AgNav - a climate action planning tool for farmers and their advisors

M. Lynch[1], P. Fenton[1], J. Herron[2], D. O'Brien[2], E. Murphy[3] and M. Houlihan[2]

[1]ICBF, Link Road, Ballincollig, P31 D452, Cork, Ireland
[2]Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy P61 P302, Co. Cork, Ireland
[3]Bord Bia, 140 Pembroke Road, Dublin 4, D04 NV34, Ireland

Abstract

Agriculture accounts for 37% of Ireland's carbon emissions. The Irish government, in its Climate Action Plan, has set a target of a 25% reduction in emissions from agriculture by 2030.

One of the key challenges facing farmers, advisors and processors is having an accurate picture of on-farm emissions as well as understanding the potential carbon mitigation effects of individual farm management practices.

The AgNav tool was developed as part of a collaborative effort by three agencies involved in the science, promotion and implementation of best practice in sustainability in Irish agriculture. It combines robust scientific models, validated input data and a high performance technology platform to enable farmers see detailed emissions data specific to their farm.

Furthermore, interactive scenario forecasting tools allow the farmer to see the impact of adopting various mitigation practices on emissions. Finally, an integrated planning tool allows the farmer and their advisor to devise a sustainability plan specific to their farm.

AgNav was piloted in 2023 with farmers involved in dairy and beef production. In 2024 this engagement increased, with over 10,000 livestock farmers working with their advisors to develop a farm sustainability plan on AgNav.

This has allowed for important insights to be gained on which mitigation activities farmers are most engaging with and the support they need in adopting these practices.

Further functionality continues to be added to AgNav for livestock farmers including, in 2024, the ability to include the affect of carbon sequestration by soil in overall emissions and, in relation to water quality, the ability to estimate the nutrient balance (nitrogen and phosphorous) of the farm.

A module for tillage farms will be launched later in 2025 while future developments will see AgNav extend into the sheep, pig and poultry sectors.

Introduction

In Irland, the national and sectoral targets are set by the Irish Government and set out in the Climate Action Plan.

The Climate Action Plan sets out a target of a 25% reduction in GHG emissions in Agriculture by 2030. A number of state agencies are involved in assessing how this target can be achieved in this timeframe.

One of these agencies is Teagasc, the national body providing integrated research, advisory and training services to the agriculture in Ireland.

Estimating the impact of on-farm mitigation practices

Teagasc has developed a Marginal Abatement Cost Curve Curve (MACC) to display the abatement potential and relative cost of different mitigation measures (Figure 1).

In the MACC, the wider the bar on the x-axis, the more carbon abatement potential for that action. On the y-axis if an action is below 0 it also cost-negative, if it is above 0 then there is a cost to this measure.

The MACC outlines the activities that will have an impact at the macro level. It is then necessary to translate this into actions that can be undertaken at individual farm level.

This involves three steps:

- Understanding where each farm is at currently in its ghg emissions
- Examining the menu of mitigation actions and see what does it mean for that farm
- Agreeing on mitigation actions and making a farm specific plan

In order to achieve these steps there are 3 important elements that come into play

