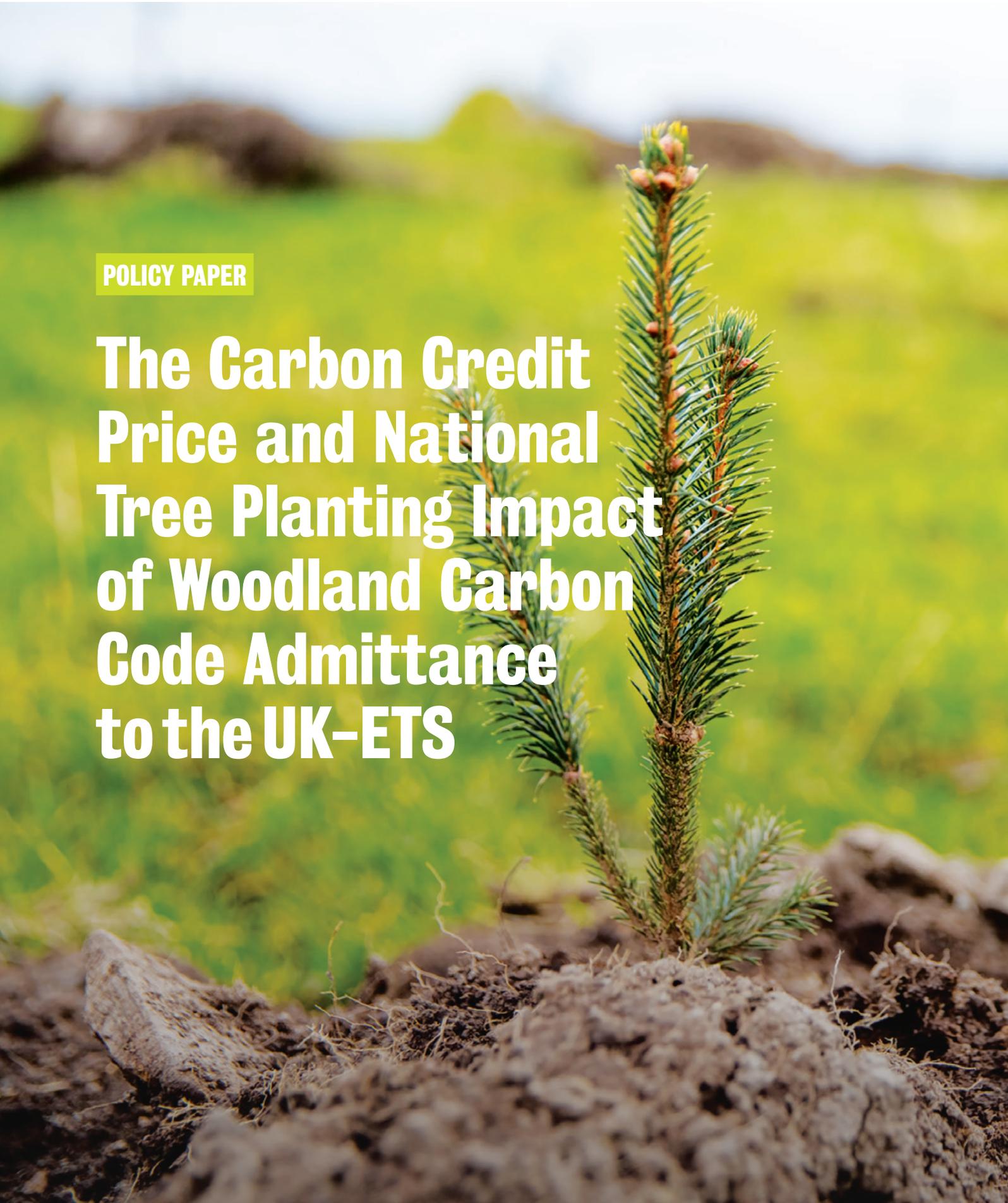


POLICY PAPER

The Carbon Credit Price and National Tree Planting Impact of Woodland Carbon Code Admittance to the UK-ETS



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1. ABSTRACT

Is there a rationale for admitting the **Woodland Carbon Code (WCC)** into the **UK Emissions Trading Scheme (UK ETS)**? How would admitting the WCC into the UK-ETS affect the pricing of **WCC-verified carbon units (WCUs)**? What would be the impact of the price discovery for WCU in afforestation and carbon sequestration?

The research assesses the price impact of admitting the WCC into the UK-ETS on WCUs, examining its correlation with afforestation, land values, national tree planting goals, and its impact on regional carbon sequestration. The inclusion of WCC into the UK-ETS is expected to significantly increase the price of WCUs versus current prices, attracting greater levels of investment into UK afforestation projects more quickly and enabling the UK's Government to come closer to achieving its climate and net zero ambitions.

This paper also delves into the WCC, and the UK-ETS, and presents best practices from New Zealand's carbon markets, as well as exploring the latter's correlation with other regional markets such as the EU ETS. The resulting policy paper suggests recommendations addressed to policymakers, regulators, investors, and other regional carbon markets.

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2. EXECUTIVE SUMMARY

This policy paper responds to the question: What would be the price impact on WCUs if they were to be admitted into the UK ETS, and how would this impact afforestation rates across the UK?

This research explores the relationship between the WCC and the **UK ETS in the context of U.K. greenhouse gas removals and agriculture and land-use emissions**. It aims to provide an understanding of both the regulated and voluntary carbon markets and improve the routes to market for the carbon units generated by nature-based carbon sequestration projects to mobilise increased capital investment that can positively impact the environment.

Our objective is to assess the price impact of WCUs by admitting the WCC into the UK ETS and its correlation with afforestation and land values. In addition, we aim to connect this relationship with afforestation with the national goals in the UK for tree planting. Finally, the report presents policy recommendations for an amended carbon market in the UK. This policy will reduce volatility and increase its transparency, integrity and efficiency.

The admission of WCUs into the UK-ETS emerges as an opportunity to foster afforestation projects across the UK by increasing its economic competitiveness. However, aiming for market efficiency and transparency, whilst mitigating public policy uncertainty, suggests that developers might have the opportunity to choose between the UK ETS or to sell some or all of their WCUs in existing Voluntary Carbon Markets (VCMs) platforms. This flexibility would provide the market efficiency required by investors.

The admittance of the WCC into the UK ETS would likely result in a higher price signal for WCUs, thereby increasing the investment incentive for afforestation in the UK. The impact of this admittance is expected to be particularly significant in England and Wales, where afforestation activity presently falls well short of national targets.

We conclude with a conservative estimate that the price for UK ETS admitted WCUs immediately after the integration into the UK ETS ranges from £41 to £47 per tonne, up from £28 currently. Our statistical model anticipates a steady rise in WCU credit prices post-integration, with a projected increase from £68 in 2024, £74 in 2027, and £79 in 2030 once the market stabilises.

To evaluate the impact of the UK-ETS admitted WCU prices on afforestation rates, we used Foresight Group LLP's methodology, proprietary model and database following a comprehensive map-based screening of Scotland, Wales, and Northern England. This identifies 4,500 specific properties with good afforestation potential, spanning in aggregate over approximately 800k hectares.

Our scenario analysis depicts the hectares of land economically viable for afforestation per region at different WCU prices. It concludes that there is potential to immediately unlock between 11% to 26% of identified land with good afforestation potential in the UK which would likely otherwise not be developed and converted into commercial forestry. In other words, the higher WCU pricing and more secure route to market the greater the unlocking effect.

The research suggests that the inclusion of WCC in the ETS could assist the UK government in approaching its national afforestation goals for 2050, increasing the total carbon sequestered by afforestation in the UK by an estimated range of 12% to 30%.

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3. POLICY RECOMMENDATIONS

1. To expand the UK-ETS to include Greenhouse Gas Removals (GGRs) through forestry by including the WCC

This would improve market efficiency, giving a stronger WCC price signal for afforestation investors, helping to increase the demand of WCUs, and ultimately helping bring the UK closer to achieving its national afforestation goals, as well as net-zero target.

It is recommended a dual-market option where developers and owners of WCUs have the possibility to trade some or all of their units within the UK-ETS while retaining the right to 'Opt-Out' and alternatively sell some or all of their units in the voluntary market. This solution aims to provide integrity, transparency, and market efficiency.

2. To set up a sound and long-term policy in the context of the WCC admitted into the UK-ETS in order to build investors' confidence

This policy will include transparency in pricing mechanisms for forestry carbon credits. According to our quantitative analysis, this policy could set up a baseline price of £41 per WCU to increase afforestation levels positively by more than 10% across the U.K.

