



## Tracing Carbon: Refining CO<sub>2</sub> Emission Factors from Urea and Protected Urea in Irish Soils

**Walsh Scholars Reference Number:** 2026028    **Research Institution:** Teagasc  
**University:** University College Dublin (UCD)  
**Location:** Teagasc Johnstown Castle, Co. Wexford and UCD (two years in each location).  
**Funding:** Teagasc    **Proposed Start Date:** September 2026

### Project Summary

By 2030, protected urea is expected to account for 95% of straight nitrogen fertiliser use in Ireland, with the potential to substantially increase direct carbon dioxide (CO<sub>2</sub>) emissions arising from urea hydrolysis. Current national emissions estimates are based on the IPCC 2006 Tier 1 default emission factor (0.20 kg C kg<sup>-1</sup> urea), which assumes complete mineralisation and release of CO<sub>2</sub>. However, international studies indicate that this default factor may overestimate actual emissions by 70–90%, particularly under temperate, moist soil conditions.

This PhD project will combine a meta-analysis of existing international datasets with targeted experimental studies to refine CO<sub>2</sub> emission factors across representative Irish soils and to develop a mechanistic understanding of soil carbon cycling following the application of urea and protected urea.

### Supervision

The project will be supervised by Dr Dominika Krol at Teagasc, with co-supervision provided by Professor Olaf Schmidt and Professor Christoph Müller at University College Dublin. The student will be based across Teagasc Johnstown Castle and UCD for the duration of the programme, with time divided between both institutions. Together, the supervisory team provides integrated supervision across Teagasc and university research environments, supporting the delivery of the project through complementary institutional expertise and access to facilities at both locations.

A funded research visit to Professor Müller's laboratory at the University of Giessen, Germany, is planned to undertake <sup>13</sup>C stable isotope experiments, providing advanced methodological training and international research experience.

### Research Environment

You will be based between Teagasc Johnstown Castle, a leading centre for agri-environmental research, and University College Dublin, one of Ireland's top research-intensive universities. The project offers access to state-of-the-art laboratory facilities, long-term experimental sites, and strong national and international research networks.

As a Walsh Scholar, you will be part of a vibrant interdisciplinary research community, benefiting from regular seminars, collaboration opportunities, and engagement with researchers across soil science, biogeochemistry, and climate mitigation.

### Career and Training Opportunities

The Teagasc Walsh Scholars Programme provides a structured four-year training and development framework designed to support both academic excellence and long-term career readiness. Scholars develop advanced scientific and analytical expertise alongside transferable skills in communication, project management, and stakeholder engagement through expert-led training, workshops, and tailored professional development.



Opportunities are provided to present research at national and international conferences, supporting professional networking and active engagement with the wider research community. Dedicated final-year career supports focus on preparing scholars for impactful roles across research, industry, advisory services, and policy, in Ireland and internationally.

Through the Teagasc International Training Awards, scholars may undertake an international research placement of up to 12 weeks aligned with their PhD project. Outstanding achievement may also be recognised through the Walsh Scholars of the Year and Gold Medal Awards.

### **Candidate Profile and Eligibility**

Applicants should ideally:

- Hold a First or 2.1 Honours degree (or Master's) in environmental science, soil science, agricultural science, plant science, or a related discipline
- Demonstrate experience in field- and/or laboratory-based research, with strong data handling and analytical skills
- Show the ability to apply multidisciplinary approaches to hypothesis-driven research
- Possess excellent written and verbal communication skills and the ability to work effectively as part of a team
- Hold a full, clean driving licence valid in Ireland, or be willing to obtain one
- Meet UCD postgraduate entry requirements, including English language requirements where applicable

### **Funding Details**

This is a fully funded four-year PhD funded by Teagasc, including:

- €25,000 annual stipend
- University fees covered up to €6,000 per annum

### **How to Apply**

Applicants should complete the [online application form](#) by **4:00pm on Wednesday, 18 March 2026**.

Applications must include a curriculum vitae and a 1–2 page statement of motivation submitted as part of the online application.

### **Interviews**

Shortlisted candidates will be invited to interview in **early to mid-April 2026**. Online interviews can be accommodated.

### **Further Information**

Informal enquiries are welcome and may be directed to Dr Dominika Krol at: [Dominika.krol@teagasc.ie](mailto:Dominika.krol@teagasc.ie)

Further information on the Walsh Scholars Programme is available at:

<https://www.teagasc.ie/about/research-innovation/the-walsh-scholars-programme/about-the-programme/>