Updating of CCC Land Use Scenarios for Scotland and Northern Ireland

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1. Introduction

The Committee on Climate Change (CCC) will be providing its recommendations on the setting of emission targets to the Scottish Government and Northern Ireland Assembly by December 2022 and early 2023 respectively. The land sector will play an important role in the development of these targets.

The original analysis of land-based greenhouse gas (GHG) mitigation measures was undertaken for the 6th Carbon Budget (Thomson *et al.* 2021). This updated analysis aims to capture technical and methodological changes in the estimation of forestry and peatland emissions. The original assumptions regarding how land is used in each scenario have not been changed. The CCC requires updated estimates of afforestation and peatland restoration for the Business-As-Usual, or Baseline, and Balanced Net Zero pathways for Scotland and Northern Ireland and the Tailwinds pathway for Northern Ireland.

1.1 Previous CCC land use pathway modelling

1.1.1 Forestry

The forestry measures in the original analysis included afforestation of previously unforested land and management of existing forests for fuel and timber. In the 6th Carbon Budget pathways the forestry assumptions were:

- BAU pathway:
  - Afforestation from 2020: fixed planting rates of 7.06 kha yr^{-1} (Scotland) and 0.184 kha yr^{-1} (Northern Ireland) were used for 2020-2050, based on the average 5 year planting rate 2014-2018 (10% open space included).
  - Conifer afforestation is assumed to be yield class (YC)14 and broadleaf planting YC6.
  - The conifer: broadleaf planting ratio was 55:45 in Scotland and 34:66 in Northern Ireland
- Balanced Net Zero pathway:
  - Afforestation from 2020: the UK planting rate is ramped up to 30 kha yr-1 by 2025, changing to 50 kha yr^{-1} in 2035 and maintained to 2050. This equates to 15 kha yr^{-1} (Scotland) and 1.5 kha yr^{-1} (Northern Ireland) in 2025 and 25 kha yr^{-1} (Scotland) and 2.5 kha yr^{-1} (Northern Ireland) in 2035.
  - Conifer afforestation is assumed to be YC16 and broadleaf planting YC6.
  - The conifer: broadleaf planting ratio was 50:50 in Scotland and 20:80 in Northern Ireland
- Tailwinds pathway for Northern Ireland:

- Afforestation from 2020: the UK planting rate is ramped up to 70 kha yr-1 by 2035 and maintained to 2050. This equates to 15 kha yr^{-1} (Scotland) and 1.5 kha yr^{-1} (Northern Ireland) in 2025 and 25 kha yr^{-1} (Scotland) and 2.5 kha yr^{-1} (Northern Ireland) in 2035.
- Conifer afforestation is assumed to be yield class (YC)16 and broadleaf planting YC6 2020-2029 and YC18 for conifers and YC8 for broadleaves 2030-2050.
- The conifer: broadleaf planting ratio changed over time from 80:20 in 2020 to 68:32 from 2035 onwards.

The forest carbon model, CFlow, was used to assess the net change in forest carbon stocks, and hence the CO_2 emissions and removals associated with afforestation (see Thomson *et al.* 2021 for further details).

The Forest Research CARBINE model is used for the calculation of afforestation carbon stock changes in the Land-Use, Land-Use Change and Forestry (LULUCF) sector of the UK GHG Inventory. CARBINE is a complex process model that takes account of a wide range of tree species and management types and is resource-heavy to run. For the original 6th Carbon Budget pathways, the CFlow model results indicated the magnitude and trends in afforestation carbon stock changes of sufficient robustness for policy assessment based on fewer input requirements. A correction was applied so that the initial values for 2018 matched those published in the 1990-2018 national GHG Inventory (Brown *et al*. 2019).

