollution, whereas groundwater flow and levels can be affected by agricultural irrigation and industry.<br>• Diffuse pollution as a result of atmospheric deposition can effect both water and air quality and increased nitrogen concentrations can lead to acidification and eutrophication of water bodies. |
| **Biodiversity, flora and fauna** | • Air pollution can cause damage to plants and animals and other impacts on biodiversity that can result in species loss, habitat composition changes and increased sensitivity of organisms to environmental stresses.<br>• Ammonia is a key pollutant and nitrogen deposition is a key pressure on a wide range of habitats and nitrogen emissions from combustion plants, intensive agriculture and transport causes acidification, eutrophication and direct tissue damage to plants.<br>• Key pressures on biodiversity include the spread of invasive species and wildlife disease, land use intensification and modification, pollution and climate change.<br>• Climate change including shifting weather patterns can affect nature across the country. |
| **Material assets** | • Key pressures include emissions associated with agricultural practices, mostly dominated by ammonia release when slurries, manures and nitrogen fertilisers come into contact with air, leading to diffuse pollution in water and soil.<br>• Intensive land use/ land management practices are leading to pressures on associated natural resources such as land (and environmental receptors such as soil, water and biodiversity). |

## 3.2. Likely evolution of the environment without implementation of CAFS2

3.2.1 The SEA process requires an assessment of the likely evolution of the environment without the implementation of the plan.

3.2.2 The draft CAFS2 has a key role to place in ensuring that sufficient actions are in place to address air quality improvement. CAFS2 brings together existing policies and proposals on air pollution, climate change, carbon reduction, and mobility and recognises that these are strongly interconnected. It also introduces measures to tackle air pollution relating to domestic combustion and agricultural emissions, nitrogen deposition and environmental impacts.

3.2.3 The proposed joined up approach to improved air quality across a range of sectors (such as climate change and mobility) can support multiple benefits and environmental outcomes that could be missed in the absence of CAFS2. For example, air quality and climate change are intrinsically linked and in the absence of CAFS2, an opportunity could be missed to develop a concerted effort to tackle the main sources of greenhouse gas emissions which are also sources of air pollutants (e.g. transport).

3.2.4 While concentrations of most key pollutants in Scotland are compliant with EU standards and some are already below World Health Organisation (WHO) guideline values, there are some general, local and periodic poor air quality areas which require urgent attention and action. In the absence of CAFS2, poor air quality trends could continue and have an adverse impact on a range of other environmental receptors as well as population and human health.

3.2.5 Further in the absence of new measures to tackle air pollution resulting from domestic combustion and agricultural emissions (Theme 7), poor air quality trends could continue and have an adverse impact on a range of other environmental receptors including population and human health.

## 3.3. The current regulatory framework

3.3.1 There are a range of existing regulatory controls in place which serve to improve air quality locally. These include Air Quality Management Areas (AQMA) and Smoke Control Areas[4]. In addition, Part 2 of the Transport (Scotland) Act 2019[5] confers new powers on local authorities in relation to the creation, and civil enforcement, of Low Emission Zones (LEZs). This supports the Scottish Government's commitment to introduce LEZs into Glasgow, Edinburgh, Dundee and Aberdeen. LEZs set an environmental limit on certain road spaces, allowing access to only the cleanest vehicles

[4] Scottish Environmental Protection Authority (undated) Local Air Quality Management. Available at: http://www.scottishairquality.scot/laqm/ (accessed 28/01/2020)

[5] Scottish Government (2019) Transport (Scotland) Act. Available at: https://www.legislation.gov.uk/asp/2019/17/contents/enacted (accessed 10/08/2020)

with the aim of improving air quality in Scotland's city centres. Vehicles that do not meet the emission standards set for a LEZ will not be able to drive within the zone and a penalty charge will be payable by the vehicle's registered keeper, unless the vehicle is either out of scope of the LEZ or is exempt.

## 3.4. Relationship with other Plans, Programmes and Strategies

3.4.1 The following paragraphs provide a summary of the key statutory measures, including plans, programmes and strategies (PPS) framing air quality management in Scotland, expanding on the draft CAFS2's high level policy context as illustrated in **Figure 1**.

3.4.2 Key PPS originate from international treaties which are implemented as legislation at the EU, UK and Scotland levels[6]. Key EU air quality legislation includes Directive 2008/50/EC on ambient air quality and cleaner air for Europe ('the Directive')[7], Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air ('the 4th air quality Daughter Directive')[8] and Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (National Emissions Ceilings Directive or NECD)[9].

3.4.3 The NECD sets national emission ceilings for certain atmospheric pollutants (nitrogen oxides, non-methane volatile organic compounds, sulphur dioxide, ammonia and (new in the 2016 Directive) fine particulate matter $PM_{2.5}$). It implements at EU level obligations under the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution of 1979 (CLRTAP) and, in particular, its 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of 1999, which was revised in 2012 (the revised Gothenburg Protocol). The NECD transposes 2020 targets agreed under the revised Gothenburg Protocol, along with more ambitious targets for 2030.

3.4.4 The NECD has been transposed into domestic law through the National Emission Ceilings Regulations 2018 and the requirements will be implemented at UK level through a National Air Pollution Control Programme[10]. Although the UK is on course to meet the 2020 targets for all

[6] Scottish Government (2019) Cleaner Air for Scotland Strategy: independent review. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/ (accessed 25/10/19)

[7] European Commission (2008) Directive 2008/50/EC on ambient air quality and cleaner air for Europe. Available at: http://data.europa.eu/eli/dir/2008/50/oj (accessed 12/03/20)

[8] European Commission (2004) Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air ('the 4th air quality Daughter Directive'). Available at: http://data.europa.eu/eli/dir/2004/107/oj (accessed 12/03/20)

[9] European Commission (2016) Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants National Emissions Ceilings Directive or NECD. Available at: http://data.europa.eu/eli/dir/2016/2284/oj (accessed 12/03/20)

[10] Department for Environment Food and Rural Affairs (2019), Air Quality: National Air Pollution Control Programme, Available at:

pollutants (other than ammonia), new policies will be required to ensure 2030 compliance.

3.4.5 The Directive sets health and environment-based objectives and values for limits of certain air pollutants. These include particulate matter (PM), sulphur dioxide, nitrogen dioxide and oxides of nitrogen, lead, benzene, carbon monoxide, and ozone. Meanwhile, the NECD sets national emissions ceilings (mass emissions) for oxides of nitrogen, sulphur dioxide, non-methane volatile organic compounds, ammonia and PM. These must be met by prescribed dates. Air quality is devolved and these legal requirements are the responsibility of Scottish Ministers.

3.4.6 At the UK and Scotland Level, the Environment Act 1995 (EA95)[11], the Pollution Prevention and Control Regulations 2012 (PPC)[12], and the Clean Air Act 1993 (CAA93)[13] are particularly relevant regulatory drivers for protecting air quality.

3.4.7 The EA95 establishes the Local Air Quality Management (LAQM) system which requires local authorities to regularly review and assess air quality in their areas against objectives for several pollutants of concern for human health. Where an authority identifies a risk of an objective being exceeded at a relevant location, an Air Quality Management Area (AQMA) must be declared after which the authority must prepare an air quality action plan setting out how it proposes to tackle the issues identified. SEPA provides regulatory oversight and has reserve powers under Section 85 of EA95 (with the approval of Scottish Ministers) to direct local authorities to fulfil their duties and also provides significant support and advice to local authorities on LAQM and wider air quality matters.[14]

3.4.8 Under PPC, Scottish Environment Protection Authority (SEPA) regulates prescribed industrial activities which require a permit to operate. Permits contain measures to control emissions to air (such as abatement systems) and suitable emission limit values (ELVs) for both point and fugitive sources for certain substances, and requires monitoring to be conducted which allows compliance to be assessed. In setting appropriate permit

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/791025/air-quality-napcp-march2019.pdf (accessed 11/03/2020)

[11] HM Government (1995) Environment Act 1995. Available at: http://www.legislation.gov.uk/ukpga/1995/25/contents (accessed 12/03/20)

[12] Scottish Government (2012) Pollution Prevention and Control (Scotland) Regulations 2012 (as amended). Available at: http://www.legislation.gov.uk/ssi/2012/360/contents/made (accessed 12/03/20)

[13] HM Government (1993) Clean Air Act 1993. Available at: http://www.legislation.gov.uk/ukpga/1993/11/contents (accessed 12/03/20)

[14] Scottish Government (2019) Cleaner Air for Scotland Strategy: independent review. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/ (accessed 12/02/20)

conditions, SEPA must have regard to the requirements of the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (the AQS)[15].

3.4.9 Emissions to air of smoke which are not captured by PPC may be controlled through the provisions of the CAA93. This is not a permitting regime, but action is taken by local authorities in response to public complaints. The Act seeks to control emissions of dark smoke, smoke, grit, dust and fumes from smaller-scale/non-PPC activities, and the provisions can cover both domestic and commercial premises. The Act does not apply to activities which have a PPC permit. Local authorities can monitor for air pollution from these activities and take action via investigations, notices and prosecutions. SEPA also has powers in relation to the declaration of Smoke Control Areas (SCAs) but has no regulatory powers under the Act[16].

3.4.10 The upcoming Heat Decarbonisation Policy Statement and updated Energy Efficient Scotland Route Map will set out our policy proposals and actions to drive down emissions from heating our homes and buildings. This is central to meeting the ambitious climate change targets set out in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. In addition to delivering reductions in $CO_2$ emissions, these actions will also contribute to reduced air pollution by reducing the need for supplementary domestic heating.

3.4.11 The Committee on Climate Change (CCC), which is the Scottish Government's statutory advisor on climate change, produced a report in 2018, Biomass in a Low Carbon Economy[17], which explored how biomass could be prioritised for the most valuable end use. The CCC recommended a transition on the use of biomass away from domestic heating and towards use in timber construction and Bioenergy Carbon Capture and Storage (BECCS).