3. To evaluate the potential impact of linking the UK-ETS (with WCC admitted into it) with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

Linking in this way could present opportunities across these markets and CORSIA's potential to increase demand for high-quality forestry carbon credits through WCUs aligned with efforts to reduce costs and standardise Measurement Reporting and Verification (MRV) practices is strong.

4. To evaluate the synergy between the integrated WCC & UK-ETS and its interconnection with the EU-ETS

This aims to bolster the demand for WCUs, enhance overall market liquidity, and standardise MRV processes.

5. To encourage applied impact research that:

- a. Builds a theoretically and data-driven methodology of pricing, where price elasticity is defined simultaneously by supply and demand; and
- b. Explores linking the UK and EU markets to merge supply and scale demand and ensure fair but attractive pricing to investors and companies.

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4. RATIONAL – OBJECTIVES, DATA AND METHODOLOGY

The world is in the midst of a climate and biodiversity challenge. **The International Panel on Climate Change (IPCC)** is clear that the world must keep global temperatures to less than 1.5 degrees above pre-industrial levels to avoid a global climate catastrophe. To achieve this, global Net Zero by 2050 requires emissions reductions of 90-95% alongside negative emissions to offset the final 5-10% of unabatable/unavoidable emissions. **The IPCC recognises** that there is no credible emissions pathway to 1.5 degrees without substantial offsetting to address negative emissions¹.

Voluntary carbon credit markets (VCMs) have been established to direct finance into negative emissions-enabling projects. In other words, voluntary carbon credits direct private financing to climate-action projects that would not otherwise get off the ground. There is a voluntary use of carbon credits generated by nature-based solutions (NBS) credits by companies with net zero commitments, who can retire credits to offset carbon emissions elsewhere in their supply chains. **The World Economic Forum recognises** that nature-based solutions, such as afforestation, are needed to deliver one-third of all negative emissions required by 2030 to keep the possibility of 1.5 degrees alive.

The UK is one of the least forested countries in Europe, with only 13% canopy cover², versus nearly 44% on average³. A key element of the UK's Government's Net Zero plan is to increase tree canopy cover by 1m hectares, taking the UK to be 17% forested by 2050. The WCC is the UK's primary issuer of voluntary carbon credits for afforestation schemes. It issues developers with one carbon credit for each tonne of carbon dioxide, or equivalent, that is additionally and permanently sequestered from the atmosphere.

The ability of developers to economically convert agricultural land to woodland and commercial forestry depends on the land's afforestation value exceeding its agricultural value. Underpinning the afforestation value is the price/value of voluntary carbon credits. The higher the voluntary carbon credit price, the more and faster afforestation-based land use change can occur.

However, VCMs are nascent, and current WCU prices represent a fraction of those achieved on compliance carbon markets, such as the EU and UK-ETS due to the lower level of pricing transparency and the need to build up market efficiency to scale up VCMs. Voluntary transactions currently occur in bilateral, over-the-counter deals, often with high transaction costs.

VCMs lack a liquid and price-transparent trading destination. A combination of market infrastructure, liquidity and price transparency has the potential to increase the price of voluntary carbon credits significantly. That, in turn, would likely increase afforestation values of land across the UK, unlocking potentially large tracts of land that could newly become economically viable / unlocked for afforestation.

4.1. OBJECTIVES OF THE RESEARCH

The research analyses the rationale and responds to the following questions. If the WCC were to be admitted into the UK-ETS, what price impact would this likely have on **WCUs**? With this new price in consideration, how much additional tree planting could be incentivised by making the conversion of agricultural land into forestry as a more economically attractive land use, versus the land remaining in agriculture?

Our policy paper aims to assess the rationale for admitting WCC into the UK-ETS and its potential impact on WCU pricing dynamics. Furthermore, we seek to analyse the projected effects of carbon pricing on regional land values and the feasibility of afforestation initiatives under this revised pricing. Through our analysis, we inform policy recommendations to encourage the U.K. Government to proceed and accelerate the project of admitting WCC into the UK-ETS whilst establishing new standards for the carbon markets.

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4. RATIONAL – OBJECTIVES, DATA AND METHODOLOGY CONTINUED

4.2. DATA AND METHODOLOGY

This report focuses on the WCC within the UK-ETS context, seeking to contribute scientific evidence to aid policymakers and investors in decision-making regarding greenhouse gas removal (GGR) initiatives. Our objective is to assess the potential impact of admitting WCUs into the UK-ETS on carbon credit prices. Additionally, we aim to investigate the correlation between afforestation rates and land value. To achieve this, we employ a methodology that incorporates an autoregressive integrated moving average (ARIMA) model specifically designed for price discovery in the scenario of WCU UK-ETS integration.

The **WCC** is the quality assurance standard for woodland creation projects in the U.K., backed by the Government, and generates high-integrity, independently verified carbon units in the U.K. Meanwhile, the **UK-ETS** was launched on January 1, 2021, replacing the UK's participation in the **EU-ETS**. This transition reflects the UK's commitment to advancing its carbon market infrastructure in the post-Brexit era.

To estimate the mean price in a scenario where the WCC is admitted to the UK-ETS, we analyse the **data from the UK Government and ICE**, which includes the date of UK-ETS allowances auctions, the volume supplied and sold, the price, and the revenue generated. The data corresponds to 61 trading sessions extending from 19 May 2021 to 04 October 2023. Furthermore, we look at the government announcements about allowances and we use data from the WCC to inform us about the volumes of these forestry credits on the market.

In addition, **Foresight Group LLP** (Foresight), a sustainability-led infrastructure, real estate, and private equity investor, **has developed a proprietary database of 4,500 properties** that extend over 800k hectares. It has **the James Hutton Land Capability for Agriculture (i.e. grades, 3, 4, 5)** breakdown for each property. The research conducted as part of this policy paper, ascribed an indicative value to each grade of land per region to develop an estimated agricultural value for each property.

Methodology

1. We conducted a detailed analysis to better understand the main government response in Chapter 7 (2023) of the document titled "Calls for evidence on GGR and agriculture and land use emissions". This chapter addresses the proposals articulated in Chapter 8 of the consultation. **"The Authority believes that the UK-ETS is an appropriate long-term market for GGRs in the UK-ETS, subject to further consultation, a robust Monitoring, Reporting and Verification (MRV) regime being in place and the management of wider impacts."** This response in Chapter 7 incorporates policy recommendations with industry-wide support inclusion into the UK-ETS, minimising prolonged policy uncertainty and enhancing the effectiveness of emissions price signals.
2. We analysed the price elasticity of supply when admitting WCUs into the UK-ETS, with data from the **UK Government** and **ICE** and considering the impact of Allowances to estimate a range of prices for the new WCUs if admitted to the UK-ETS. For this purpose, a Box-Jenkins ARIMA model was used to model the time series data to estimate a range of likely prices for WCUs immediately after integration into the UK ETS, if it happens.
3. Finally, we ran a scenario analysis using the current price for WCUs and the predicted price range of WCUs after WCC integration into the UK-ETS (£41-£47), along with its implied impact on afforestation land values across regions using Foresight's model and proprietary database of approximately 4,500 specific properties across Scotland, Wales, and Northern England. The difference between the land areas that are economically viable at the current carbon price, and the predicted new carbon price (associated with WCC admission to the UK ETS), would be the amount of land estimated to be deemed to become viable / unlocked for afforestation because of WCC credits being admitted to the UK-ETS.

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5. OVERVIEW OF THE WCC AND UK-ETS

5.1. DESCRIPTION OF THE BUSINESS MODEL OF THE UK ETS

Following Brexit, the UK established, in January 2021, its carbon pricing system known as the UK-ETS. Like other ETS systems worldwide, the UK ETS operates on the “cap-and-trade” principle and covers approximately 25% of the UK’s greenhouse gas emissions, including sectors like aviation, power, and industry. The majority of allowances are allocated through auctions⁴, while free allocations help protect emissions-intensive trade-exposed (EITE) sectors from carbon leakage.

Participants are required to adhere to MRV regulations, with annual reporting and independent verification. Currently, the UK-ETS is not linked to other systems such as the EU ETS, but the UK government might be open to future linkages.