1.1.2 Peatlands

The peatland restoration measures included in the CCC pathways cover the restoration, rewetting and sustainable management of degraded peatlands currently under agricultural and forest land use. Degraded peatlands no longer function like natural peatlands because of damaging interventions such as drainage, over grazing or burning management, resulting in net GHG emissions to the atmosphere rather than net removals. By 2050 mitigation on these areas will abate GHG emissions rather than increase GHG removals due to the long time-profile required to sequester carbon following restoration, and relatively slow rate of peat formation in natural systems.

The areas and emission factors used for calculating emissions from peatland restoration in the original 6th Carbon Budget pathways were taken from Evans *et al*. (2017). Emission factors for CO_2, CH_4 and N_2O were given for pristine ("near-natural"), degraded and rewetted peatlands under different land use types. Under the current IPCC method, it is assumed that the emissions change in the year of restoration as there is currently insufficient evidence on the time it takes for a peatland to shift from a degraded to a rewetted condition. Emissions from organic soils were fully included in the 1990-2019 UK GHG inventory published in 2021, and

the activity data and emission factors were updated from those used in the 6th Carbon Budget analysis (see section 1.2).

For the BAU pathway, peatland restoration is assumed to only occur where there are current policies and funding in place. Only Scotland had policies/funding in place for peatland restoration (Scottish Government 2018) when the CCC 6th Carbon Budget advice was being developed: the target areas are 50 kha of upland peatlands and forest restored by 2020 and 250 kha restored by 2030 (representing 40% of the currently degraded peatland area). No restoration of peatland was assumed for Northern Ireland.

For the Balanced Net Zero pathway:

- 100% restoration is assumed by 2045 for upland grassland on peat
- 50% restoration by 2050 for lowland intensive grassland.
- 75% rewetted by 2050 is assumed for cropland, 15% to paludiculture use, 25% to near-natural condition, and 35% under water level management.
- 100% restoration by 2035 for extraction sites.
- 100% restoration of forest on peat with forest yield class <8.

Other net emissions arising from LULUCF activities were based on urban expansion in line with the projected increase in national population and pre-2019 land use change (see Thomson *et al*. 2021 for more details).

1.2 Changes in UK GHG inventory since 2020

There have been updates and revisions to the UK GHG inventory methodology since the CCC developed its land pathways for the 6th Carbon Budget in December 2020, as well as different methodological approaches taken by the devolved administrations. The main differences were:

- The incorporation of emissions from organic soils (peatlands) in the 1990-2019 inventory based on the data and methodology developed in the Evans *et al.* (2017) report. This included amendments to the original emission factors, updated peatland restoration activity, and changes in the area (and therefore net emissions) of land-use change on mineral soils in all land-use categories. The direct CO_2 emissions from forests on organic soils were calculated by the CARBINE model rather than using the emission factor for forest on organic soils in Evans *et al*. (2017), which meant that the overall increase in LULUCF emissions was smaller than originally anticipated. Overall LULUCF net emissions increased by 18 Mt CO_2e in 1990 and 15.8 Mt CO_2e in 2018 between the 1990-2018 and 1990-2019 inventories.
- A methodological update to the land-use change (LUC) activity data used in the LULUCF soils and non-forest biomass models was implemented in the 1990-2020 inventory. The new approach assimilates a wider range of LU and LUC data sources to produce an annual time series, rather than the previous approach that used decadal rates of change based on the Countryside

Survey. Overall LULUCF net emissions reduced by -5 Mt CO_2e in 1990 and -2 Mt CO_2e in 2019 between the 1990-2019 and 1990-2020 inventories.

2. Methodology

The CCC's assumptions for the extent of land-use change within each scenario remain the same as was set out in the original 6th Carbon Budget analysis.

2.1 Afforestation

Baseline pathway afforestation activity data

The actual forest planting areas (for conifers and broadleaves) were used for the 2020 and 2021 input values. The average annual planting rate 2014-2018 from Forestry Statistics was used for 2022-2050 for the BAU scenario (Table 1). These compare to annual rates of 7.06 kha/year for Scotland and 0.18 kha/year for Northern Ireland in the 6th Carbon Budget pathways.