3.4.12 Due to the wide ranging impacts of nitrogen at the local to global scale, a partnership project has been initiated between Defra, the devolved administrations, the country nature conservation bodies and JNCC. The Scottish Government is a part of the project's steering group. The project, called Nitrogen Futures[18], is being undertaken by a consortium led by the Centre for Ecology & Hydrology (CEH) which brings together leading

[15] HM Government, Scottish Government, Welsh Assembly Government and Norther Ireland Government (2011) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Defra and the Devolved Administrations. Available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1 (accessed 12/03/20)

[16] Scottish Government (2019) Cleaner Air for Scotland Strategy: independent review. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/ (accessed 12/02/20)

[17] CCC (2018) Biomass in a low-carbon economy. Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Biomass-in-a-low-carbon-economy-CCC-2018.pdf (accessed 10/08/20)

[18] JNCC (2020) The Nitrogen Futures Project [online]. Available at: https://jncc.gov.uk/our-work/nitrogen-futures/ (accessed 06/04/20)

expertise with the aims to compare current and possible future emission reduction policies to help maximise the benefits to ecosystems and the people that live near them. Following the completion of the project, a report will be produced detailing the methods and results of modelling the different policy scenarios together with the optimisation of the spatial targeting of $NH_3$ and $NO_x$ mitigation measures. The report will also discuss how emission mitigation scenarios might interact with other policy areas such as those dealing with climate change. The Nitrogen Futures project will also produce case studies to demonstrate how scenarios work in practice at local scale. Country-specific and UK-level resource packages to assist with communicating the results to a wider audience will be developed.

3.4.13 Finally, studies are emerging exploring the effect of the COVID-19 pandemic currently being experienced. Time variance analysis of air quality in Scotland during COVID-19 lockdown shows that $NO_2$ and particulate matter emissions experienced significant drops (between 9% and 81% compared to previous years depending on pollutant)[19]. In addition, recent reports outline what Scotland can learn from the lockdown experience to create safer, attractive urban spaces which put people first to make walking and cycling the norms for everyday journeys[20]. These recognise opportunities to improve our urban environments in the context of changing congestion patterns and associated challenges for air pollution and climate change.

[19] Ricardo (2020) Scottish Air Quality website: COVID19 lockdown - Time Variance analysis of air quality in Scotland. Available at: http://www.scottishairquality.scot/assets/documents/news/COVID19%20lockdown%20-%20Time%20Variance%20analysis%20of%20air%20quality%20in%20Scotland%20-%2027-05-2020.html

[20] Transform Scotland (2020) Active Recovery: locking-in the active travel benefits. Available at: https://transformscotland.org.uk/wp/wp-content/uploads/2020/06/Transform-Scotland-Active-Recovery-2020-06-11.pdf

# 4. Assessment findings and recommendations

## 4.1. Introduction

4.1.1 This section sets out the likely significant environmental effects that are expected as a result of the draft CAFS2.

4.1.2 The assessment takes the form of a broad narrative analysis of themes 1, 2, 3, 5, 6 and 8 together with a more detailed analysis of theme 7 - Tackling Non Transport Emissions Sources.

4.1.3 Themes relating to data (theme 4); governance, accountability and delivery (theme 9) and further progress review (theme 10) were not considered likely to have significant environmental effects because they relate to administrative or procedural matters and consequently they have been scoped out of the assessment.

4.1.4 Where any actions identified in CAFS2 themselves give rise to new plans, programmes or strategies, or to new more detailed project proposals, these will themselves be subject to consideration under the relevant statutory assessment and consenting requirements, including the 2005 Act.

## 4.2. Theme 7 - Tackling Non Transport Emissions Sources

4.2.1 This theme provides new policy proposals and supportive measures that focus on domestic (household) burning as well as agriculture, as two sectors not previously addressed in detail in CAFS, but which make an important contribution to air pollution in Scotland.

4.2.2 The consideration of performance and standards for domestic fires, stoves and fuels, and local authority powers to permit and control these, have the potential to deliver significant improvements in air quality beyond current regulatory and management approaches. The development of actions to target agricultural emissions, nitrogen deposition and environmental impacts including a code of good agricultural practice for Scotland has potential to further contribute to positive effects on these topics.

**What are the key environmental pressures relevant to this theme?**

4.2.3 Key environmental pressures relevant to this theme relate to **air, population and human health**, **climatic factors, soil, water, biodiversity** and **material assets.**

4.2.4 Pressures on **air quality** include emissions from domestic and agricultural sources with ammonia declining at a slower rate than other pollutants. Burning fuels for heating negatively affects both indoor and outdoor air quality through the release of combustion particles and gases (such as CO, $CO_2$, $NO_x$). Poor air quality continues to affect human health and the environment in some areas.

4.2.5 Pressures on **population and human health** include poor outdoor and indoor air quality which can also exacerbate existing health conditions with impacts not evenly spread across different demographics and geographies.

4.2.6 **Climate change**-related changes in temperature and atmospheric circulation have the potential to exacerbate poor **air quality** and associated **health** problems. The burning of hard fuels contributes to **climate change** through the emission of greenhouse gasses which also release pollutants such as particulate matter.

4.2.7 Pressures on **soil, water, biodiversity** and **material assets** include land management linked to agricultural practices and associated emissions, including from the release of pollutants such as ammonia.

**What are the likely significant environmental effects of this theme?**

4.2.8 This theme is likely to have **significant positive effects** on **air quality, population** and **human health** and **climatic factors.** New policy to target domestic combustion emissions at a national level combined with support for appliance improvements and education/incentives have the potential to deliver significant improvements in air quality beyond current regulatory and management approaches. The development of a code of agricultural practice to target agricultural emissions has potential to further contribute to positive effects on these topics.

**Actions focusing on domestic combustion emissions**

4.2.9 Actions targeting domestic emissions under this theme include the introduction of legislation to control the supply of the most polluting domestic fuels. Other supportive measures include education/initiatives, working with a range of stakeholders and commissioning research to support emissions reduction. These actions are likely to result in **significant positive effects** on **air quality, population and human health,** and **climatic factors**.

4.2.10 The introduction of legislation to control the supply of the most polluting domestic fuels, which includes a ban on house coal, restricting the sulphur content of smokeless fuels to 2%, and prohibiting the sale of wet wood, also has the potential to lead to **significant positive effects** on **air quality, population and human health** and **climatic factors.** Prohibiting the use of wet wood could lead to a significant reduction in emissions if its use is replaced by dried wood, which has 80% less emissions, including a reduction in sulphur dioxide. In urban areas, it is often the cumulative effect of a number of appliances in a relatively small geographic area which makes a notable contribution to overall emissions, rather than emissions from an individual stove or fireplace.

4.2.11 Actions to encourage the uptake of Ecodesign stoves and the replacement of pre-Ecodesign appliances have the potential to lead to reductions in

particulate matter emissions, which alongside nitrogen oxide and sulphur oxide are the main pollutants resulting from domestic combustion. This is due to the Ecodesign particulate matter limit being 55% lower than the current UK testing regime for exempting appliances for use in Smoke Control Areas (SCAs). This is likely to contribute to **positive effects** for **air quality** and **climatic factors** (due to their intrinsic link) and, as a result, **population and human health.**

4.2.12 Improvements in **air** are likely to be both in relation to outdoor and indoor air quality, including a reduction of nuisance (smoke). This would also serve to improve air quality in areas where solid fuel might not be the main source of heat but where wood burning stoves have been installed as a secondary or amenity heating source.

4.2.13 Future actions to support domestic emission reductions also have the potential to result **in localised positive effects** on **air** and **population and human health** through improved air quality. In addition, measures to support improved energy efficiency of stoves have the potential to lead to a reduction in fuel poverty. Effects associated with the installation of Ecodesign stoves in individual dwellings on **material assets** and, in particular, the built environment, are considered to not be significant.

**Actions focusing on Agricultural Emissions, nitrogen deposition and environmental impacts**

4.2.14 Actions targeting agricultural emissions, nitrogen deposition and environmental impacts under this theme include the development of a voluntary code of good agricultural practice, as well as review, investigation and monitoring of nitrogen deposition and environmental impacts. These actions have the potential to contribute to **positive effects** on **air quality, population and human health, climatic factors**. The development of a voluntary agricultural code also has the potential for **localised positive effects** on **soil, water, biodiversity** and **material assets (land**).

4.2.15 The development of a voluntary code has the potential to increase the efficiency of and to reduce the overall (amount) use of ammonia. Ammonia is a reactive nitrogen compound which is released when slurries, manures and nitrogen fertilisers come into contact with the air. It produces odours and is mobile, combining with acids and particulates, resulting in polluting and nuisance effects. A reduction in ammonia emissions resulting from changes in agricultural practices could contribute to **positive effects** on **air quality** (including odour), **climatic factors** (NOx emissions) and **population and human health** (in relation to air quality effects).

4.2.16 Other actions identified have the potential to result in **localised positive** effects on **soil**, **water**, **biodiversity** and **material assets** (land). For example, a reduction in leaching of N-based fertiliser in watercourses and on land/ soil associated with good agricultural practice, can lead to reduced

levels of N, thus preventing eutrophication and acidification[21], contributing to **localised positive effects** on **biodiversity, water and soil.**

4.2.17 There is also potential for **localised positive effects** in relation to **material assets,** such as land where a code of practice to support nitrogen emissions reductions is implemented. This has the potential to lead to changes in agricultural practices, and as a result increase the efficient use of land. For example, practices which retain as much nitrogen as possible by reducing losses to the atmosphere or leaching in soil and water, can maximise nitrogen use efficiency and thus returns from farm inputs and good practice in managing soil, manure, fertiliser and feed will help reduce ammonia emissions (and other nitrogen losses).