In 2022, the UK-ETS allocated 81 million allowances through auctioning, raising total revenues of £6.1 billion to the general budget⁵, and generated a Tax revenue of £4.56 billion⁶, with an average price of £75.47 per allowance⁷. Mechanisms like the supply adjustment mechanism (SAM) and Cost Containment Mechanism (CCM) maintain market stability to ensure the efficiency of the scheme. Moreover, during the transition period from EU to UK-ETS, the government set an auction reserve price (price floor) at £22⁸.

The UK’s call for a response paper is exploring the inclusion of carbon removal credits in its operations and focusing on nature-based solutions such as forestry⁹. The UK is currently considering including three voluntary carbon market sectors in the scheme: (1) heat and buildings, (2) GHG removal techniques and (3) road transport¹⁰.

5.2. DESCRIPTION OF THE BUSINESS MODEL OF WCC VOLUNTARY CARBON CREDITS

In the space of voluntary markets and forestry, the **WCC** is the quality assurance standard for UK-based woodland creation initiatives aiming to provide carbon offsets. It is internationally renowned for its standards for sustainable forestry and carbon management (Forestry Commission, 2023). The WCC generates carbon credits for woodland creation projects and is supported by the UK government to meet the **goal of reaching 16.5% tree and forest cover by 2050**.

The WCC, supported by the UK government, is internationally renowned for its standards for sustainable forestry and carbon management¹¹. WCC credits range from £10 to £30+ per unit, with each unit representing a metric ton of carbon dioxide emissions. They can potentially bring significant returns over time. Woodland creation projects can yield from 100 WCUs/ha to 500 WCUs/ha, generating revenues ranging from £1,000/ha to £15,000+/ha through the sale of carbon units via the WCC during the same period¹².

WCC Process. To participate, projects must register with the WCC, pass additionality tests (including a financial additionality test), and follow specified instructions to generate carbon units. A new woodland creation project must satisfy associated additionality tests to be validated by the WCC. Validation after planting completion and verification occurs at least every ten years, for up to 100 years¹³.

WCC-verified carbon units (WCUs) recognise actual additional carbon dioxide that has been additionally and permanently sequestered from the atmosphere. Pending Issuance Units (“**PIUs**”) recognise future expected additional and permanent carbon dioxide sequestration that convert it to WCUs in vintages. PIUs and WCUs are tradeable instruments that can be traded on the open market (Figure 1).

Developers tend to implement the following steps to develop and execute an afforestation project:

1. Register the project with the WCC to participate.
2. Pass associated additionality tests to ensure the project’s reliance on carbon offset funds or income generation.
3. Plant trees to align with the WCC registered design.
4. Verify and list PIUs on the UK Land Carbon Registry within three years.
5. Wait for PIUs to mature in vintages and become WCUs; validation points are typically at years 5 then every 10 years.
6. Optionally, sell or retain PIUs on the open market, or sell WCUs and/or choose to retire them .

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5. OVERVIEW OF THE WGC AND UK-ETS CONTINUED

5.2. DESCRIPTION OF THE BUSINESS MODEL OF WGC VOLUNTARY CARBON CREDITS CONTINUED

Figure 1. WCC Process



Source: Forestry Commission – The benefits of woodland creation Woods and Carbon

5.3. CASE STUDIES

We've selected the New Zealand ETS and CORSIA as case studies. Their pioneering approaches in integrating forestry carbon credits and improving market efficiency, respectively, showcase vital aspects for our research. They constitute a base for comparison with our findings.

New Zealand's ETS (NZ ETS) is the first system that fully integrated forestry carbon credits into its ETS since inception. NZ ETS is still undoubtedly one of the key contributors to an increased afforestation activity in NZ. It has created industry incentives to grow and provide net positive externalities.

Even though CORSIA stands as a pivotal initiative within the aviation industry, addressing international climate change mitigation, there is good alignment with ETS markets, which operate on a region or country-focused level.

5.3.1. Case Study: New Zealand. Is there a rationale for an integration of the WCC into the UK ETS business model? Lessons learnt from New Zealand

The New Zealand Emissions Trading Scheme (NZ ETS) serves as a robust and unique model of an efficient climate mitigation system that successfully incorporates forestry. It is currently the only ETS in existence that has been able to include the entire forestry sector in its framework, creating credits for afforestation and liabilities for deforestation activities. Consequently, emitters across different industries have the possibility of investing in afforestation as part of their compliance obligations⁶⁵.

Emission unit (NZU) prices and controls. Established in 2008, the NZ ETS aimed to gradually reduce emissions by issuing New Zealand Emissions Units (NZUs), each representing a metric ton of carbon dioxide emissions. NZ ETS has shown a compelling case study through the integration of forestry-generated carbon offsets, highlighting the land sector's high sensitivity to emissions pricing and the crucial role of policy certainty for offsetting mechanisms' success.

Initially implementing a Fixed Price Option with controls until 2020, the NZ ETS saw alterations to pricing strategies, notably with a fixed price ceiling for emissions between 2010 and 2019 where participants could pay a fixed price of NZ\$25 per ton (a hard price ceiling) for emissions. This evolved further and increased to NZ\$35 per ton in 2020, with significant improvements, and the elimination of the fixed price⁶⁶. Subsequently, the market experienced substantial changes, exemplified by a surge in afforestation applications as the scheme continued to evolve.

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5. OVERVIEW OF THE WCC AND UK-ETS CONTINUED

5.3. CASE STUDIES CONTINUED

5.3.1. Case Study: New Zealand. Is there a rationale for an integration of the WCC into the UK ETS business model? Lessons learnt from New Zealand continued

The market's sensitivity to regulatory uncertainties and price signals was evident in the fluctuation of NZU prices, dropping to a two-year low of approximately NZ\$47 in June 2023 due to concerns regarding forestry's role in the ETS¹⁷. As clarity emerged, the NZU prices rebounded, auctioning at around NZ\$65¹⁸. Policy certainty emerges as a critical factor for the success of offset mechanisms within emissions trading schemes.

The NZ ETS experience underscores the high sensitivity of the land sector to emissions pricing, notably observed in the connection between land-use profitability and values, particularly in forest and agricultural lands. The NZ ETS played a crucial role in making forestry more profitable, leading to an increase in forest land values, showcasing the impact of emissions pricing on land-use decisions and afforestation potential. However, the NZ ETS experience has also been shaped by multiple factors such as policy uncertainty, complex rules, low and volatile emissions prices, and competing land uses¹⁹.

Key conclusions include the high sensitivity of NZUs to regulatory uncertainty and price signals, the necessity for improved modelling and transparency in reporting forestry activities within the NZ ETS, and the crucial need for a robust price signal to efficiently support afforestation and deter deforestation. This necessity stems from the critical role these aspects play in informing decisions by policymakers, landowners, and market participants.

In summary, the NZ ETS significantly influences land values, particularly in the forestry sector, showcasing the intricate interplay between environmental policy, market forces, and land-use profitability in New Zealand's landscape.

5.3.2. Case study: CORSIA. An international solution in carbon markets for the aviation sector

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) stands as a pivotal international agreement developed by the International Civil Aviation Organization (ICAO), a specialised agency of the United Nations (UN). Its primary goal is to address the environmental impact caused by greenhouse gas emissions from global flights. Unlike country or regional ETSs, CORSIA's scope extends to a worldwide scale and currently covered by several domestic or regional ETS agreements. Notably, the European ETS encompasses all flights within the EU, Iceland, and Norway, while China and New Zealand have initiated domestic ETSs covering their respective aviation sectors. Thus, CORSIA stands as an international body that can prevent double pricing for airlines subject to one or more domestic carbon mechanisms such as ETS schemes.

CORSIA's implementation plan consists of voluntary phases between 2021 and 2035, during which states and airlines can choose whether to participate. Overall, this represents a significant global effort to mitigate the climate impact of aviation, and emerges as an international body to offset emissions in the aviation sector as the implementation of a domestic carbon pricing system could potentially negatively impact the domestic aviation industry, leading to carbon leakage. Thus, a unified and comprehensive approach is essential, highlighting the need for international carbon offsets units that can accommodate the complexities of sectors with cross-border implications.

Moreover, for CORSIA to succeed it needs certified and credible carbon offset units, underscoring the UK's potential to provide a solution. By incorporating forestry-generated carbon offsets into the UK-ETS, the UK can meet CORSIA's demand for reliability and quality, and allowing UK airlines to meet their CORSIA obligations while meeting their cap-and-trade domestic obligation. This approach aligns with CORSIA's focus on offsetting rather than allowances, contributing to efficient emission management in one of the main emitting industries.