Table 1: Annual tree planting rates (kha yr^{-1}) in the updated BAU pathway.

Year	Scotland Total	Scotland Conifer	Scotland Broadleaf	N. Ireland Total	N. Ireland Conifer	N. Ireland Broadleaf
2020	11.05	7.43	3.61	0.20	0.06	0.14
2021	10.66	6.94	3.72	0.28	0.07	0.22
2022-2050	6.48	2.85	3.63	0.19	0.05	0.14

In Scotland, there are available statistics on tree species and yield class planted 2017-2021 under the Forestry Grant Scheme (representing >90% of all afforestation in Scotland). For all planting:

- Conifers: 51.2% was Sitka spruce YC14, 7.0% Norway spruce YC16, 7.4% Scots pine YC10, 1.1% low density/natural regeneration native pines YC2;
- Broadleaves: 4.0% beech YC8, 15.1% native broadleaves YC8, 9.8% native broadleaves YC6, 4.4% low density/natural regeneration native broadleaves YC4.

There were no Northern Ireland-specific breakdowns of species and yield classes but the Scottish proportions were used as a proxy as environmental conditions are similar.

Balanced Net Zero pathway afforestation activity data

The actual forest planting areas (for conifers and broadleaves) were used for the 2020 and 2021 input values (Table 1). In line with previous BNZ assumptions, afforestation in Scotland increased to 15.0 kha yr^{-1} in 2025, and 25.0 kha yr^{-1} from 2035 to 2050 (50% conifer, 50% broadleaf). In Northern Ireland afforestation increased to 1.5 kha yr^{-1} in 2025 and 2.5 kha yr^{-1} in 2035-2050 (20% conifer, 80% broadleaf). The same species and yield classes were used as in the BAU pathway.

Tailwinds pathway afforestation activity data

In Northern Ireland afforestation rates increased from the 2021 values to 4.2 kha yr^{-1} in 2035-50. Conifer planting was assumed to be Sitka spruce YC16, increasing to YC18 in 2030, and broadleaf planting was assumed to be Sycamore/Ash/Birch YC6 increasing to YC8 in 2030.The ratio of conifer to broadleaf planting was 48:52 from 2022-2050.

Estimation of afforestation carbon stock changes.

Carbon stock changes in forest biomass (including deadwood and litter) and soils were estimated using data tables for each species, yield class and management combination. These were extracted from the Q4C data cube (Matthews *et al.* 2022) and provided by Robert Matthews of Forest Research. The data tables have been derived from the CARBINE model and can represent forest management as "Standard thinning and rotation management", "Continuous cover management" and "No thinning and no felling management". The data tables estimate net emissions from soil for mineral soils, organo-mineral soils and organic soils. A mid-point value between mineral and organo-mineral soils for afforestation in Scotland and Northern Ireland was used: it is assumed that no afforestation of organic soils occurs in any of the CCC pathways. The updated methodology is more consistent with the CARBINE model used for the UK GHG inventory and includes better representation of the carbon stock losses associated with forest establishment, particularly from soils, compared with the C-Flow methodology used in the original analysis.

"Standard thinning and rotation management" was assumed for planting of Sitka spruce and Norway spruce. "Continuous cover management" was assumed for Scots pine, beech and native broadleaves YC8 and YC6 to represent low levels of management for amenity, stability and/or habitat. "No thinning and no felling management" was assumed for low density native pines and broadleaves. For natural regeneration of native broadleaves and pines a net biomass carbon stock change of 0.4 $tC/ha^{-1}yr^{-1}$ was assumed with an offset of 10 years and no impact on soil carbon. This was based on expert judgement from Forest Research (R. Matthews, personal communication).

2.2 Peatland Restoration

Baseline pathway peatland restoration activity data

The area of different peatland categories in 2020 were the same as those used in the 1990-2020 GHG inventory. There are 1,946,638 ha in Scotland, of which 42,578 ha were in a rewetted category in 2020. There are 238,421 ha in Northern Ireland, of which 6,461 ha were in a rewetted category in 2020.