**Does the theme address key environmental problems identified?**

4.2.18 The introduction of legislation to control the supply of the most polluting domestic fuels, which includes a ban on house coal, restricting the sulphur content of smokeless fuels to 2% and prohibiting the sale of wet wood has the potential to lead to **significant positive effects** on **air quality, population and human health** and **climatic factors.** Additional actions identified to support tackling non transport emissions sources (focused on domestic and agricultural emissions) are also likely to contribute to **positive localised effects** for **soil**, **water**, **biodiversity** and **material assets**, contributing to addressing the key environmental pressures identified in section 3.

4.2.19 It should also be noted that in regard to actions that target agricultural emissions reductions, the draft CAFS2 recognises that the most effective measures to reduce these impacts are those which directly reduce emissions of ammonia to the atmosphere, as opposed to attempting to introduce post emissions mitigation. Pre-emissions mitigation strategies can be useful and include separation of sensitive receptors from local sources and the use of shelterbelts to enhance both dispersion through increasing turbulence and capture of ammonia close to source. Pre-emissions mitigation has the potential to mitigate against a range of **localised environmental effects** on both human and ecosystem health and reduce the need for post emissions mitigation.

**Opportunities for Enhancement**

4.2.20 To obtain the maximum environmental benefits **under theme 7 (Domestic emissions)** a focus could be given to urban areas/those outside of existing Smoke Control Areas. This is because urban areas are often recognised as having increased levels of particulate matter pollution and there are

[21] The European Nitrogen Assessment (2011) Mark A. Sutton, Clare M. Howard, Jan Willem Erisman, Gilles Billen, Albert Bleeker, Peringe Grennfelt, Hans van Grinsven and Bruna Grizzetti. Available at: http://www.nine-esf.org/files/ena_doc/ENA_pdfs/ENA_c21.pdf (accessed 10/08/20)

currently limited controls on the installation of domestic wood burners and flues. This can lead to poor air quality and smoke/ odour nuisance.

4.2.21 To obtain the maximum environmental benefits under **theme 7 (agricultural emissions, nitrogen deposition and environmental impacts),** it is recommended that early and targeted action should be focused on practices that can realise multiple environmental benefits. This includes a focus on practices which can deliver both ammonia emission reductions and support the recovery of as much nitrogen as possible. Not only will this reduce agricultural emissions but can contribute to positive localised effects on people, water, soil, biodiversity and material assets.

## 4.3. Wider policy proposals[22]

4.3.1 Wider policy proposals under the draft Strategy do not themselves set out new polices and proposals but in combination these themes can support improved air quality through research and behaviour change (themes 1 and 5), policy integration and application (themes 2 and 6) and by drawing together existing Scottish Government policy to support positive outcomes for air quality across the themes of placemaking and sustainable transport (themes 3 and 8).

**What are the key environmental problems relevant to this theme?**

4.3.2 Key environmental problems relevant to these themes relate to **air, population and human health** and **climatic factors.**

4.3.3 Pressures on **air quality** include emissions from industrial, domestic, agricultural, natural and transboundary sources and poor air quality continues to affect human health and the environment in some areas.

4.3.4 A key pressure on **population and human health** is outdoor air pollution which is known to cause damage to human health across a wide range of conditions and is likely to be more prevalent in highly urbanised areas. Air pollution and the consequent impacts on human health are not evenly spread and disproportionately linked to more vulnerable groups and deprived areas.

4.3.5 **Climate change** has the potential to exacerbate poor air quality and has the potential to exacerbate key pressures on a range of environmental receptors. Air quality and climate change are intrinsically linked as they both arise from broadly the same sources. Key pressures on climate change include greenhouse gas emissions from a range of sectors including transport (37%), agriculture and related land uses (24%), business/Industry (22%), energy (15%), and residential (15%).

[22] themes 1, 2, 3, 5, 6 and 8

**What are the likely significant environmental effects of the wider policy proposals?**

4.3.6 These themes are likely to **cumulatively** contribute to **positive effects** on **air quality, population and human health** and **climatic factors.**

### Actions focusing on research and behaviour change

4.3.7 Actions focusing on further research in relation to public health seek to adopt a precautionary approach which supports continued efforts to reducing preventable air pollution beyond domestic and international air quality standards; this has the potential to contribute to **broad positive effects on climatic factors, air and population and human health**.

4.3.8 For example, actions that support evidence gathering and research on air pollution reduction at a national level can contribute to **positive effects** on **climatic factors**, **air** and **population and human health.** Further actions to consider issues associated with indoor air pollution and population exposure to air pollution have the potential for improved human health in a range of settings/locations.

4.3.9 Proposals relating to behaviour change seek to support the development of complimentary and co-ordinated strategies as a means to deliver required behavioural change outcomes and can contribute to **broad positive effects** on **climatic factors, air and population and human health**.

4.3.10 For example, actions that focus on behaviour change (especially alongside appropriate policy intervention) can support **positive effects** on **air quality** and **population and human health.** This is because public information provision, awareness and behavioural change are interlinked and integral to the delivery of long term sustained change in environmental quality generally, and air pollution specifically.

### Actions focusing on policy integration and application

4.3.11 Policy integration proposals seek to support policy integration across climate change, transport delivery, public health and related polices and as such can contribute to **broad positive effects** on **climatic factors, air and population and human health**.

4.3.12 For example, ensuring the close co-ordination of climate change, transport delivery, public health and related policies has the potential to maximise co-benefits across a number of environmental receptors. Policy integration at national and local levels that targets greenhouse gases and air pollutants share common sources, notably transport, energy generation and land use practices, and will thus benefit from many of the same policy interventions.

4.3.13 By ensuring EU environmental themes remain at the heart of environmental law and policy in Scotland, proposals on industrial emissions

regulation can also contribute to **broad positive effects** on **climatic factors** and **air**.

4.3.14 For example, actions that seek to ensure the continued implementation of EU environmental requirements into domestic legislation are likely to contribute to **positive effects** on **climatic factors** and **air quality**. These requirements have so far demonstrated that controls placed on industry are a proportionate and effective mechanism in the reduction of greenhouse gas emissions.

### Actions drawing together existing placemaking and sustainable transport policy (themes 3 & 8)

4.3.15 Existing place-making proposals seek to embed air quality improvements in placemaking plans and policies, and can contribute to **broad long term positive effects** on **population and human health, climatic factors** and **air.**

4.3.16 Existing placemaking actions such as the use of the Place Standard tool[23] aim to address the accumulation of challenges resulting from historical policies and decisions in relation to the built environment, road layouts and other infrastructure, with the aim of co-delivering improvements in air quality as a by-product of improving the quality of places and ensuring that future developments are future-proofed.

4.3.17 Utilising a version of the Place Standard tool which focuses on improving air quality has the further potential to support localised **long-term positive environmental effects** on **air** and **population and human health**. For example, actions that embed air quality improvements associated with place making (such as co-location of infrastructure/amenities to minimise travel) could contribute to reducing the amount of air pollutants and greenhouse gas emissions resulting from new development.

4.3.18 Existing transport actions which recognises air quality improvements associated with transport plans and polices are also likely to contribute to **broad long term positive effects** on **population and human health, climatic factors** and **air.**

4.3.19 For example, actions under existing legislation such as the Transport (Scotland) Act 2019 promotes the implementation of Low Emission Zones (LEZs) in Scotland's four largest cities and sets out proposals on active and bus travel.

[23] Scottish Government, NHS, Improvement Service, Architecture and Design Scotland, Glasgow City Council (2020) Place Standard Strategic Plan 2020 – 2023. Available at: https://www.placestandard.scot/docs/Place_Standard_Strategic_Plan.pdf (accessed 14/08/20)

4.3.20 Similarly, the new National Transport Strategy (NTS2)[24], published in February 2020, sets out an ambitious and compelling vision for Scotland's transport system for the next 20 years which is underpinned by four priorities – reducing inequalities, taking climate action, helping deliver inclusive economic growth and improving our health and wellbeing.

4.3.21 NTS2 will therefore contribute to the delivery of improved air quality for example through its focus on embracing new technologies, better public transport provision and constraints upon private vehicle use, especially in urban centres where pollution and congestion are most acute. Increasing modal shift to public transport and active travel is also key to further reductions in transport emissions that are recognised as the biggest contributor to air pollution in Scotland.

**Do the themes address key environmental pressures identified?**

4.3.22 Actions identified across the wider policy proposals in the draft Strategy are likely to contribute to addressing the key environmental pressures identified. This is because these themes can support improved air quality through research and behaviour change (themes 1 and 5), policy integration and application (themes 2 and 6) and drawing together existing Scottish Government policies that contribute to air quality across the themes of placemaking and sustainable transport (themes 3 and 8).

**Opportunities for Enhancement**

4.3.23 To obtain maximum environmental benefits across **wider policy proposals** there may be further opportunities to identify alignment with other existing Scottish Government policy. Whilst the SEA findings support the focus on opportunities to integrate primarily climate change, public health and transport policies identified by the draft CAFS2, a consideration of wider Scottish Government policies such as those with a focus on soil health, biodiversity or land use, for example the next iteration of the Land Use Strategy, have the potential to lead to benefits across the wider environment.

4.3.24 Further, in addition to recognising alignment with other existing Scottish Government policy, future actions under CAFS should also take into account experiences from Covid-19. For example, this could be through recognising the need for a green recovery which supports Scotland's emergence from the global pandemic. This may provide opportunities for businesses and organisations as a result of the pandemic to operate differently, and more sustainably. This has potential for additional

[24] Scottish Government (2020) National Transport Strategy 2. Available at: https://www.transport.gov.scot/our-approach/national-transport-strategy/ (accessed 10/08/20)

environmental benefits that can contribute further to improving air quality in the long term.

4.3.25 To obtain the maximum environmental benefits under **health and integrated policy proposals (themes 1 and 2)** a focus could be given to evidence and research focused on urbanised/deprived areas as these are recognised as being more vulnerable to air pollution.

# 5. Summary of Assessment findings, Mitigation and Enhancement

## 5.1. Assessment findings

5.1.1 The draft CAFS2 is likely to have **significant positive effects** on **air quality, population and human health** and **climatic factors.** This is likely to result from new legislative proposals to control the supply of the most polluting domestic fuels coupled with new supportive measures to target domestic emissions.