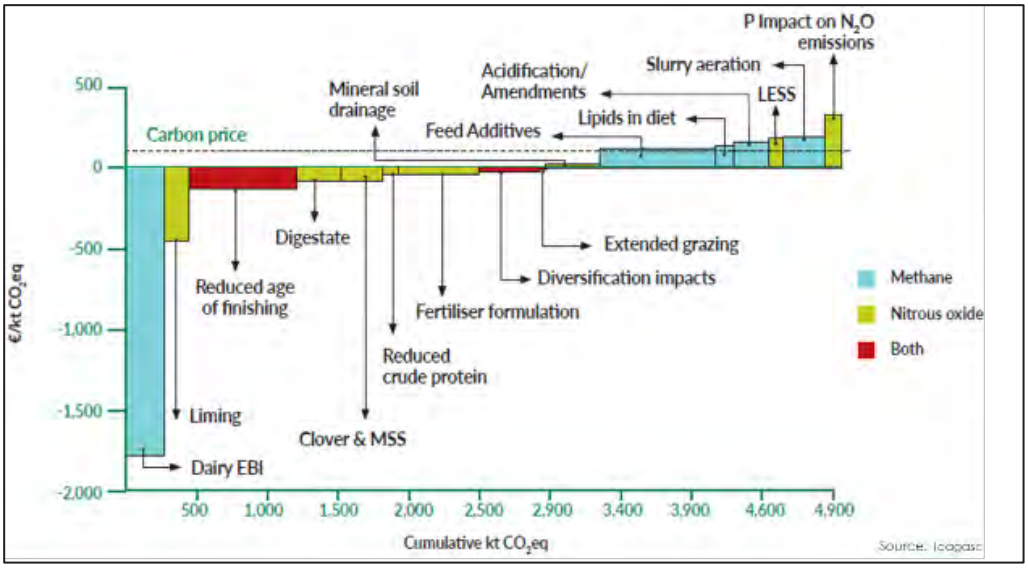

Figure 1. Marginal abatement cost curve – Teagasc 2023.

Robust scientific models

Assessing GHG emissions on farm involves modelling a complex system with a large number of variables. Furthermore, the area of climate science is evolving rapidly with frequent updates coming from the IPCC. The scientific models involved require updating, testing and validating across a variety of farm scenarios.

Accurate data

The factors that contribute to the overall GHG emission of a farm are varied and complex. While it is possible to use industry average figures for certain inputs, the ideal situation is to have accurate, on-farm data, both for accurate modelling and for follow up verification of mitigation practices and their outcomes (Figure 2).

Effective engagement

Climate mitigation practices can be difficult to understand and to quantify. Farmers need support from a range of stakeholders in embarking on any actions. The role of the farm advisor is crucial in this respect. Furthermore, both the farmer and their advisor need the tools that can help them assess where a farm is in its mitigation journey, the actions that are available, the effectiveness of these actions and the ability to plan and verify.

The aim of AgNav is to bring together these three elements in order to facilitate the implementation of effective climate action mitigation practices through the development of a farm-specific plan by the farmer in consultation with their advisor.

AgNav – bringing climate action to farmers and advisors

The AgNav tool was developed as part of a collaborative effort by three agencies involved in the science, promotion and implementation of best practice in sustainability in Irish agriculture. It combines robust scientific models, validated input data and a high performance technology platform to enable farmers and their advisors see detailed emissions data specific to their farm.

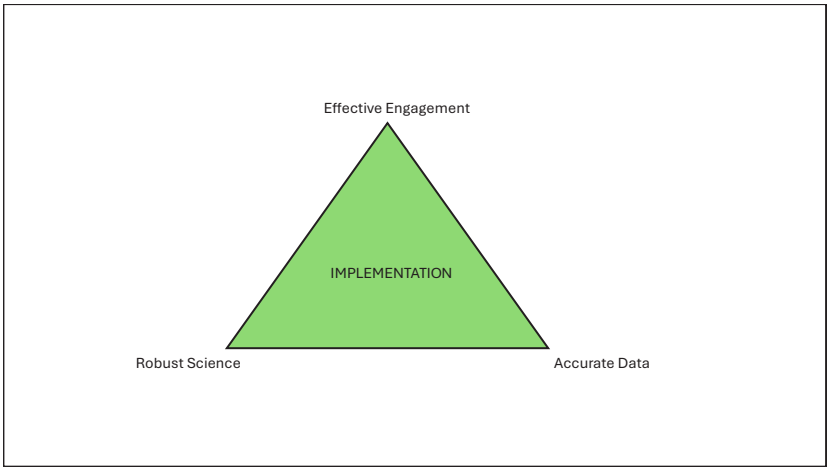

Figure 2. The elements of implementation in climate action practice.

Teagasc as described in section 2, Bord Bia which is the agency that promotes Irish agricultural produce and manages the Quality Assurance Schemes to which the majority of beef and dairy farmers belong, and ICBF, which is the central database for genetic evaluations and for wider data services in the Agrifood sector in Ireland.

The three agencies have developed the AgNav data platform. The contribution from each agency can be summarised as follows;

- **Teagasc**: latest of the scientific research and models for calculating emissions across agriculture. In addition to this there is the link with the Signpost Climate Advisory programme, that is being rolled out across the entire industry.
- **ICBF**: Software engineering and database capabilities in managing data, combining the data from different sources, programming and running the scientific models, testing at scale and updating in line with the latest research. In addition to this it has to technical capability required for development of tools and dashboards for farmers and advisors.
- **Bord Bia**: interface with the existing Quality Assurance Schemes in which farms are audited periodically across a variety of sustainability measures, providing a key source of validating data. In addition to this, as part of the of the Quality Assurance Schemes, farmers develop actions plans for their own farms across a variety of areas covering sustainability and animal welfare. Bord Bia is also the agency for the promotion of Irish agricultural produce both nationally and internationally.