In the Baseline pathway CCC assumed that peatland restoration only occurred where there were current policies and funding in place. There were no policies or funding for Northern Ireland so no restoration has been assumed. Scotland has targets in its 2018 Climate Change Plan for 250,000 ha of degraded peat restored by 2030[1]. This covers restoration of 60,000 ha of forest on peat, 155,000 ha of upland grassland and 5,000 ha of lowland extensive grassland between 2020 and 2030. There are no restoration targets for cropland, intensive grassland or peat extraction sites.To achieve these targets, restoration rates (from 2021) were assumed: 5748 ha yr^{-1} for forest, 653 ha yr^{-1} for drained eroded upland grassland, 14,847 ha yr^{-1} for drained natural upland grassland and 500 ha yr^{-1} for lowland extensive grassland.

Balanced Net Zero pathway peatland restoration activity data

The rates of peatland restoration under the Balanced Net Zero pathway are described in section 2.1. These are converted into annual rates of restoration (Table 2 and Table 3) and cropland water table management (Table 4).

The restoration assumptions for the Tailwinds pathway for Northern Ireland are the same as those in the Balanced Net Zero pathway.

[1] As Scotland's existing restoration targets have been incorporated into the baseline, the BAU pathway represents the abatement potential from Scotland's restoration plans and could be used by the CCC to assess the differing levels of potential additional abatement.

Table 2: Annual rates of peatland restoration for Scotland in the Balanced Net Zero Pathway

Peat category	Forest	Cropland	Eroded Natural Grass Drained	Eroded Natural Grass Undrained	Natural Grass Drained	Natural Grass Undrained	Intensive grass	Extensive grass	Industrial extraction	Domestic extraction
Period	2021-2050	2021-2050	2021-2045	2021-2045	2021-2045	2021-2045	2021-2050	2021-2050	2021-2035	2021-2035
Rate hectares yr^{-1}	2189	See Table 4	351	1141	8690	25531	1427	0	164	2957

Table 3: Annual rates of peatland restoration for Northern Ireland in the Balanced Net Zero Pathway

Peat category	Forest	Cropland	Eroded Natural Grass Drained	Eroded Natural Grass UnDrained	Natural Grass Drained	Natural Grass UnDrained	Intensive grass	Extensive grass	Industrial extraction	Domestic extraction
Period	2021-2050	2021-2050	2021-2045	2021-2045	2021-2045	2021-2045	2021-2050	2021-2050	2021-2035	2021-2035
Rate hectares yr^{-1}	227	See Table 4	12.3	22	581	1055	632	0	52	5836

Table 4: Annual rates of cropland restoration, hectares yr^{-1} 2021-2050

	Dynamic water level management	Raised water-table continuously	Full restoration - paludiculture	Full restoration - to near natural condition
Scotland	32	24	24	41
Northern Ireland	21	16	16	26

Estimation of peatland restoration emissions

Emissions are estimated using the activity data described above and the same emission factors (Table 5) as were used for the 1990-2019 and 1990-2020 GHG inventories. These were updated from those developed in the Evans et al. (2017) report and used in the 6th Carbon Budget analysis. Changes included:

- An updated EF literature review and meta-analysis included recent GHG flux publications;
- The use of the CARBINE model (Tier 3) for direct forest carbon stock changes, and Tie1 and 2 EFs for indirect CO_2 and non-CO_2 emissions;
- Inclusion of an EF for Settlement on organic soil;
- Amendments to the Eroded Modified Bog EF to split out actively eroding (bare) and non-actively eroding peat;
- The inclusion of a Rewetted EF for rewetted Modified Bog (semi-natural bog) to distinguish it from more heavily degraded bog categories.