5.1.2 Actions identified to target agricultural emissions, nitrogen deposition and environmental impacts, including a code of good agricultural practice for Scotland (theme 7) has potential to further contribute to positive effects on these topics. Further, drawing together existing air quality improvement polices and proposals in a co-ordinated way across a range of topic areas including health, planning and transport (themes 2, 5, 6, and 8), can **cumulatively** contribute to **broad positive effects** for **air quality, population and human health** and **climatic factors.**

5.1.3 The potential for effects **in combination** with other PPS has also been considered. The draft CAFS2 has the potential to **positively** and **cumulatively** contribute across a wide range of Scottish Government policy areas. Air quality improvement is captured across a range of national plans, policies and programmes (for example placemaking and sustainable transport policy) and these are recognised within the draft CAFS2.

5.1.4 Taking into account the high level nature of the draft CAFS2, there is a degree of uncertainty regarding the environmental impacts that may arise as a result of future actions targeting domestic and agricultural emissions, nitrogen deposition and environmental impacts (theme 7). The assessment also identifies the potential for **localised positive effects** on the majority of **SEA topics** (**air, population and human health, water, soil, biodiversity and material assets**) as a result of actions undertaken to support the implementation of theme 7. For example, actions focusing on agricultural emissions such as the development of a voluntary code of agricultural practice for improving air quality in Scotland has the potential to realise **localised positive effects on soil, water, biodiversity** and **material assets.** Where any future plans, projects, and proposals are developed as a result of actions identified by CAFS2, these will themselves be subject to consideration in accordance with the requirements of the Environmental Assessment (Scotland) Act 2005.

## 5.2. Mitigation

5.2.1 The 2005 Act requires that 'the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the

environment of implementing the plan or programme' are outlined within the Environmental Report.

5.2.2 The assessment has identified a range of potential environmental effects, and has concluded that the proposals in the draft Strategy would not result in any potential significant negative environmental effects. Therefore, no mitigation measures are identified.

## 5.3. Conclusions and Opportunities for Enhancement

### Conclusions

5.3.1 The SEA findings support the inclusion of **theme 7** as actions associated with targeting domestic and agricultural emissions, nitrogen deposition and environmental impacts go further than CAFS (2015) which focused on transport as the largest source of urban air quality issues. In regard to actions identified to address and support a reduction in domestic combustion emissions, the SEA findings support the introduction of legislation to control the supply of the most polluting domestic fuels. This is because a consistent national approach, as opposed to local approach is likely to have a greater impact on reducing domestic combustion emissions.

5.3.2 In regard to actions targeting agricultural emissions, nitrogen deposition and environmental impacts, the SEA findings support the inclusion of actions that seek to further consider risks associated with ecological effects from nitrogen deposition such as the development of a voluntary agricultural code and research.

5.3.3 Further, and voluntary code of good agricultural practice could be subject to an early review process to assess its effectiveness and compliance. If a review indicates that insufficient progress is made, the need for direct regulatory intervention will be considered. In the event further regulatory intervention was progressed, this SEA can provide a useful starting point in considering opportunities for realising wider environmental benefits.

5.3.4 The SEA findings support the inclusion of **theme 1 and 5** as actions that support research and public engagement and behaviour change can contribute to continued efforts to reduce preventable air pollution and support the delivery of long term sustained change in environmental quality generally, and air pollution specifically.

5.3.5 The SEA findings support the inclusion of **theme 2 and 6** as actions that support strong policy alignment across wider Scottish Government policy objectives. This is because air pollution, climate change, carbon reduction and mobility are strongly interconnected. Effective policy co-ordination across these broad themes, at both central and local government levels, can help to realise multiple environmental benefits.

5.3.6 The SEA findings support the inclusion of **theme 3 and 8** as actions that draw together existing place-making and sustainable transport policy. Embedding place-making principles for example, with a strong focus on nature based solutions, across policy areas can support a cleaner, healthier and more attractive environment. Similarly, sustainable transport policy for example, that promotes active travel has the potential to increase physical activity, significantly reduce cardiovascular incidence and mortality, and has been shown to reduce all-cause mortality. Measures to reduce air pollution from road transport and to increase levels of active travel can therefore amplify benefits to public health.

### Opportunities for enhancement

5.3.7 Opportunities for enhancement have been identified in relation to themes 7 (Tackling Non-Transport Emissions Sources), 1 (Health) and 2 (Integrating policy); and the wider policy proposals.

5.3.8 To obtain maximum environmental benefits **under theme 7 (Domestic emissions)** a particular focus could be given to urban areas/ those outside existing Smoke Control Areas as a means to realise greatest impact.

5.3.9 To obtain the maximum environmental benefits **under theme 7 (agricultural emissions, nitrogen deposition and environmental impacts),** it is recommended that early and targeted action should be focused on agricultural practices that can realise multiple environmental benefits. This includes a focus on practices which can deliver both ammonia emission reductions and support the recovery of as much nitrogen as possible. Not only will this reduce agricultural emissions but can contribute to positive localised effects on people, water, soil, biodiversity and material assets.

5.3.10 To obtain the maximum environmental benefits under **health and integrated policy proposals (themes 1 and 2)** a focus could be given to evidence and research focused on urbanised/deprived areas as these are recognised as being more vulnerable to air pollution.

5.3.11 To obtain maximum environmental benefits across the **wider policy proposals**, there may be further opportunities to identify alignment with other existing Scottish Government policy and to apply lessons learnt from COVID-19 as a means to further support improved air quality.

# 6. Monitoring

6.1.1 Section 19 of the 2005 Act requires the responsible authority to monitor the significant environmental effects of the implementation of the PPS. This should be done in a way to enable them to identify any unforeseen adverse effects at an early stage, and to take appropriate remedial action where relevant.

6.1.2 The consultation draft CAFS2 recognises that air pollution, climate change, carbon reduction, and mobility are strongly interconnected. A wide range of existing programmes are already in place at the national and local level to report on environmental status and assess performance against relevant environmental indicators. These include the annual greenhouse gas emissions reporting which covers sectoral emissions, as well as monitoring associated with the Annual Energy Statement introduced by the Energy Strategy. At a local level, air pollution monitoring across Scotland is also relevant.

6.1.3 An important addition to the existing reporting landscape will also be the statutory requirement, established by the Climate Change (Reduction Emissions Targets) (Scotland) Act 2019, for annual publication (and laying in Parliament for scrutiny) of separate monitoring reports on progress to delivering each sectoral chapter of Climate Change Plans. The first set of such reports is required in May 2021 and will help Ministers and stakeholders to understand areas where the Plans are on track and areas where more effort may be needed.

6.1.4 Further, given that the draft CAFS2 draws together existing plans, programme and strategies that will contribute to improved air quality, monitoring of these PPS will also be relevant. For example, the finalised monitoring and evaluation framework for the National Transport Strategy (identified under theme 8) will provide an opportunity to measure and report annually on performance at a national, and where possible, regional and local levels.

6.1.5 An annual progress report has been published for each year of the current CAFS (2015 – 2020). An enhanced and strengthened annual performance report has been proposed as part of CAFS2 and will also be accompanied by the convening of a CAFS2 Delivery Group which will be provided with a clear remit, including the authority and defined procedures to ensure that the actions in the new strategy are effectively delivered, and a description of how its advice is conveyed to the Scottish Ministers. The Delivery Group will also need clear targets and Key Performance Indicators. It is therefore proposed that the monitoring for SEA purposes is an integral part of the monitoring of the strategy.

# 7. Consultation and Next Steps

7.1.1 Public views and comments are invited on both this Environmental Report and the draft CAFS2 to which it relates. Details of how to respond are provided below.

| **When can I respond?** |
|---|
| Respondents are asked to submit responses to this Environmental Report directly to the Scottish Government by closing date of 22 January 2021. |
| **How can I respond?** |
| • **Online:** You can respond online using the Scottish Government's consultation platform, Consultation Hub, at: https://consult.gov.scot/environmental-quality/cleaner-air-for-scotland-2<br>Consultation Hub allows you to save and return to your responses while the consultation is still open. A copy of your final response will be emailed to you.<br>• **By Email:** air.quality@gov.scot<br>• **By post:** Cleaner Air for Scotland 2, Environmental Quality Unit, Directorate for Environment and Forestry, Scottish Government, Victoria Quay, Edinburgh EH6 6QQ |
| **How will responses be considered?** |
| Following the consultation, a Post-Adoption Statement will be prepared. The Statement will reflect on the views provided on the findings of the assessment and the proposals in the Consultation Paper and will explain how the issues raised have been taken into account in finalising the Strategy. |
| **Consultation Questions on the Environmental Report** |
| Respondents may find the following questions helpful to provide a focus for their responses to this Environmental Report. Please note that responses do not need to be limited to these questions, and more general comments on this Environmental Report and the proposals set out in the Consultation Paper are also invited. |
| 1. What are your views on the accuracy and scope of information used to describe the environmental baseline set out in the Environmental Report?<br>2. What are your views on the predicted environmental effects as set out in the Environmental Report?<br>3. What are your views on the findings of the SEA and the proposals for mitigation and monitoring the environmental effects set out in the Environmental Report? |

# Appendix A. Environmental Baseline

## Air quality

The air that we breathe is fundamental to human life and the quality of our environment. The quality of life lived is placed at both short and longer term risk by poor air quality. In Scotland today, whilst industrial, domestic, agricultural, natural and transboundary pollution are all important air pollution sources, emissions from transport in urban areas remain the single biggest issue of concern.