Finally, the analysis of potential environmental impacts and policy options for the UK ETS for aviation alongside CORSIA offers valuable insights. By accepting WCUs generated through forestry in the UK, CORSIA could offer the UK aviation sector a mechanism to meet its CORSIA obligations without the risk of double counting. Moreover, aligning the MRV system within the UK ETS with CORSIA and the EU ETS will promote standardisation and cost reduction in MRV practices, contributing to bolstering market infrastructure and enhancing market efficiency in addressing aviation-related emissions.

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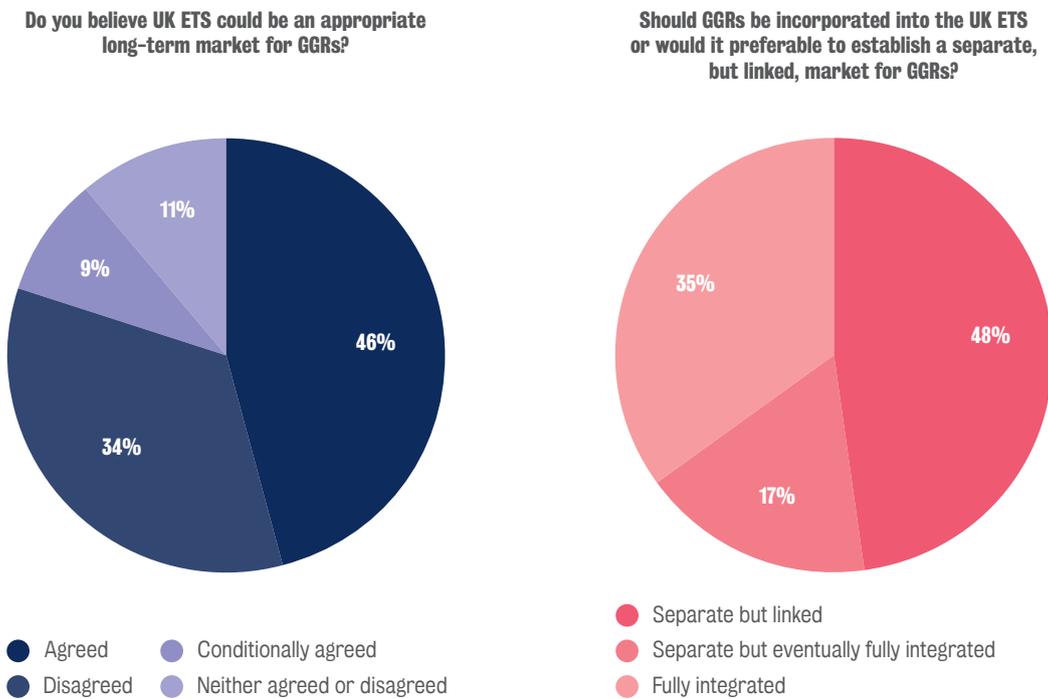
6. UK GOVERNMENT CONSULTATION: THE WCC AS AN OPPORTUNITY TO EXPAND THE UK-ETS TO INCLUDE GGRS

The UK Government’s recent “**Main Response Chapter 7**” consultation paper, “**Call for evidence on GGRs and agriculture and land use emissions**”, explored the considerations for GGRs and their link to the voluntary carbon market, and in particular the possibility of WCC being included in the UK-ETS. Key findings arising from the consultation include:

1. Support for WCC inclusion in the UK-ETS

The UK-ETS holds the potential to serve as a long-term market for GGRs including engineered and nature-based solutions. 80% of respondents ‘agreed’ and ‘conditionally agreed’ that UK ETS could be an appropriate long-term market for GGRs.

Figure 2. Inclusion of GGRs in the UK ETS



Source: Developing the UK Emissions Trading Scheme main government response (Question 147)

Source: Developing the UK Emissions Trading Scheme main government response (Question 159)

The conditions respondents articulated for their “Conditional Agreement” centred on factors such as technology choices, MRV, and the presence of complementary policies.

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6. UK GOVERNMENT CONSULTATION: the WCC as an opportunity to expand the UK-ETS to include GGRs continued

2. Incentive to Decarbonise

The UK ETS is designed to incentivise participants to reduce their carbon footprint. An essential consideration flagged in the consultation paper, was the need for maintaining an incentive for corporates in the UK-ETS to decarbonise whilst at the same time admitting GGRs. The concern flagged is that by admitting GGRs, and WCC carbon credits specifically, this would increase the supply of credits / permits in the ETS, reducing the cost of emissions and all else equal reducing the incentive for companies to invest in projects that reduce their emissions.

Moreover, it would be difficult for trading participants in the UK ETS market and current or prospective WCC credit developers/ owners to feel positive about the admission of WCC credits into the UK ETS market if they knew the increased level of supply of carbon credits could materially decrease and/or depress UK ETS pricing. Policymakers can address this concern by ensuring that demand for UK ETS permits remains relatively stable and that any material depression of UK ETS pricing, relating to the proposed admission of the WCC credits, is minimised. In other words, the regulator should consider decreasing the annual emissions cap in line with the anticipated increase in supply of credits/permits from the WCC sector in order to retain some balance and equilibrium in the UK ETS pricing, thereby maintaining the financial incentive for companies to invest to avoid emissions and the incentive for WCC developers to trade their credits through the UK ETS system.

3. Positive Impact on VCM and broader Ecosystem Services

The consultation found that admittance of GGRs, and the WCC specifically, into the UK-ETS is expected to bring a positive transformation to the nascent VCM. This admittance would establish both mandatory and voluntary markets for WCC credits, stimulating demand and potentially increasing the value of WCC credits. Furthermore, it would help alleviate uncertainties stemming from short-term public policy shifts due to political changes, consequently enhancing the market's economic sustainability and fostering trust among stakeholders.

Further the liquidity and price transparency benefits that UK-ETS admittance would provide, would likely reduce WCC transaction costs, and provides a fundamentally more liquid market for which credits can trade. These benefits are expected to lead to increased level of investment into climate change mitigation projects that yield WCUs. Importantly, UK-ETS admittance has the potential to benefit ecosystem services like biodiversity, flood management, and water quality as bi-products / co-benefits of increased investment into WCU yielding climate change mitigation projects.

In summary, the efficient inclusion of GGRs in the UK-ETS presents numerous opportunities and challenges. By connecting these insights with the potential inclusion of the WCC in the ETS, the forestry sector can play a pivotal role in optimising the market's effectiveness while contributing to carbon reduction objectives and ecosystem services enhancement.

“The Authority believes that the UK ETS is an appropriate long-term market for GGRs. We will only include GGRs that meet robust standards set by the Authority.”²⁰

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7. ESTIMATING THE PRICE DISCOVERY OF THE WCUS IN THE POTENTIAL INTEGRATION WITH THE UK ETS

In our work to estimate the price of WCUs immediately following the potential admittance of the WCC into the UK-ETS, we employed a predictive tool known as the Autoregressive Integrated Moving Average (ARIMA) model. This robust statistical tool is commonly used in econometrics to model time series data in finance. We selected this method due to its proficiency in capturing and forecasting time-dependent data, and after trying other statistical tools.

We will first start with the conclusion of this quantitative analysis. Based on current UK-ETS allowance levels and using an ARIMA model, we estimate that the WCUs price immediately afterwards of the WCC integration into the UK-ETS falls within a range of £41 to £47.