Emission factors for cropland water table management are in Table 6, based on water table depth as supplied by Prof. Christopher Evans. Emissions of methane and nitrous oxide are converted to CO_2 equivalents based on the Global Warming Potentials in the IPCC Fifth Assessment Report (28 for CH_4 and 265 for N_2O).

Please note that N_2O emissions from cropland and intensive grassland on organic soils are reported within this analysis and included in the totals; however, they are not included in the LULUCF sector in the national GHG inventory but are instead reported in the Agriculture sector, in accordance with IPCC guidelines.

Table 5: Organic soil GHG emission factors (CO_2e based on IPCC AR5 global warming potentials without feedback)

WS project category		Woodland	Cropland	Eroding Modified Bog		Modified Bog		Intensive grassland	Extensive grassland	Rewetted bog	Rewetted fen	Rewetted Modified bog	Rewetted Modified fen	Near natural bog	Near natural fen	Extracted industrial	Extracted domestic	Settlement
Drainage status D: drained UD: undrained R: Rewetted		D	D	D	UD	D	UD	D	D	R	R	R	R	UD	UD	D	D	D
Total CO_2	EF CO_2e (tCO_2 ha^{-1} yr^{-1})	1.44	30.04	12.32	11.88	1.57	0.92	22.74	8.40	0.29	5.25	-2.85	-4.72	-2.85	-4.72	12.32	12.41	0.78
Total CH_4	EF CH_4 (kg CH_4 ha^{-1} yr^{-1})	7.86	59.21	32.90	6.10	76.79	53.10	85.32	104.55	143.43	112.25	113.07	151.52	113.07	151.52	32.90	32.90	31.81
Total N_2O	EF N_2O (kg N_2O-N ha^{-1} yr^{-1})	2.80	13.00	0.30	0.30	0.12	0.12	5.69	4.30	0.08	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.06
Total CO_2e	Total CO_2e (tCO_2e ha^{-1} yr^{-1})	2.82	37.11	13.37	12.17	3.77	2.46	27.50	13.12	4.33	8.39	0.32	-0.48	0.32	-0.48	13.37	13.45	1.70

Table 6: Emission factors for cropland water table management on organic soil

		Dynamic water level management	Raised water-table continuously	Full restoration - paludiculture	Full restoration - to near natural condition
Total CO_2	EF CO_2e (tCO_2 ha^{-1} yr^{-1})	10.87	7.83	-1.95	-3.47
Total CH_4	EF CH_4 (kg CH_4 ha^{-1} yr^{-1})	59.59	61.96	154.41	166.28
Total N_2O	EF N_2O (kg N_2O-N ha^{-1} yr^{-1})	11.13	13.02	0.60	0.60
Total CO_2e	Total CO_2e (tCO_2e ha^{-1} yr^{-1})	17.18	14.99	2.62	1.43

2.3 Other Land Use Activities

Estimated projections of net GHG emissions from other activities in the LULUCF sector are needed in order to assess the impact of GHG mitigation activities. The most recent projections available are those based on the 1990-2019 GHG inventory (BEIS unpublished): the Baseline projected scenario was used. Net emissions from existing forest (planted before 2020) and other LULUCF activities were treated separately.

Afforestation rates in this analysis were adjusted to take account of the low level of afforestation that was already included in the Baseline projected scenario. Net emissions from existing forest in the 1990-2019 inventory projections were calculated by the CARBINE model. Net emissions from existing forest on non-organic soils were used directly but net emissions from existing forest on organic soils were adjusted to take account of the reduced area following peatland restoration of existing afforested peat.

Net emissions from other LULUCF activities for 2020 for each GHG were matched to those in the 1990-2020 inventory. An adjustment factor was applied to the projected emissions to account for methodological differences between the projections and the 1990-2020 inventory (see section 1.2 for details). The adjustment factor was -277 kt CO_2e for Scotland and -340 kt CO_2e for Northern Ireland. Emissions of methane and nitrous oxide were converted to CO_2 equivalents based

on the Global Warming Potentials without feedback in the IPCC Fifth Assessment Report (28 for CH_4 and 265 for N_2O).