Types of pollutants and sources include:

- **Particulates PM10 and PM2.5** - There are a number of AQMAs across Scotland designated due to an exceedance of the Scottish annual mean objective for PM10. Main sources include combustion coal, solid fuel and diesel and road transport.
- **Oxides of nitrogen** - All high temperature combustion processes in air produce nitrogen oxides primarily from transport emissions but also energy generation, manufacturing and heating.
- **Ground level ozone** - A secondary pollutant arising as a result of chemical reactions between various air pollutants, primarily oxides of nitrogen and volatile organic compounds (VOCs), initiated by strong sunlight.
- **Ammonia** - a result of agricultural activities such as decomposition and volatilisation of animal wastes, including livestock manure / slurry management and spreading.
- **Sulphur dioxide** - Primarily from combustion of fuels containing sulphur, such as coal and heavy fuel oils used in energy generation.
- **Volatile organic compounds** – Primarily a result of road transport, the manufacturing industry and domestic combustion, solvent manufacturing and use, petrol distribution and handling energy generation, refineries and industry.

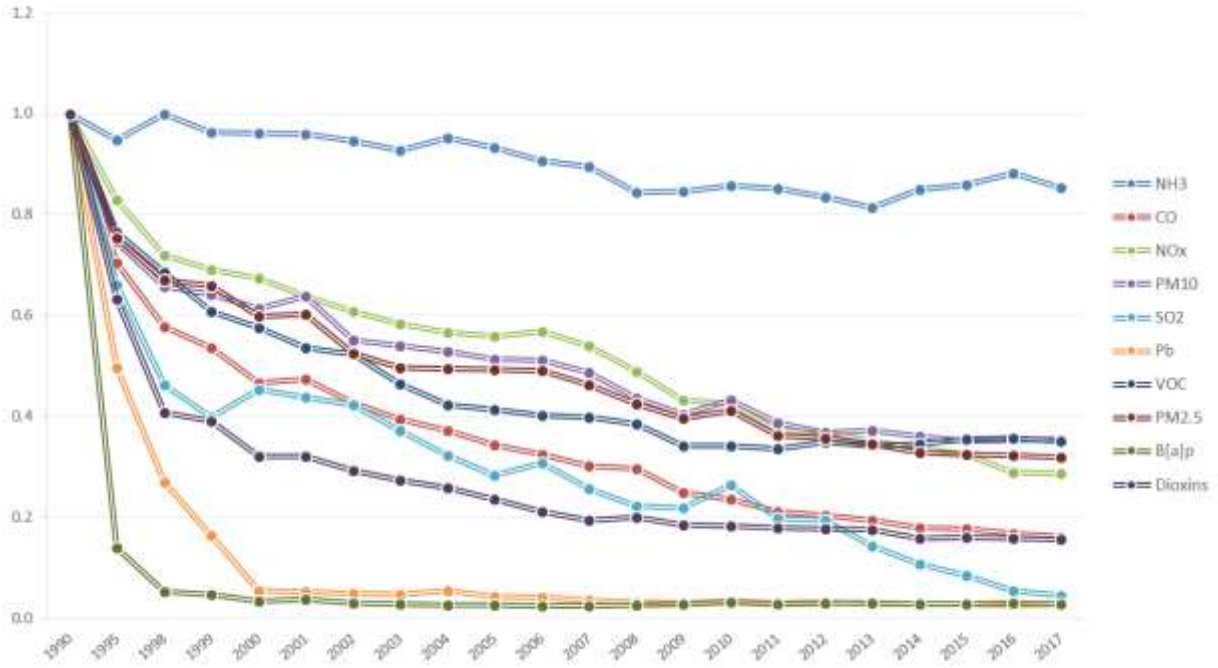


**Figure 2. Main pollutant emissions in Scotland - 1990 - 2017**

*Source: Scotland's Environment Web*

Emissions of the eight main air pollutants are lower in 2017 than they were in 1990. This rate of decline is relatively similar for particulate matter (PM10 and 2.5), oxides of nitrogen (NOx), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO2) and carbon monoxide (CO). Lead (Pb) shows a much higher rate of reduction from 1990 to 2000 coinciding with the phase-out of leaded petrol from 2000, while ammonia ($NH_3$) emissions have declined at a slower rate than other pollutants[25].

In regard to the domestic environment, since 2005 there has been an increase in emissions from the domestic sector due to an increase in popularity of open fires and wood burning stoves[26]. Approximately 38% of UK primary particulate matter emissions come from burning wood and coal in domestic open fires and solid fuel stoves. This compares with industrial combustion (16%) and road transport (12%)[27].

Trade sources suggest that c. 80 Ktonnes of coal is burned in Scottish homes. This is a significant contributor to PM2.5 due to the high particulate output of coal

[25] National Atmospheric Emissions Inventory (2019) Air Pollutant Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2017. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1910031755_DA_Air_Pollutant_Inventories_1990-2017_Issue_1.1.pdf (accessed 11/03/2020)

[26] DEFRA (2018) Consultation on the cleaner domestic burning of solid fuels and wood [online]. Available at: https://consult.defra.gov.uk/airquality/domestic-solid-fuel-regulations/ (accessed 11/02/2020)

[27] ibid

compared to approved smokeless fuels. Non-approved fuels also account for significant SO2 emissions and such fuels range up to c.7% in sulphur content.[28]

The National Atmospheric Emissions Inventory data (NAEI) for Scotland shows a continuous reduction in PM2.5 over recent years to below WHO recommended limits. In Scotland, research commissioned by DEFRA[29]showed that emissions from wood burning in UK cities, including Glasgow, Edinburgh and Dundee were going down between 2009 and 2015. This was against a background of increasing stove sales. The main reason given for the drop in emissions is the replacement of open fires and older stoves with more modern appliances that produce lower amounts of particulate matter (PM10 and PM2.5).

Ammonia is also recognised as a key air pollutant that can have effects on both human health and the environment. For example, ammonia deposition can lead to the acidification of soil and water which can degrade the natural environment. Ammonia deposition can also result in excessive nitrogen being supplied to sensitive habitats which can reduce biodiversity.

Emissions of some key pollutants in Scotland are EU compliant and some are already below World Health Organisation (WHO) guideline values, but there are both some general and some localised and periodic poor air quality areas which require urgent attention and action[30]. Where air standards are not being met, local authorities in Scotland have set up Air Quality Management Areas (AQMAs) to help reduce pollution. There are currently 38 AQMAs across Scotland's 32 Local Authorities and these have been established primarily as a result of road traffic emissions. Compared to 1990, in 2017 there were reductions in emissions across all air pollutants, including ammonia (15%), $PM_{10}$ (63%), $PM_{2.5}$ (68%), NMVOC (65%), nitrogen oxides (71%), carbon monoxide (84%) and sulphur dioxide (96%). [31]

Finally, studies are emerging which explore the effect of the COVID-19 pandemic currently being experienced. Time variance analysis of air quality in Scotland during COVID-19 lockdown shows that $NO_2$ and particulate matter emissions experienced significant drops. Figures for the period March - May 2020 show a decrease of between 51% and 81% in relation to $NO_2$ emissions compared to previous years. Particulate matters emissions have also seen a significant reduction with $PM_{2.5}$ down

[28] Scottish Government (2019) Cleaner Air for Scotland Strategy – An Independent Review – Final report to the Scottish Government Annex 6. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/independent-report/2019/08/cleaner-air-scotland-strategy-independent-review/documents/cleaner-air-scotland-strategy-review-report-annexes/cleaner-air-scotland-strategy-review-report-annexes/govscot%3Adocument/cleaner-air-scotland-strategy-review-report-annexes.pdf (accessed 06/02/2020)

[29] DEFRA (2017) Airborne particles from wood burning in UK cities (King's College London and National Physical Laboratory). Available at: https://uk-air.defra.gov.uk/library/reports?report_id=953 (accessed 12/03/20)

[30] Scottish Government (2019) Cleaner Air for Scotland Strategy – An Independent Review – Final report to the Scottish Government. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/pages/2/ (accessed 06/02/2020)

[31] National Atmospheric Emissions Inventory (2019) Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2017. Available at https://naei.beis.gov.uk/reports/reports?report_id=996 (accessed 28/10/19)

between 0% and 56%, and $PM_{10}$ by between 9% and 53% compared to previous years. These changes have been likely associated with the drop in road traffic within Scotland's cities. [32]

**Key Pressures**

- Key pressures on air quality include emissions from transport, industrial, domestic, agricultural, natural and transboundary sources.
- In urban areas, transport emissions are the biggest source of air pollution.
- Emissions of the majority of air pollutants have declined in recent years, with ammonia declining at a slower rate than other pollutants.
- Ammonia is recognised as a key air pollutant that can have significant effects on both human health and a detrimental impact on soils, water and biodiversity.
- Poor air quality continues to affect human health and the environment in some areas.

## Population and human health

Scotland has a population of around 5.4 million people with a population density among the lowest in Europe despite significant variation between highly urbanised areas in the Central Belt and rural and island areas. Scotland's population is expected to rise to approximately 5.7 million by 2041. Life expectancy has also generally increased across Scotland since 1981 with life expectancy of 75.3 years for males and 77.1 years for females. However, life expectancy in Scotland remains lower than the UK average and is the lowest of all UK constituent countries for both males and females.[33]

The Scottish Index of Multiple Deprivation (SIMD), which identifies small concentrations of multiple deprivation across all of Scotland, shows that the 15% most deprived data zones in Scotland are located predominantly in urban areas, including Glasgow, Dundee, and Edinburgh.[34]

Outdoor air pollution is widely accepted as causing damage to human health, from pre-birth to old age and air pollution globally is recognised as the most serious of all

[32] Ricardo (2020) Scottish Air Quality website: COVID19 lockdown - Time Variance analysis of air quality in Scotland. Available at: http://www.scottishairquality.scot/assets/documents/news/COVID19%20lockdown%20-%20Time%20Variance%20analysis%20of%20air%20quality%20in%20Scotland%20-%2027-05-2020.html

[33] National Records of Scotland (2019) Mid-2018 population estimates Scotland. Available at: https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/mid-2018 (accessed 30/09/19)

[34] Scottish Government (2016) The Scottish Index of Multiple Deprivation [online]. Available at: https://www2.gov.scot/Topics/Statistics/SIMD (accessed 30/09/19)

environmental health problems[35]. Particulate matter (PM), NO2, SO2 and O3 are the most harmful pollutants to human health with studies showing that prolonged exposure to lower levels of these pollutants can have a more detrimental impact on health than exposure to high peak pollution events. Poor air quality is associated with both short and long-term adverse effects on human health, including irritation of the respiratory system and the exacerbation of existing health conditions, particularly heart disease and respiratory illnesses in vulnerable individuals.[36]

In 2016, the level of PM2.5 was associated with an estimated equivalent number of attributable deaths across Scotland of 1,724. This is a decrease compared to the estimation of 2,070 in 2010 and is associated with the reduction of PM2.5 concentrations from 6.8 µg/m3 to 5.2 µg/m3 between 2010 and 2016. In addition, highly urbanised areas, such as Dundee, Edinburgh, Glasgow and Aberdeen were found to have higher concentrations of particulate matter in comparison with rural locations such as the Western Isles.[37]

In terms of indoor air pollution, the World Health Organisation (WHO) estimated that in 2017 up to 117,000 (early) deaths each year in Europe could be attributable to indoor air pollution; including up to 3% of all heart disease, 3% of chronic pulmonary disease, 3% of stroke and 2% of lung cancer fatalities[38].