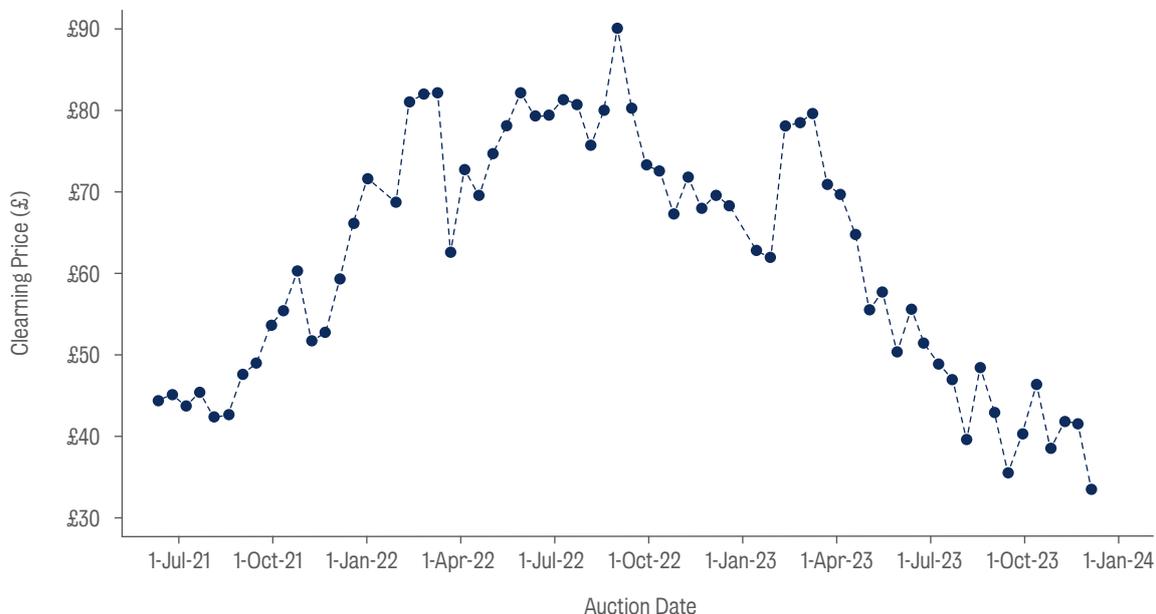
To find likely the WCU price in a scenario where the WCC were to be admitted to the UK-ETS, we analysed data retrieved from Intercontinental Exchange (ICE), UK-ETS announcements, and WCC reports. To analyse the price elasticity of supply we used the best ARIMA model to model the clearing price data.

The ICE data covers 61 bi-weekly trading sessions from May 19, 2021, to October 4, 2023. It includes UK-ETS auction specifics like auction dates, volume supplied and sold, prices, and revenue generated. Additionally, the **UK ETS announcement** indicates a reduction in carbon allowances: from 69 million in 2024 (a 12.4% decrease from 2023) to around 44 million by 2027 (a 45% reduction from 2023) and 24 million by 2030. Lastly, we incorporated **WCC** forestry credit volume data.

As a policy action, as we previously mentioned, it's crucial to note that during the launch of the UK-ETS on 19 May 2021, the **UK ETS auction regulations set the Auction Reserve Price** (the minimum price for bids in UK-ETS auctions) at £22 setting up a floor price. Additionally, the regulations implemented a Cost Containment Mechanism (**CCM**) to mitigate potential spikes in prices. One of the mechanisms employed involves adjusting the volume of allowances available²¹.

Figure 3 illustrates the volatility of the Clearing Prices in the UK ETS as a function of the auction sessions and volume of Allowances, with bidders' confidence steadily increasing over 2021, reaching a steady state during 2022 with an unprecedented high peak of £90, and continuing that trend up to April 2023. Amidst global events and economic dynamics, prices remain above the £40 line, in line with European ETS.

Figure 3. Clearing Prices over auction sessions



Source: ICE Auctions for UK Emission Allowances (ice.com)

The UK-ETS data reflects the typical adoption behaviour of new market products. At its launch, bidders exhibited an unusually conservative approach, resulting in clearing prices that diverged from typical market behaviour. This was most likely motivated by high levels of Allowances, hesitance of risk-averse investors, slow transfer from the EU ETS market, comparison of Clearing Prices with EU, and uncertainty around government commitment to climate change mitigation.

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7. ESTIMATING THE PRICE DISCOVERY OF THE WCUS IN THE POTENTIAL INTEGRATION WITH THE UK ETS CONTINUED

However, this trend was shifted when bidders entered the market, driving up Clearing Prices. This increase reflected industry concerns about potential emission penalties and a scarcity of supply. Subsequently, the market exhibited characteristics of a free market with perfect information and no distinct clustering of demand. Notably, Clearing Prices averaged £75.47, with over 75% surpassing £69.44, and the minimum price exceeding £62.21 throughout 2022. As adoption broadened and Allowances became scarcer, prices began responding more systematically to external factors. This behaviour isn't unique to the UK ETS but echoes across other UK markets, including timber²².

In pursuit of establishing a price signal for the incorporation of WCUs into the UK ETS, our approach involved employing the ARIMA model to explore different scenarios. Specifically, we considered three scenarios corresponding to different periods in the model, each representing a potential time frame for the inclusion of the WCC into the UK ETS. In these scenarios, we assessed the new clearing price, accounting for the entire anticipated increase in supply for each period. Tied to allowance levels and with a 95% confidence interval estimate over each of the three scenarios, the ARIMA model forecasted clearing prices ranging from £40.99 to £42.78 for the anticipated allowance level immediately following the proposed inclusion of WCC into the UK ETS scheme. Alternative statistical models would set this price at £46.72.

In summary, setting a price discovery is a delicate matter, in the presence of multiple external geopolitical and climate factor uncertainties. We conclude with a range of prices set around £41 to £47 for the WCU post-admittance into the UK-ETS and policy recommendations to provide stability and avoid volatility. **A conservative estimate of the price should be set around £41 to £47.**

While the objective of our research does not focus on projecting prices for the subsequent years, we acknowledge that estimations based on announced allowance targets for future years indicate a potential increase in the price as the allowances diminish. The ARIMA model projections suggest a rise to £68.37 in 2024, £74.04 in 2027, and £78.57 in 2030, assuming a reasonable price elasticity of supply.

The overall market behaviour of WCUs in the UK is closely correlated to the trends of their New Zealand counterpart. This stipulates that the variability of prices and the elasticity of the supply in the UK is driven by global phenomena. Lessons learned from the New Zealand experience, the availability of forestry, and the impact of their pricing strategy can be translated to the UK market. On 23 Nov 2023, **New Zealand's market opened at NZU \$69.00, after last fixing at NZU \$70.60**²³.

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8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION

To evaluate the impact of increased WCU prices after admitting WCC into the UK-ETS on afforestation rates, and in developing our methodology, we used Foresight Group LLP's methodology and its proprietary model. This involved conducting a comprehensive map-based exercise across Scotland, Wales, and Northern England, identifying 4,500 specific properties extending over c.800k hectares, showing promising afforestation potential.

Each property was assigned both agricultural and afforestation market values. Agricultural value is determined by the current agricultural use, while afforestation value considers potential future value from converting the land into commercial forestry and generation of WCUs. As part of our methodology, we created three distinct planting designs based on Foresight Sustainable Forestry Company Plc.'s portfolio. These designs were randomly assigned to target properties, and we calculated designated hectares for each tree species. The model increased complexity by integrating three tree growth yield curves to represent high, typical, and low yield scenarios based on implemented woodland creation designs.

It is important to note that although the three distinct planting designs referred to above are diverse forestry and are in excess of the requirements of UK Forestry Standards (UKFS) and the Ecological Site Classification (ESC) guidelines, the focus of this study is land that is suitable for commercial forestry. All three designs assumed 17% land allocation to broadleaf woodland (considerably in excess of the minimum UKFS requirements of 5%) with Design 1 splitting the residual balance of land by 43% commercial conifers and 40% open ground, Design 2 splitting it by 61% commercial and 22% open ground and Design 3 splitting it by 73% commercial conifers and 10% open ground. The land in question is normally marginal livestock farmland.

The analysis provided in this paper considers how much extra farmland becomes unlocked by the stronger carbon credit pricing and the more stable route to market that admittance of WCC credits to the UK ETS afforded to commercial afforestation projects and their contribution towards overall national planting targets. Other carbon-focused projects with less of a commercial forestry and timber focus tend to take place on even more marginal land which tends to be lower in price.

A hypothesis could therefore potentially be supported to show that admission of the WCC in the UK ETS market could also unlock a material amount of additional purely broadleaf-focused afforestation (and peatland restoration) in the UK, noting that further work would be required to substantiate this and to quantify the potential positive impact. However, it would not be unreasonable to assume that the estimated impacts of the positive effect for UK afforestation as presented in this paper are, if anything, conservative because the analysis currently focusses on commercial forestry.

To complete the evaluation, the model utilised the WCC's carbon calculator to estimate potential WCUs per property. Furthermore, using proprietary regional knowledge of afforestation valuations (informed by research from Strutt & Parker and Knight Frank) we calculate the Current Afforestation Value for each component of every property based on current prices of WCUs, as well as each property's Agricultural Value based on the agricultural quality grade of the land and the associated market price.

Finally, the model compares afforestation value with agricultural value to identify land more suitable for forestry under different WCU scenarios, including the assumed WCU price of £28 and potential post-ETS inclusion WCUs prices ranging between £41-£47. The contrast between land areas where Current Afforestation Value exceeds Agricultural Value and where Future Afforestation Value surpasses Agricultural Value defines the potential area economically unlocked for woodland creation due to anticipated increases in WCUs prices from WCC UK-ETS integration. Additionally, we estimated additional carbon dioxide sequestration resulting from unlocked land for afforestation due to higher WCUs prices under the post-UK-ETS WCC integration scenario.