The additional mitigation activities from the original CCC 6th Carbon Budget analysis were also included. These were bioenergy crops, and hedges & agroforestry.

3. Results: Scotland

The net GHG emissions from combined activities for the Baseline and Balanced Net Zero pathways are shown in Table 7 and Table 8[2]. These are compared with the original 6th Carbon Budget analysis LULUCF emissions pathways published in 2021 (Figure 1). Note the difference in 2020 values due to inventory methodological updates.

Table 7: Baseline pathway net emissions for Scotland 2020 - 2050, Mt CO_2e

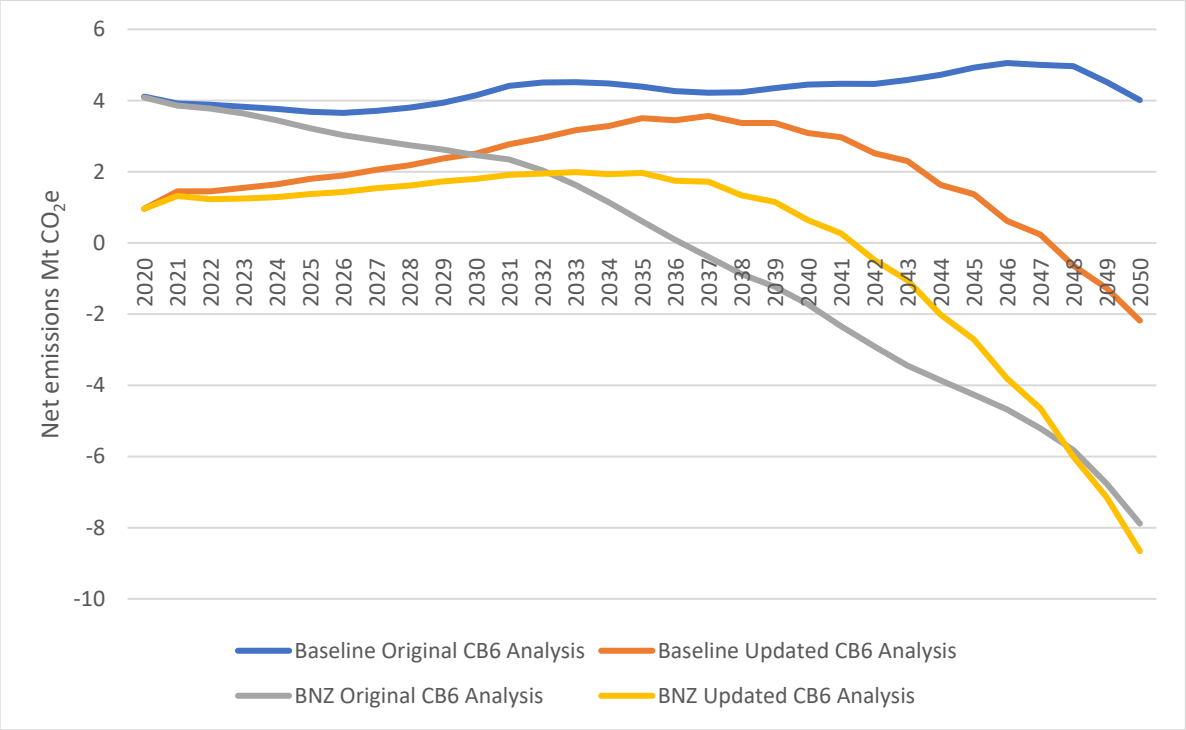
	Existing forest on non-organic soils	Existing forest on organic soils	New forest	Other LULUCF	Bioenergy	Hedges and Agroforestry	Peatland mitigation	Total
2020	-5.9	-1.2	0.0	1.8	0.0	0.0	6.3	**1.0**
2025	-5.1	-0.3	0.6	0.5	0.0	0.0	6.1	**1.8**
2030	-4.3	0.3	0.8	-0.2	0.0	0.0	5.9	**2.5**
2035	-3.4	0.9	0.6	-0.4	0.0	0.0	5.9	**3.5**
2040	-3.0	1.0	-0.7	-0.1	0.0	0.0	5.9	**3.1**
2045	-3.0	0.7	-2.7	0.4	0.0	0.0	5.9	**1.4**
2050	-3.1	0.3	-6.1	0.8	0.0	0.0	5.9	**-2.2**