Sources of indoor air pollutants differ by setting (e.g. home, school, workplace). Key sources include combustion particles and gases (CO, CO2, NOx) from burning fuels for heating and cooking and from tobacco smoke; chemicals used for cleaning and disinfection; perfumed products; chemicals, including volatile organic compounds (VOCs) released from building materials, furniture, fixtures and fittings such as carpets and wall coverings[39].

The degree of correlation between indoor and outdoor air quality depends on physical factors such as the rate of air exchange. However, buildings are increasingly being designed to reduce active heating needs and associated carbon

[35] Scottish Government (2019) Cleaner Air for Scotland Strategy – An Independent Review – Final report to the Scottish Government. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/pages/2/ (accessed 06/02/2020)

[36] Health Protection Scotland (2014) Air Quality (PM2.5 particulate air pollution) and Mortality in Scotland: Briefing paper. Available at: https://hpspubsrepo.blob.core.windows.net/hps-website/nss/1745/documents/1_air-quality-and-mortality-2014-04.pdf (accessed 03/10/19)

[37] Health Protection Scotland (2018) Air Pollution & Health Briefing Note Mortality associated with exposure to fine particulate matter (PM2.5 attributable mortality) in Scotland. Available at: https://www.hps.scot.nhs.uk/web-resources-container/air-pollution-and-health-briefing-note-mortality-associated-with-exposure-to-fine-particulate-matter-pm25-attributable-mortality-in-scotland/ (accessed 28/10/19)

[38] WHO (2017) Preventing noncommunicable diseases (NCDs) by reducing environmental risk factors. Available at: https://www.who.int/quantifying_ehimpacts/publications/preventing-ncds/en/ (accessed 12/03/20)

[39] WHO (2010) Guidelines for indoor air quality. Chemical indoor air pollutants: selected pollutants. Available at: https://apps.who.int/iris/handle/10665/260127 (accessed 12/03/20)

emissions, by making them more air tight which has the potential to lead to pollution remaining in the occupied space[40].

Air pollution and the consequent impacts on human health are not evenly spread and exposure can fall disproportionately on disadvantaged or vulnerable populations; typically, people living in more deprived areas, those with pre-existing health problems, the very young and the old. Air pollution in Scotland is often worse in inner city deprived areas, worsening existing inequalities in local environmental quality and human health.[41]

Climate change also has the potential to impact on air quality and associated human health, for example through exacerbating poor air quality and associated health problems.

**Key Pressures**

- Key pressures on population and human health include outdoor air pollution which is known to causes damage to human health across a wide range of conditions.
- Highly urbanised areas are likely to have higher concentrations of pollution than rural locations.
- Early deaths and other health impacts can be associated with indoor air pollution with sources differing by setting but including emissions from burning fuels for heating and cooking.
- Air pollution and the consequent impacts on human health are not evenly spread and disproportionately linked to more vulnerable groups and deprived areas.
- Climate change has the potential to exacerbate poor air quality and associated health problems.

## Climatic factors

Air quality and climate change are intrinsically linked as they both arise from broadly the same sources. For example, road transport makes up 68% of transport

[40] Scottish Government (2019) Cleaner Air for Scotland Strategy – An Independent Review – Final report to the Scottish Government. Available at: https://www.gov.scot/publications/cleaner-air-scotland-strategy-independent-review/pages/2/ (accessed 06/02/2020)

[41] Scotland's Environment Web (2017) Air quality [online]. Available at: https://www.environment.gov.scot/our-environment/air/air-quality/ (accessed 30/09/19)

greenhouse gas emissions and is also a source of a number of air pollutants such as particulate matter and nitrous oxides.[42]

The global climate is changing. Since the 1880s, human activity has led to a significant increase in atmospheric greenhouse gas emissions and global warming. This has resulted in an increase in the average temperature of the atmosphere and oceans; a reduction in snow and ice cover; and sea level rise. At the UK level, there was a 4% increase in rainfall for in the period 2008 – 2017 compared to 1850 – 1900, as well as a 1°C increase in temperature and a 16 cm rise in sea level. In Scotland, the period 2008 – 2017 was an average of 0.7°C warmer than 1961 – 1990 and had fewer days of air and ground frost. An increase in precipitation (11%) has been observed for the same period. The amount of rain from extremely wet days across the UK has also increased by 17% with the biggest observed changes seen in Scotland.[43]

Key pressures on climate change include greenhouse gas emissions from a range of sectors with the highest contributors being the transport sector (excluding international aviation and shipping) (12.9 MtCO2e), agriculture and related land uses (7.5 MtCO2e), business (8.4 MtCO2e), energy supply (6.8 MtCO2e), and the residential sector (16.2 MtCO2e). Relatively minor contributions were reported for public sector buildings, industrial processes, and waste management. Land use, land use change and forestry was a net carbon sink and contributed to reducing emissions by approximately 5.4 MtCO2e in 2018. [44] In general, climate change projections suggest observed climate trends will continue to intensify in the future, including:

- an increase in both summer and winter average temperatures across both low and high emission scenarios;
- drier summers and wetter winters;
- increase in sea level and coastal erosion;
- an increase in the intensity of rainfall; and

[42] Transport Scotland (2018) Scottish Transport Statistics No 37 2018 Edition. Available at: https://www.transport.gov.scot/publication/scottish-transport-statistics-no-37-2018-edition/sct01193326941-16/ (accessed 30/09/19)

[43] Met Office (2018) UK Climate Projections 2018: Overview Report. Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf (accessed 01/10/19)

[44] Scottish Government (2020) Scottish greenhouse gas emissions 2018. Available at: https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2017/ (accessed 19/06/20)

- increased risk of flooding, drought, and extreme weather events.[45, 46]

While warmer summers could lead to increases in productivity in some cases (e.g. forestry) due to the fact nitrogen and water are not limiting factors, a warmer climate can negatively impact wider ecosystem services – e.g. increase the spread of pathogens and impacts on biodiversity. Climate change can also have an impact on air pollution patterns and exacerbate negative effects on population and human health in relation to air quality.[47] Population and human health vulnerabilities to climate change, such as ones due to higher temperatures and an increase in extreme weather events, can further compound the negative effects on human health as a result of air pollutants (e.g. respiratory conditions). [48] European studies on heatwave episodes have consistently shown a synergistic effect of air pollution and high temperatures and their impact on human health. In addition to this, allergen patterns are changing as a result of climate change and air pollution can modify pollens' allergenic potential, particularly in the presence of specific weather conditions. This can all have consequences for population and human health and more specifically allergic respiratory conditions.[49]

Finally, climate change could affect air quality at different scales through changes in chemical reaction rates, boundary layer heights affecting vertical mixing of pollutants, as well as changes to airflow patterns.[50]

[45] Met Office (2018) UK Climate Projections 2018: UKCP18 Climate Change Over Land. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-infographic-headline-findings-land.pdf (accessed 03/10/19)

[46] CCC (2017) UK Climate Change Risk Projections 2017 Evidence Report, Summary for Scotland. Available at: https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/national-summaries/scotland/ (accessed 28/10/19)

[47] Kan et al. (2012) Ambient air pollution, climate change, and population health in China, *Environment International, Volume 42, pages 10 – 19.* Available at: https://doi.org/10.1016/j.envint.2011.03.003 (accessed 08/04/20)

[48] D'Amato et al. (2013) Climate change, air pollution and extreme events leading to increasing prevalence of allergic respiratory diseases, *Multidisciplinary Respiratory Medicine.* Available at: https://link.springer.com/article/10.1186/2049-6958-8-12 (accessed 08/04/20)

[49] De Sario et al. (2013) Climate change, extreme weather events, air pollution and respiratory health in Europe. *European Respiratory Journal 42: 826-843.* Available at: https://erj.ersjournals.com/content/erj/42/3/826.full.pdf (accessed 08/04/20)

[50] Ebi and McGregor (2008) Climate Change, Tropospheric Ozone and Particulate Matter, and Health Impacts. *Environmental Health Perspectives 116:11.* Available at: https://doi.org/10.1289/ehp.11463 (accessed 08/04/20)

## Key Pressures

- Air quality and climate change are intrinsically linked as they both arise from broadly the same sources.
- Key pressures on climate change include greenhouse gas emissions from a range of sectors including transport (37%), agriculture and related land uses (24%), business/Industry (22%), energy (15%), and residential (15%).
- Climate change has the potential to exacerbate key pressures on a range of environmental receptors
- Climate change could alter current patterns and concentrations of air pollution.
- Key inter-related climate change risks include:
  - flooding and coastal change risks to communities, businesses and infrastructure
  - high temperature-related risks to health, well-being and productivity
  - shortages in the public water supply, agriculture, energy generation and industry
  - risk to natural capital, including terrestrial coastal, marine and freshwater ecosystems, soils and biodiversity
  - domestic and international food production and trade
  - new and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals.