Figure 4 provides a comprehensive scenario analysis, depicting the hectares of land economically viable for afforestation per region at different WCUs prices. This reveals the potential unlocking of an additional 11% to 26% of total land identified as having good afforestation potential in the UK, equivalent to approximately 43,000 to 107,000 hectares of new land that could be economically unlocked for afforestation, specifically where the agricultural value is newly surpassed by the afforestation value.

Figure 5 enhances this understanding by depicting the percentage of land suitable for afforestation that could achieve economic viability under different prices of WCCs. It presents that the impact on Scottish woodland creation is minimal, as the value of land for afforestation tends to already surpass its agricultural value in most cases, at current WCUs price. The figure illustrates that almost 100% of land is more economically viable for afforestation rather than agricultural use, assuming current WCC prices.

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8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION CONTINUED

Figure 4. Scenario analysis – hectares (ha) of land economically viable for afforestation per region

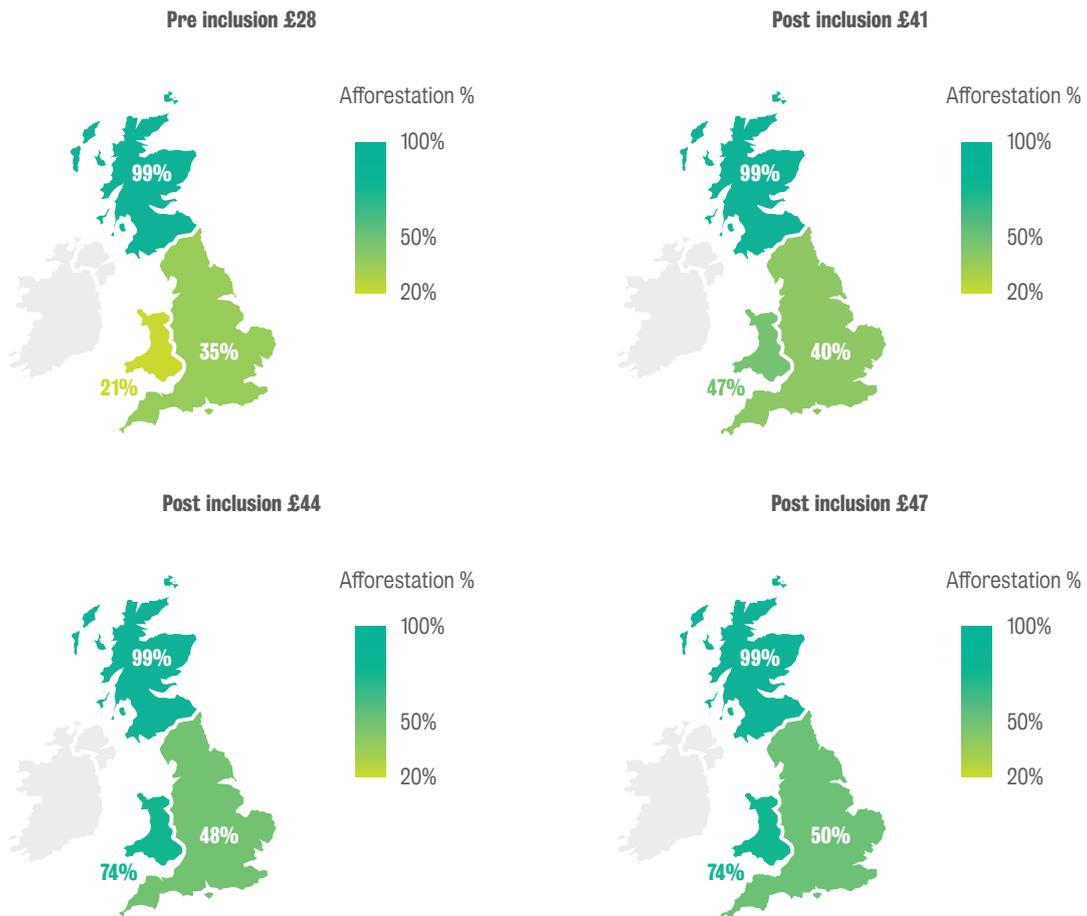
Area	No. of properties	Total Area with Afforestation Potential (Hectares)	Total Ha per price % change per price from pre-inclusion levels						
			Area currently economically unlocked for afforestation with current WCU price (Hectares, % of Total area)	Area economically unlocked for afforestation with £41 WCU price (Hectares, % of total area)	% change	Area economically unlocked for afforestation with £44 WCU price (Hectares, % of total area)	% change	Area economically unlocked for afforestation with £47 WCU price (Hectares, % of total area)	% change
Scotland	351	236,672.63	234,818.12	235,029.43	0%	235,029.43	0%	235,029.43	0%
England	3406	454,694.67	159,922.07	183,310.74	15%	220,226.48	38%	225,446.59	41%
Wales	566	77,305.23	16,510.44	36,186.85	119%	57,393.31	248%	57,393.31	248%
Total	4323	768,672.53	411,250.63	454,527.02	11%	512,649.22	25%	517,869.33	26%

Caption: The table above depicts the total area of land suitable for afforestation for each region (England, Scotland, Wales). It compares how much of the total area identified with good afforestation potential is economically unlocked with current WCU price of £28 compared to the area economically unlocked for afforestation post WCC UK-ETS integration using this paper's estimated range of post UK-ETS inclusion WCC prices of between £41 and £47.

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8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION CONTINUED

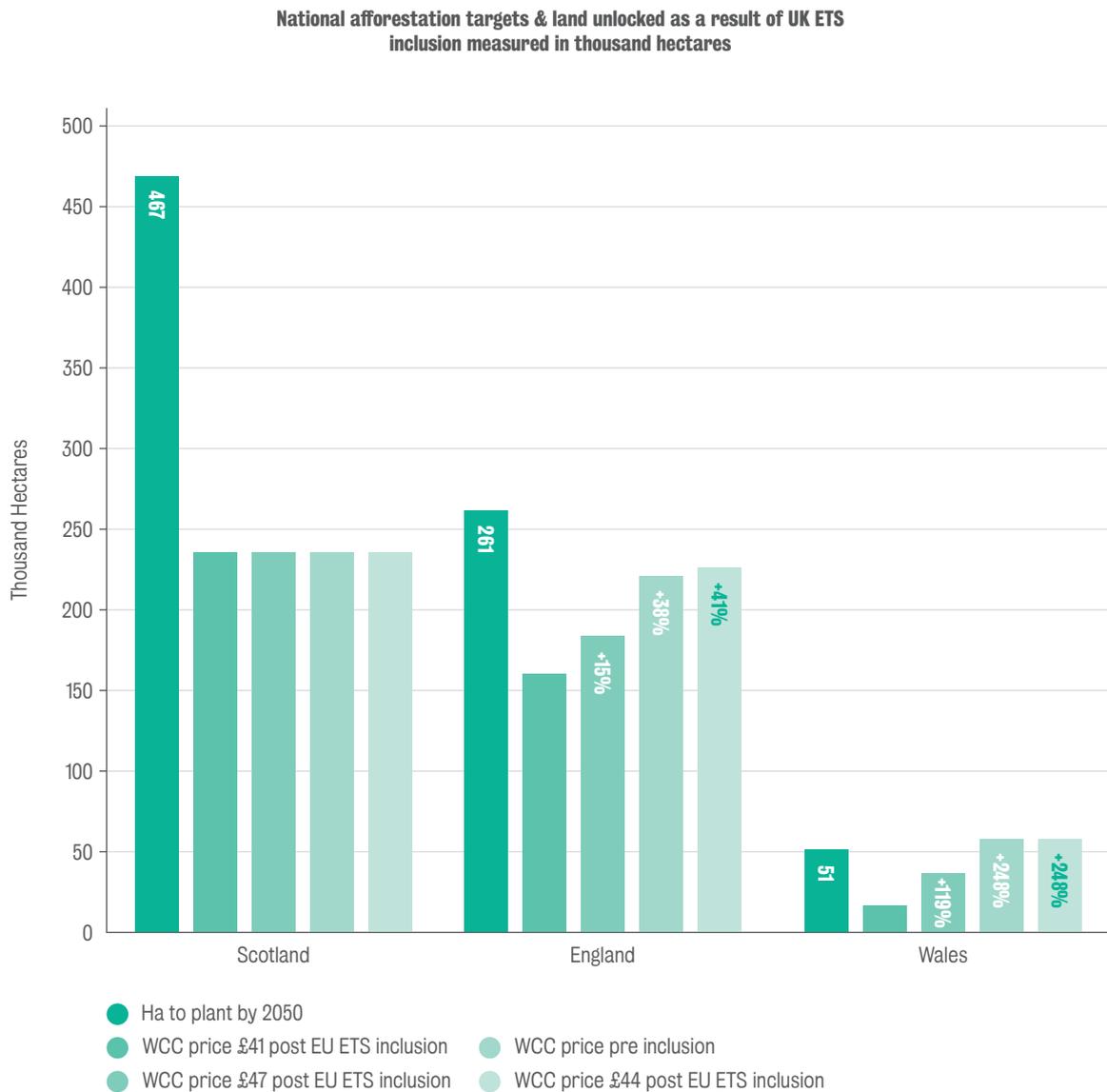
Figure 5. Scenario analysis – % of land suitable for afforestation that would become economically viable for afforestation based on different prices of woodland carbon credits