[2] A full time-series has been provided to the CCC.

Table 8: Balanced Net Zero pathway net emissions for Scotland 2020 - 2050, Mt CO_2e

	Existing forest on non-organic soils	Existing forest on organic soils	New forest	Other LULUCF	Bioenergy	Hedges and Agroforestry	Peatland mitigation	Total
2020	-5.9	-1.2	0.0	1.8	0.0	0.0	6.3	**1.0**
2025	-5.1	-0.4	0.7	0.5	0.0	0.0	5.6	**1.4**
2030	-4.3	0.4	1.3	-0.2	-0.1	-0.1	4.8	**1.8**
2035	-3.4	1.0	1.4	-0.4	-0.5	-0.2	4.1	**2.0**
2040	-3.0	1.1	0.4	-0.1	-0.9	-0.4	3.5	**0.6**
2045	-3.0	0.7	-1.9	0.4	-1.3	-0.6	2.9	**-2.7**
2050	-3.1	0.3	-7.0	0.8	-1.8	-0.7	2.8	**-8.7**

Figure 1: Comparison of total emissions between the original and updated 6th Carbon Budget pathways for Scotland 2020 - 2050



4. Results: Northern Ireland

The net GHG emissions from combined activities for the Baseline, Balanced Net Zero and Tailwinds pathways are shown in Table 9, Table 10 and Table 11. These are compared with the original 6th Carbon Budget analysis LULUCF emissions pathways published in 2021 (Figure 2). Note the difference in 2020 values due to inventory methodological updates.

Table 9: Baseline pathway net emissions for Northern Ireland 2020-2050, Mt CO_2e

	Existing forest on non-organic soils	Existing forest on organic soils	New forest	Other LULUCF	Bioenergy	Hedges and Agroforestry	Peatland mitigation	Total
2020	-0.3	-0.2	0.0	0.6	0.0	0.0	2.4	**2.5**
2025	-0.3	-0.2	0.0	0.7	0.0	0.0	2.4	**2.6**
2030	-0.3	-0.2	0.0	0.8	0.0	0.0	2.4	**2.7**
2035	-0.3	-0.2	0.0	0.7	0.0	0.0	2.4	**2.6**
2040	-0.4	-0.2	0.0	0.6	0.0	0.0	2.4	**2.5**
2045	-0.4	-0.2	-0.1	0.4	0.0	0.0	2.4	**2.2**
2050	-0.3	-0.2	-0.2	0.3	0.0	0.0	2.4	**2.0**