## Soil

Air and soil quality are linked through common sources of pollution. Scotland has a diverse range of soils, generally more organic, more acidic, more leached and wetter than those of most other European countries. Over 25% of Scotland is used for arable crops (mostly in the eastern half of the country) and improved grassland, mostly on the more mineral soils of the central belt and in lowland areas and predominantly found in the south west. The remainder of the country is occupied by semi natural habitats over more organic soils with over 20% of Scotland being cover in peatland habitat on peat soils. [51]

Soil is a non-renewable resource which supports a wide range of functions and provides many environmental, economic and societal benefits including[52]:

- Providing the basis for food and biomass production;
- Storing carbon and maintaining the balance of gases in the air as a major store of terrestrial carbon;

[51] NATURESCOT (2020) Response to Revised Clean Air for Scotland Scoping Report.
[52] Natural Scotland, Scottish Government (2011) The State of Scotland's Soil: Available at: https://www.sepa.org.uk/media/138741/state-of-soil-report-final.pdf (accessed 2/04/20)

- Providing raw materials such as the use of sand and sand gravel in construction and use of peat as a fuel;
- Providing valued habitats and sustaining and supporting biodiversity;
- Controlling and regulating environmental interactions such as water flow and quality;
- Preserving cultural and archaeological heritage by providing records and protective cover;
- Providing a platform for buildings and roads but therein largely losing its capacity to carry out other functions.

Soil quality is defined as the ability of soil to carry out these functions[53]. The concept of ecosystems services has similarities to soil function but with a stronger human dimension by identifying the benefits that soils provide to society. Soils contribute to all four types of ecosystem services such as food provision, fibre and raw material (a provisioning service), provision of clean water (a regulating service), protects and is part of Scotland's cultural heritage (a cultural service) and soil formation itself (a supporting service).[54]

Key pressures on soil include changes in land use and management and soil pollution and contamination. Changes in land use and management can result in change in soil organic matter which impacts on soil health and its ability to hold carbon, water, nutrient and contaminants, and sustain biodiversity. Soil Organic matter underpins most of the fundamental soil properties and soil functions. Loss of soil and degradation of the soil surface conditions of existing soils or soil reinstated following planning activities directly impact on soil health. Soil pollution and contamination can be locally significant and threats to soil can be exacerbated by misuse of chemicals; waste management and recycling operations during development[55].

Generally, the addition of nitrogen has a positive effect on soil quality of agricultural soils, because it enhances soil fertility and conditions for crop growth. However, it generally has a negative effect on soil quality of natural soils, because it results in changes in plant diversity. Soil acts as a filter and buffer for nitrogen, protecting water and atmosphere against nitrogen pollution. However, the filter and buffer capacity of
soils is frequently exceeded by excess of nitrogen use in both agricultural and natural soils, which results in emission of nitrogen to the wider environment.[56]

[53] Scottish Government (2009) The Scottish Soil Framework [online]: https://www.gov.scot/publications/scottish-soil-framework/

[54] Natural Scotland, Scottish Government (2011) The State of Scotland's Soil [online]: https://www.sepa.org.uk/media/138741/state-of-soil-report-final.pdf

[55] SEPA (2019) Guidance on consideration of soil in Strategic Environmental Assessment [online]. Available at: https://www.sepa.org.uk/media/162986/lups-sea-gu2-consideration-of-soil-in-sea.pdf (accessed 06/04/20)

[56] The European Nitrogen Assessment (2011) Mark A. Sutton, Clare M. Howard, Jan Willem Erisman, Gilles Billen, Albert Bleeker, Peringe Grennfelt, Hans van Grinsven and Bruna Grizzetti. Available at: http://www.nine-esf.org/files/ena_doc/ENA_pdfs/ENA_c21.pdf (accessed 10/08/20)

Key pressures on soil can be compounded by the effects of climate change which can contribute to both erosion and compaction. For example, the risk of water-based soil erosion is expected to increase as a result of projected increases in the frequency and intensity of heavy rainfall events resulting from climate change.

**Key Pressures**

- Air and soil quality are linked through common sources of pollution.
- Changes in land use and management can result in change in soil organic matter which impacts on soils ability to perform its range of functions.
- Soil pollution and contamination can be locally significant and threats to soil can be exacerbated by mis-use of chemicals; waste management and recycling operations during development.
- Ammonia deposition linked to modern agricultural practice can lead to the acidification of soil negatively impacting biodiversity.
- Key pressures on soil can also be compounded by the effects of climate change which can contribute to both erosion and compaction.

## Water

Scotland's water environment is a valuable resource, providing a range of benefits such as the provision of water for drinking, industry (e.g. fisheries and hydropower development) and recreation. Scotland's waters also support a diverse range of habitats, containing a number of nationally and internationally important species. Scotland has approximately 125,000 km of rivers, 25,500 lochs over an area of 2,000 $km^2$, 49 estuaries covering 1,000 $km^2$, 19,000 km of coastline accounting for 48,000 $km^2$, and 462,000 $km^2$ of offshore water found across Scotland and its marine territory. While covering only approximately 2% of Scotland's land area, rivers and lochs contain 90% of the UK's surface freshwater.[57]

Significant reductions in pollution have been realised over the last 25 years. Overall, in 2018 65.7% of Scotland's groundwater and surface water bodies were at good or better status, a slight increase since 2017[58]. Almost two thirds of lochs surveyed are

[57] Scottish Government (2016) Key Scottish Environment Statistics 2016. Available at: https://www.gov.scot/publications/key-scottish-environment-statistics-2016-9781786525505/pages/7/ (accessed 03/10/19)

[58] SEPA (2018) State of Scotland's Water Environment 2018 Summary Report. [online]: https://www.sepa.org.uk/media/484107/state-of-scotlands-water-environment-2018-summary-report.pdf

also in good or high condition and nearly 80% of ground water bodies in Scotland are in good condition.[59]

Key pressures currently affecting the condition of rivers and lochs in Scotland are man-made barriers to fish migration, physical changes to beds and banks and rural diffuse pollution. Groundwater quality is affected by diffuse pollution from rural sources and discharges from industry such as mining and quarrying whereas groundwater flows and levels are affected by agricultural irrigation and industry. [60]

Diffuse pollution which can result from atmospheric deposition due to activities such as fertiliser use, can have an effect on both air and water quality. Heightened nitrogen concentrations can cause the acidification and eutrophication of water bodies. Eutrophication occurs when the concentrations of otherwise limiting nutrients increase, allowing aquatic plants and algae to grow unchecked and depleting oxygen levels. [61]

**Key Pressures**

- Key pressures on water in some areas include changes to water flows and levels resulting from land use change, invasive species, poor water quality and overall ecological condition.
- Atmospheric deposition associated with activities such as fertiliser use can have an effect on both air and water quality.
- Key pressures on freshwater include physical changes to beds and banks and rural diffuse pollution.
- Similarly to soil, ammonia deposition can lead to the acidification of water, negatively impacting biodiversity, flora and fauna.
- Groundwater quality can be affected by diffuse rural pollution, whereas groundwater flow and levels can be affected by agricultural irrigation and industry.

## Biodiversity, flora and fauna

Scotland's landscape and habitats are diverse in nature and range from uplands, wetlands, grasslands, forests and woodlands, to the Scottish coast and marine environment, as well as terrestrial water bodies and river systems. These

[59] Scotland's Environment (2016) Scotland's freshwater [online]. Available at: https://www.environment.gov.scot/our-environment/water/scotland-s-freshwater/ (accessed 03/10/2019)

[60] ibid

[61] SEPA (2019) Consideration of water in Strategic Environmental Assessment. Available at: https://www.sepa.org.uk/media/162987/lups-sea-gu3-consideration-of-water-in-sea.pdf (accessed 16/12/19)

ecologically complex landscapes and habitats are home to approximately 90,000 flora, fauna and microbial species.

Designated protected areas include 1,423 Sites of Special Scientific Interest (SSSI)[62], 51 Ramsar Sites[63], 153 Special Protection Areas (SPAs)[64], and 244 Special Areas of Conservation (SAC)[65]. The UK Biodiversity Action Plan also identified 39 priority habitats and 197 priority species that either occur or are known to have occurred in Scotland in recent times, which later helped to inform the scope and focus of Scotland's Biodiversity Strategy. In addition, many undesignated areas such as urban parks and gardens contain a variety of habitats and ecosystems that are important biodiversity assets[66].

Key pressures on biodiversity include pollution, the spread of invasive species and wildlife disease, land use intensification and modification, pollution and climate change.

Damage caused by air pollution to biodiversity may be less obvious and more difficult to quantify but poor air quality can cause damage to plants and animals, impact on biodiversity through its contribution to eutrophication, acidification and otherwise damaging sensitive habitats. This can result in species loss, habitat composition changes and increased sensitivity of organisms to environmental stresses.