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8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION CONTINUED

Figure 6. Scenario analysis – Area (hectares) of land economically viable for afforestation per region



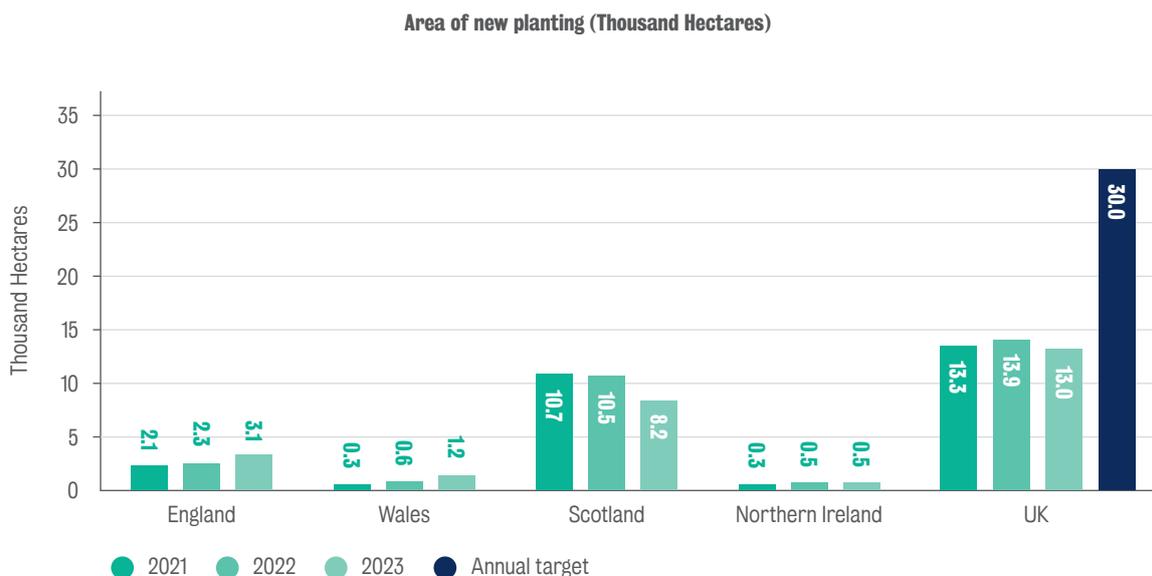
The analysis reveals that the admittance of the WCC into the UK ETS would result in a substantial increase in the price signal for afforestation-based carbon credits, consequently elevating the investment incentive for UK afforestation by an estimated 11% to 26%.

Figure 6 shows that this impact is anticipated to be particularly pronounced in England, with an expected increase ranging from 15% to 41%, and in Wales, where a remarkable surge of 119% to 248% is projected. Notably, these regions currently lag behind national afforestation targets the most.

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8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION CONTINUED

Figure 7. UK’s Annual Tree Planting Rates 2023



Source: Forest Research

Despite the analysis in this paper showing the unlocking effect being strongest in England and Wales and less pronounced in Scotland, it is important to point out that Scotland has historically been the largest contributor to UK planting targets by a substantial margin and fell short last year achieving just 8 thousand hectares (54%) of its 15 thousand hectares per annum target, a sharp 24% fall compared to the year before. Scottish government recently held an emergency forestry summit and released an action plan with the goal of getting things back on track. Stronger pricing and more stable route to market for WCC voluntary carbon credits would likely still have materially positive impacts on getting Scotland closer to achieving its planting targets, which would materially contribute to the UK’s planting efforts overall.

In conclusion, our findings underscore the region-specific implications and the transformative potential of afforestation incentives, particularly in regions where current afforestation efforts fall below national targets. There is evidence that WCC ETS inclusion would significantly help the UK government come closer to the national afforestation goals set for 2050.

The UK national carbon output is estimated to be **around 5 tonnes per capita**. At present, the afforestable land that is viable for forestry investment in the U.K. has the potential to sequester an additional 63m tons of carbon dioxide, representative of the annual carbon footprint 12.5 million UK citizens. The inclusion would allow for an additional 7.6-18.7m tons of carbon to be sequestered. Moreover, the increase in afforestable land would have the potential to sequester the annual emission of more than half of Wales’s population in the upper part of the post-inclusion price range.

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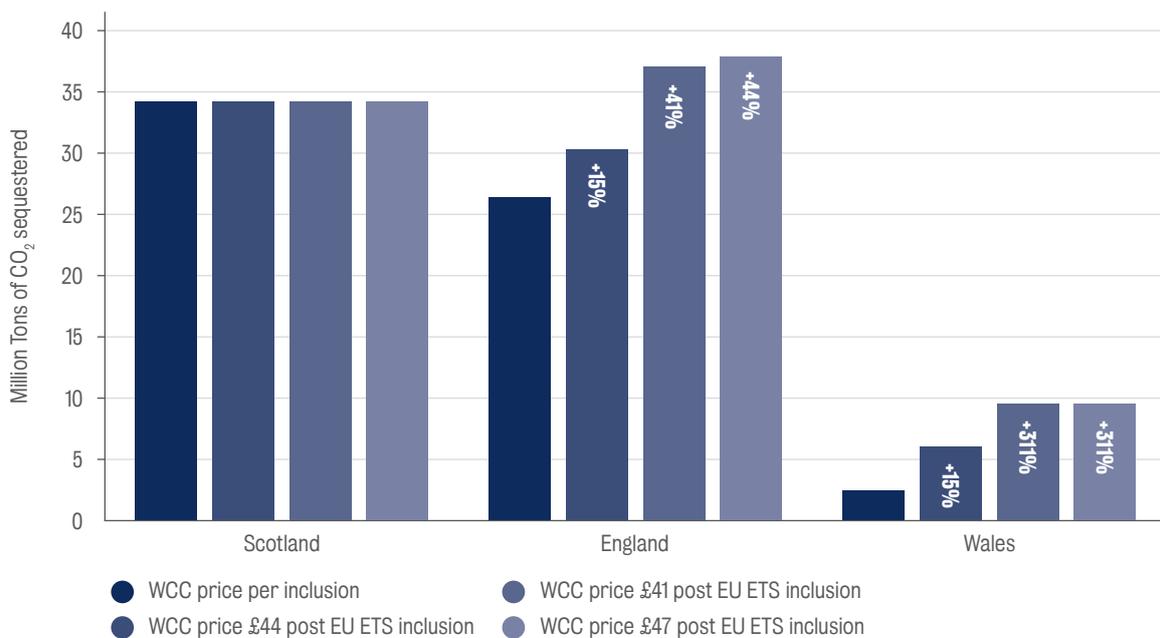
8. IMPACT OF THE NEW WCU PRICE ON INVESTMENT INCENTIVES FOR UK AFFORESTATION CONTINUED

Figure 8. Scenario analysis – Carbon sequestration potential

Area	Ha	Pre inclusion	Total Carbon Sequestered in tons % change per price from pre inclusion levels					
			Post inclusion £41		Post inclusion £44	Post inclusion £47		
Scotland	236,672.63	33,998,537.45	34,033,346.55	0%	34,033,346.55	0%	34,033,346.55	0%
England	454,694.67	26,222,065.75	30,171,037.93	15%	36,900,086.13	41%	37,732,241.03	44%
Wales	77,305.23	2,284,514.87	5,904,384.01	158%	9,397,724.17	311%	9,397,724.17	311%
Total	768,672.53	62,505,118.07	70,108,768.49	12%	80,331,156.85	29%	81,163,311.74	30%

Caption: The table above depicts the tons of carbon that could be sequestered through afforestation per each analysed region (England, Scotland, Wales). It compares how much carbon can be offset if the economically viable land is used for afforestation at current WCU price of £28 with the amount of carbon that would be possible to offset at the post inclusion price range £41-£47.