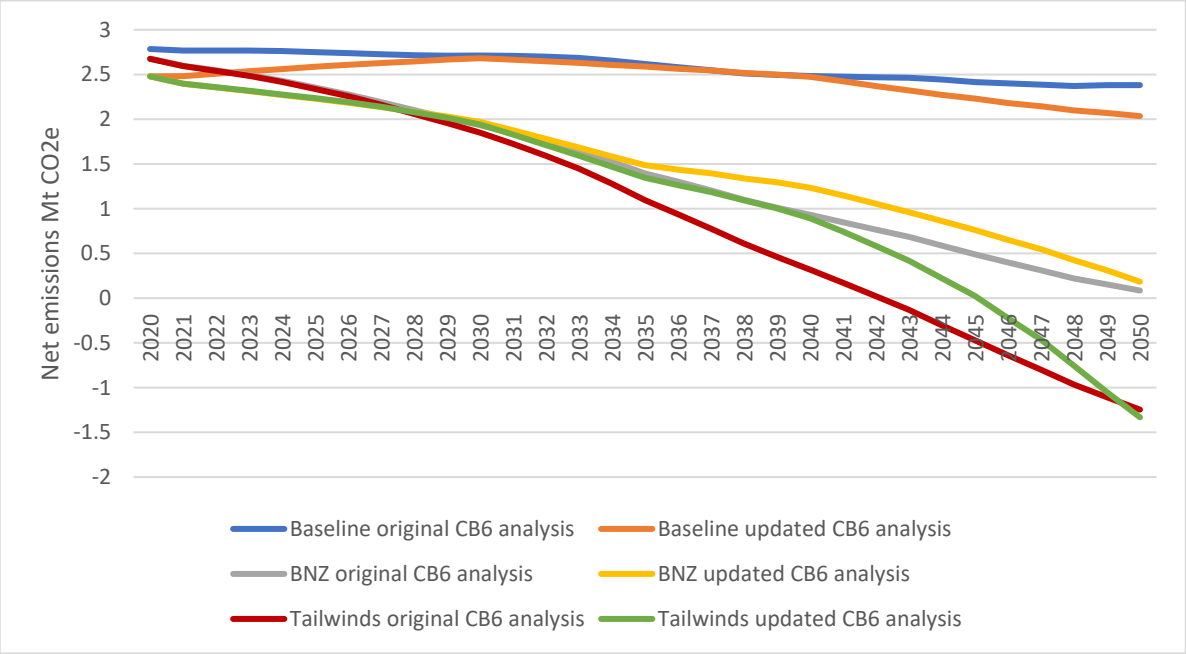
Table 10: Balanced Net Zero pathway net emissions for Northern Ireland 2020-2050, Mt CO_2e

	Existing forest on non-organic soils	Existing forest on organic soils	New forest	Other LULUCF	Bioenergy	Hedges and Agroforestry	Peatland mitigation	Total
2020	-0.3	-0.2	0.0	0.6	0.0	0.0	2.4	**2.5**
2025	-0.3	-0.2	0.0	0.7	0.0	0.0	2.0	**2.2**
2030	-0.3	-0.1	0.1	0.8	0.0	0.0	1.7	**2.0**
2035	-0.3	-0.2	0.1	0.7	-0.1	-0.1	1.3	**1.5**
2040	-0.4	-0.2	0.2	0.6	-0.2	-0.1	1.2	**1.2**
2045	-0.4	-0.2	0.1	0.4	-0.3	-0.1	1.2	**0.8**
2050	-0.3	-0.1	-0.2	0.3	-0.4	-0.1	1.1	**0.2**

Table 11: Tailwinds pathway net emissions for Northern Ireland 2020-2050, Mt CO_2e

	Existing forest on non-organic soils	Existing forest on organic soils	New forest	Other LULUCF	Bioenergy	Hedges and Agroforestry	Peatland mitigation	Total
2020	-0.3	-0.2	0.0	0.6	0.0	0.0	2.4	**2.5**
2025	-0.3	-0.2	0.0	0.7	0.0	0.0	2.0	**2.2**
2030	-0.3	-0.1	0.1	0.8	-0.1	0.0	1.7	**1.9**
2035	-0.3	-0.2	0.2	0.7	-0.3	-0.1	1.3	**1.3**
2040	-0.4	-0.2	0.3	0.6	-0.6	-0.1	1.2	**0.9**
2045	-0.4	-0.2	0.0	0.4	-0.9	-0.2	1.2	**0.0**
2050	-0.3	-0.1	-0.8	0.3	-1.2	-0.2	1.1	**-1.3**

Figure 2: Comparison of total emissions between the original and updated 6th Carbon Budget pathways for Northern Ireland 2020-2050



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