Pollution from industry, agriculture and transport impacts on air quality and sensitive habitats across Scotland. In March 2019, 78.9% of protected nature sites were in favourable overall condition[67]. The most recent report on trends in critical load and critical level exceedances in the UK shows improving trends for many pollutants, with the exception of ammonia. A notable proportion of habitats are at still risk, for example excess nitrogen deposition is reported on 40.8% of sensitive habitats, and more than 60% of designated sites in Scotland experience exceedance of nutrient nitrogen for one or more features. At a UK level, Scotland has shown the greatest

[62] NATURESCOT [undated] Special Sites of Scientific Interest [online]. Available at: https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/ramsar-sites (accessed 16/12/19)

[63] NATURESCOT [undated] Ramsar sites [online]. Available at: https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/ramsar-sites (accessed 16/12/19)

[64] NATURESCOT (2019) Special Protected Areas [online]. Available at: https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/natura-sites/special-protection-areas-spas (accessed 16/12/19)

[65] JNCC (2019) SACs in Scotland [online]. Available at: https://sac.jncc.gov.uk/site/scotland (accessed 16/12/19)

[66] Scottish Natural Heritage (2017) Urban habitats [online] Available at: https://www.nature.scot/habitats-and-ecosystems/habitat-types/urban-habitats (accessed 08/12/2019)

[67] Scottish Government (2019) National Performance Framework: Measuring Progress – Environment – Condition of protected nature sites. Available at: https://nationalperformance.gov.scot/measuring-progress/national-indicator-performance (accessed 07/10/19)

improvements in the area of N-sensitive habitats with critical load exceedance falling by almost one-third from 59.4% in 1995-97 to 40.8% in 2014-16. [68]

The impact of nitrogen emissions on sensitive habitats in particular is well-documented, and is a significant threat to biodiversity in Scotland. Nitrogen emissions from combustion plants, intensive agriculture and transport causes acidification, eutrophication and direct tissue damage to plants. Most natural plant communities are adapted to low nitrogen levels and an excess causes shifts in species composition towards a less diverse assemblage of plants and the direct loss of sensitive species, such as lichens and bryophytes for which Scotland has international renown. Recent research commissioned by Scottish Natural Heritage [69] which looked at changes in floristic composition from repeat surveys, has shown nitrogen deposition to be a key driver of change across a wide range of habitats in Scotland. The Scottish uplands are particularly sensitive due to rainfall depositing nitrogen from a variety of sources over a wide area.

In the period 2015 – 2017, the percentage of SACs with critical load in relation to nutrient nitrogen exceedance decreased between 1996 and 2016 was 36.3%, while the ones for SPAs and SSSIs was 48.8% and 49.6% respectively. Scotland has seen the largest reduction in the area of acid-sensitive habitats with exceedance of acidity critical loads – this has fallen by two thirds from 68.2% (32,774 $km^2$) in 1996 to 22.7% (10,933 $km^2$) in 2016. Similar trends were observed in relation to habitats at risk from eutrophication. At the same time, less than 0.5% of sites that have a conservation designation in Scotland currently receive ammonia concentrations above the critical level of 3 µg m-3 anywhere across a site – this is lower than elsewhere in the UK. While these figures have declined since 1995 and compare favourably with other parts of the UK, they represent a significant proportion of Scotland's natural environment and wildlife habitat.[70]

Some of the spread of invasive species and wildlife disease can be attributable to a growing global trade of plants and animals. Land use intensification, modification and overgrazing can lead to a reduction of diversity, quality and connectivity of landscapes and habitats.

[68] Natural Environment Research Council (2018) Trends Report 2018: Trends in critical load and critical level exceedances in the UK report to Defra. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1905230854_Trends_Report_2018.pdf (accessed 12/12/2019)

[69] Scottish Natural Heritage (2019) NATURESCOT Research Report 958 – Towards the development of a Nitrogen Deposition Decision Framework for vegetation assessment in Scotland. Available at: https://www.nature.scot/snh-research-report-958-towards-development-nitrogen-deposition-decision-framework-vegetation (accessed 12/02/2019)

[70] DEFRA (2019) Trends Report 2019: Trends in critical load and critical level exceedances in the UK. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1908280952_Trends_Report_2019.pdf (accessed 06/04/20)

Climate change is causing a shift in weather patterns which are affecting nature across the country through influencing natural processes that maintain our habitats, ecosystems and landscapes[71].

[71] Scottish Natural Heritage (undated). Climate change impacts in Scotland. Available at: https://www.nature.scot/climate-change/climate-change-impacts-scotland (accessed 3/04/2020)

## Key Pressures

- Air pollution can cause damage to plants and animals and other impacts on biodiversity that can result in species loss, habitat composition changes and increased sensitivity of organisms to environmental stresses.
- Ammonia is a key pollutant and nitrogen deposition is a key pressure on a wide range of habitats and nitrogen emissions from combustion plants, intensive agriculture and transport causes acidification, eutrophication and direct tissue damage to plants.
- Key pressures on biodiversity include land use intensification and modification, pollution and climate change.
- Climate change including shifting weather patterns can affect nature across the country.

# Material assets

### Agriculture and land use

Agriculture is the dominant land use in Scotland, with 75% of Scotland's land mass under agricultural production. A diverse range of farming takes place across the country including arable farming, crofting, hill farming and lowland livestock and dairy farming[72]. Over half of Scotland's agricultural land is used for upland sheep farming and mixed sheep and beef cattle farming[73]. In 2018, farms covered 5,603,815 ha of land in Scotland with grazing land an additional 579,847 ha. Sheep and cattle farming was the biggest farming type in 2018, followed by forage farming (for animal feed), mixed and general cropping.[74]

Agricultural land use has a strong influence on the landscape and environment, sustaining important habitats for biodiversity including unimproved grassland, cultivated fields, walls and hedges, watercourses, wetlands, moorland and upland grassland. Changes in land use can have an impact on wildlife habitats and water pollution (e.g. via diffuse pollution).

Agricultural emissions related to air quality are dominated by ammonia ($NH_3$). Ammonia is a reactive nitrogen compound which is released when slurries, manures and nitrogen fertilisers come into contact with the air. It produces odours and is mobile, combining with acids and particulates, resulting in polluting and nuisance effects which impact on both human and ecosystem health. Ammonia can be lost whenever slurry or manure is exposed in this way.

[72] SNH (2017) Farming and crofting [online]. Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-land/farming-and-crofting (accessed 13/08/20)

[73] SNH (undated) Hill farming [online] Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-land/farming-and-crofting/types-farming/hill-farming (accessed 13/08/20)

[74] Scottish Government (2019) Agriculture facts and figures. Available at: https://www.gov.scot/publications/agriculture-facts-figures-2019/ (accessed 13/08/20)

Agricultural practices can impact on air quality and since 1990, decreasing animal numbers and a decline in fertiliser use has seen a reduction in emissions. More recently however, an increase in the use of urea-based fertilisers has led to higher emissions. Cattle manure management accounted for 38% of agricultural emissions in 2017 (non-dairy: 28%; dairy 10%), followed by cattle manure applied to soils (19%) and inorganic fertiliser application (16% total; 9% to tillage, 7% to grassland)[75].

Agriculture also produces appreciable amounts of particulates (PM10: 14.4% and PM2.5 7.2% of totals) and volatile organic compounds (VOCs) (12.2% of total). Sources of PM10 include farm operations (31%) and manure management (cattle (25%), sheep (20%), laying hens (9%), other poultry and broiler chickens (6% each). Most emission sources have decreased since 1990, however those associated with laying hens has increased, especially since 2008[76].

PM2.5 emissions arise from manure management (cattle (57%), sheep (22%)) and farm operations (14%). Manure management associated with laying hens, other poultry and broiler chickens contribute 2% each. Emissions of PM2.5 from all sources have declined or remain unchanged since 1990, with little further change since 2010. Most emission sources of VOCs have decreased since 1990, except for poultry. VOC emissions are dominated by cattle manure management (66%), followed by cultivated crops (14%).[77]

Intensive land management is one of the main challenges to farmland wildlife and a shift toward intensification has resulted in a change in biodiversity which could have major implications for food production. Increased field sizes and use of agricultural chemicals has led to a potentially serious decline in pollinators such as bees, which in turn, can negatively affect crop volumes[78]. Poor land management can also lead to increased soil erosion, which can lead to loss of top soil and reduce soil function[79].

The demand for the services that the natural environment provides, such as food, is likely to grow in line with population growth.

### Domestic/Built environment

[75] European Environment Agency (2016) Manure management in the National Atmospheric Emissions Inventory includes emissions from livestock buildings, open yard areas and manure or slurry stores, EMEP/EEA air pollutant emission inventory guidebook 2016: Technical guidance to prepare national emission inventories. Available at: https://www.eea.europa.eu/themes/air/air-pollution-sources-1/emep-eea-air-pollutant-emission-inventory-guidebook/emep (accessed 12/03/20)

[76] Scottish Government (2019) Cleaner Air for Scotland Strategy – An Independent Review – Final report to the Scottish Government Annex 6. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/independent-report/2019/08/cleaner-air-scotland-strategy-independent-review/documents/cleaner-air-scotland-strategy-review-report-annexes/cleaner-air-scotland-strategy-review-report-annexes/govscot%3Adocument/cleaner-air-scotland-strategy-review-report-annexes.pdf (accessed 06/02/2020)

[77] ibid

[78] Scottish Government (2014) State of the environment. Available at: https://www.environment.gov.scot/media/1170/state-of-environment-report-2014.pdf (accessed 13/08/20)

[79] SEPA (2019) Consideration of soils in SEA. Available at: https://www.sepa.org.uk/media/162986/lups-sea-gu2-consideration-of-soil-in-sea.pdf (accessed 13/08/20)

In 2017, 20% of total Scottish energy consumption came from renewable sources; the highest level to date and an increase from 16% in 2016. This is driven by record years for both renewable electricity and heat generation due to an increase in installed capacity for renewable electricity and heat on 2016 - by 1.1 GW and 0.3 GW for electricity and heat respectively. Heat generation in Scotland in 2017 comprised of 79% mains gas, 12% electricity, 6% oil, 3% other fuels (e.g. solid fuel), and 1% communal/ district heating.[80]

Key pressures on the domestic/built environment include emission levels associated with domestic burning. Despite actual levels being somewhat uncertain it is considered that emissions attributable to domestic burning contribute to air pollution, the main pollutants of concern being $PM_{10}$, $PM_{2.5}$, nitrogen dioxide and sulphur dioxide.

### Key Pressures

- Emissions associated with agricultural practices, mostly dominated by ammonia release when slurries, manures and nitrogen fertilisers come into contact with air , leading to diffuse pollution in water and soil.
- Intensive land use/ land management practices putting pressure on associated natural resources such as land (and environmental receptors such as soil, water and biodiversity).

[80] Scottish Government (2019) Energy Statistics: Heating Fuel [online]. Available at: https://scotland.shinyapps.io/sg-scottish-energy-statistics/ (accessed 02/12/19)






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