Figure 9. Scenario analysis – Carbon sequestration potential stack chart



In conclusion, our findings underscore the region-specific implications and the transformative potential of afforestation incentives, particularly in regions where current afforestation efforts fall well below national targets. There is evidence that WCC ETS inclusion would significantly help the UK government come closer to the national afforestation goals set for 2050.

The admittance of the WCC into the UK-ETS scheme holds the potential to significantly impact the UK national afforestation goals, increasing the total carbon sequestered in the UK by an estimated range of 12% to 30%. The most pronounced impact is expected in England, with an estimated surge of 15% to 44%, and in Wales, with an increase ranging from 158% to 311% is foreseen.

The results affirm a significant positive impact of WCC credits being admitted into the UK-ETS on the UK’s afforestation goals, as indicated in Figure 10, which depicts national afforestation targets across regions of Scotland, Wales and England. The figure shows that the inclusion of the WCC in the UK-ETS would significantly benefit the overall UK afforestation targets. As noted above, the most notable change would be felt in England and Wales. Planting targets have historically been missed in all three countries, but the economic barrier (predominantly due to the lower value/price of agricultural land) is lower in Scotland which means the change in market dynamic (i.e. unlocking effect) would be less pronounced there.

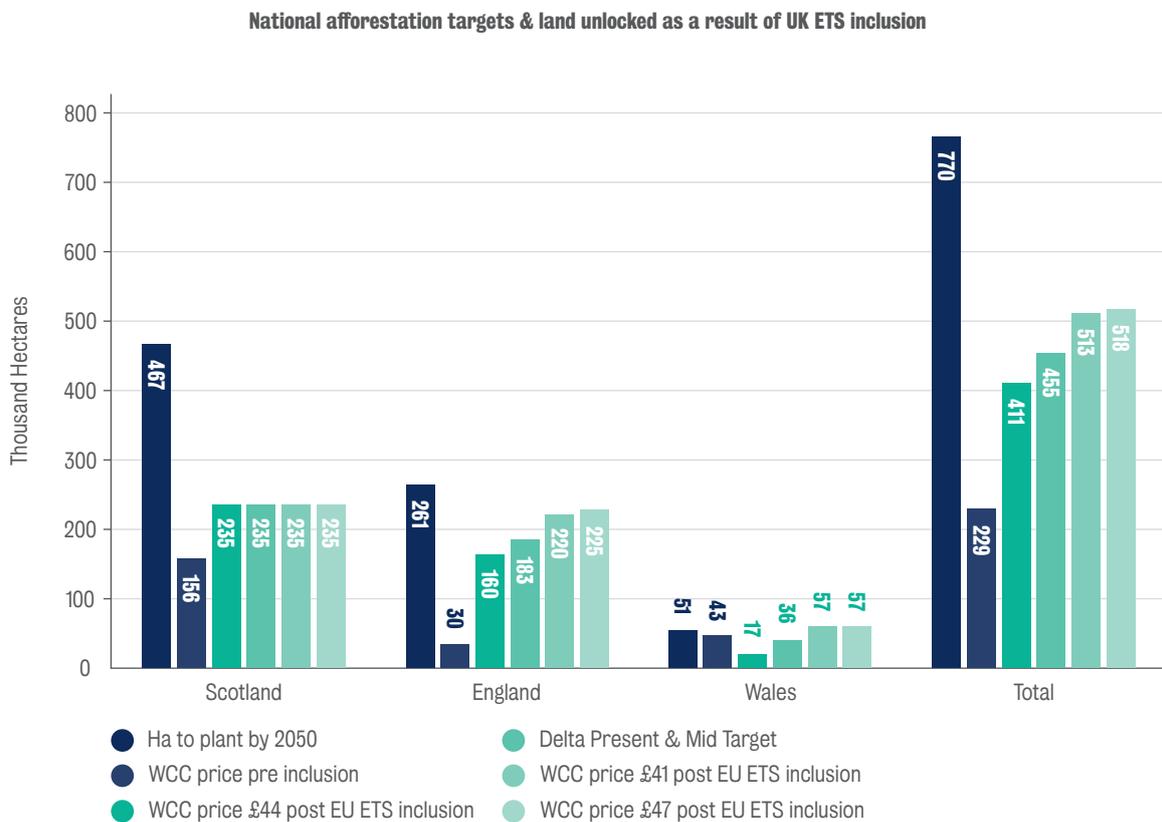
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9. EVALUATION OF THE POTENTIAL CONTRIBUTION OF WCC CREDITS ON THE UK'S NATIONAL TREE PLANTING TARGETS

In terms of the total land with afforestation potential that would become economically unlocked for afforestation as a direct result of UK-ETS inclusion of WCC WCU based on 2050 targets, England would likely be able to increase its afforestation capability by up to 25% after the inclusion. Wales on the other hand would even be able to exceed its 2050 target as the economically viable land for afforestation would exceed its national 2050 target by 6,663ha.

It is worth noting that Scotland shows minimal impact, as 99% of its land with afforestation potential is already deemed economically more suitable for afforestation than for agricultural retention. However, the land identified as suitable for afforestation in this region only meets approximately 50% of the government's 2050 regional targets. If WCC prices were to rise above the £47 per credit assumed in our research, it would further enhance the UK Government's ability to achieve its national tree planting goals, assuming other factors remain constant.

Figure 10. National afforestation targets versus land unlocked based on carbon credit price



It is estimated that a WCU price of £182 would be required before all land identified with afforestation potential would be fully unlocked for potential afforestation.

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10. CONCLUSIONS

This integrated analysis illuminates the substantial contributions and potential transformative effects of WCC's inclusion in the UK-ETS, emphasising region-specific implications and advancements toward national afforestation targets. The quantitative analysis and case studies provide evidence of the natural linkages between VCMs and compliance carbon markets and show how these can boost the efficiency of the ETS.

The UK Government's consultation paper, 'Call for evidence on GGRs and agriculture and land use emissions' in Chapter 7, examined the incorporation of GGRs in the UK-ETS. It highlights that the forestry sector can significantly enhance market efficiency, aid carbon reduction goals, and promote ecosystem services within the expanded UK-ETS.

The case studies of New Zealand and CORSIA provide evidence of the linkages between voluntary and compliance markets. In the case of New Zealand where the forestry carbon credit market was integrated into the NZ ETS since inception, the NZUs are highly responsive to regulatory uncertainty. The market needs strong price signals, improvement in modelling the land, and increased transparency in forestry reporting.

There is evidence of the economic and environmental value in the WCC being accepted into the UK ETS. However, we recommend maintaining flexibility in the admission process of the WCC into the ETS while addressing potential political measures that could jeopardise the market's economic viability and trust. In this context, we propose granting developers and/or owners of WCUs the option to choose whether to sell some or all of their units within the UK-ETS or reserve the right to "Opt-Out" and trade some or all of their units in the voluntary market.

The quantitative analysis we conducted under our statistical model predicts a steady increase over time once the market settles, with the suggested price signal of the new WCUs immediately after the WCC admittance to the UK ETS within a range of £41 to £47. This would allow the potential to economically unlock (i.e. make viable) between 11% and 26% of total land across the UK for afforestation investment. As a result, the UK would edge closer to its national afforestation targets.

The efficiency of the UK-ETS could serve as a market tool to encourage sustainable investment. As a result of the predicted escalation of WCUs price, the viability of forestry investment would significantly increase. Thus, institutional investors would have a greater incentive to pursue forestry-based investments. The most significant impact would be in England and Wales where afforestation is even further behind the national targets than Scotland is. Unlocking land to accelerate the woodland creation in England and Wales would enable the government to be on track with its 2050 net-zero commitments.

Finally, the projected baseline price of £41 per WCU post-WCC integration in the UK ETS are aligned with the EU ETS's long-term targets set at €40 (£35)²⁴. Our quantitative analysis identifies a correlation with the EU ETS and the New Zealand carbon market, suggesting a promising avenue for conducting a market assessment that connects these markets, enhancing liquidity and price signal.

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DISCLAIMER

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