  The AgNav tool endeavours to assist the farmer in the three stages of : Assess – Analyse – Act.

- **Assess**: AgNav is powered by access to the most accurate farm level data available drawing from a range of data sources. It uses certified methodology of the Lifetime Cycle Analysis model to calculate carbon emissions.
- **Analyse**: The tool provides on-demand forecasting capability that allows the farmer and their advisor to estimate the impact on farm emissions of different carbon mitigation actions, such as reducing fertilizer, optimizing grazing days or reducing finishing age.
- **Act**: Once the farmer, in conjunction with their advisor, has evaluated the most appropriate mitigation practices for their farm, AgNav provides the functionality to develop a farm specific action plan.

AgNav is available to farmers at the website https://www.agnav.ie

AgNav - Functionality

The user is presented with the latest carbon emissions for their farm: total emissions, emissions per hectare and carbon footprint. These have been calculated using existing data sources to which the farmer has granted permission (Figure 3).

The user can then investigate various mitigation scenarios. Current functionality includes scenario planning across the following areas (Figure 4):

- Modification in total fertiliser use.
- Modification in the type of fertiliser used.
- Modification to slurry spreading method and time of year of applicatio.

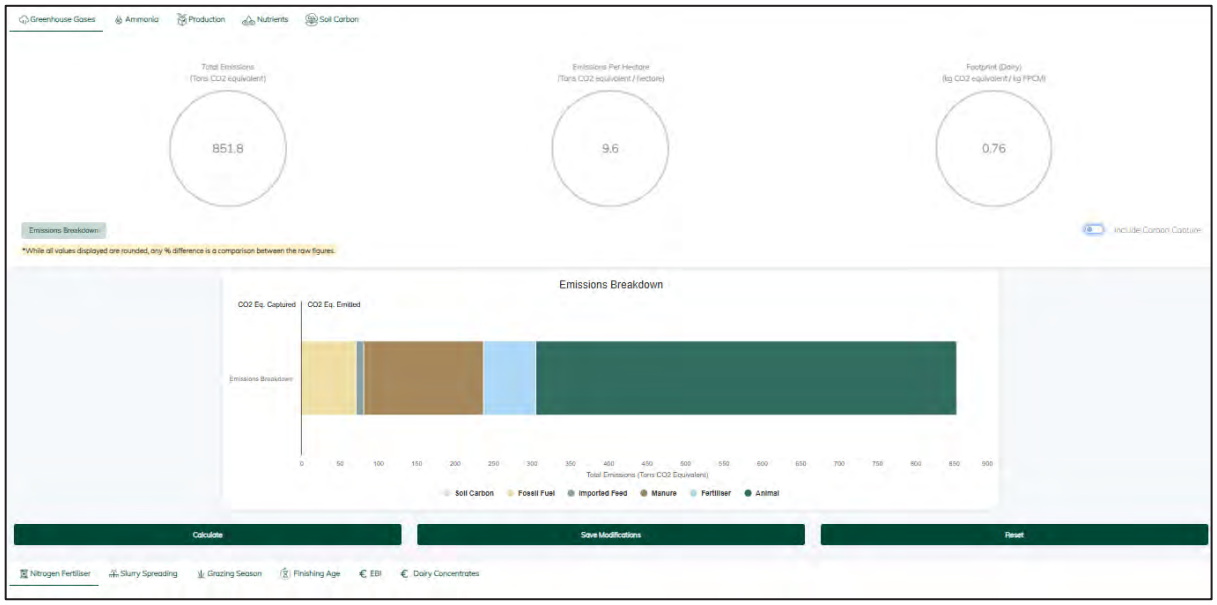

Figure 3. AgNav – Assess: Showing the current on-farm emissions breakdown.

- Modification to the begin/end of the grazing/housing seasons.
- Modification in the amount and type of concentrates.
- Impact of improved Dairy Genetics.

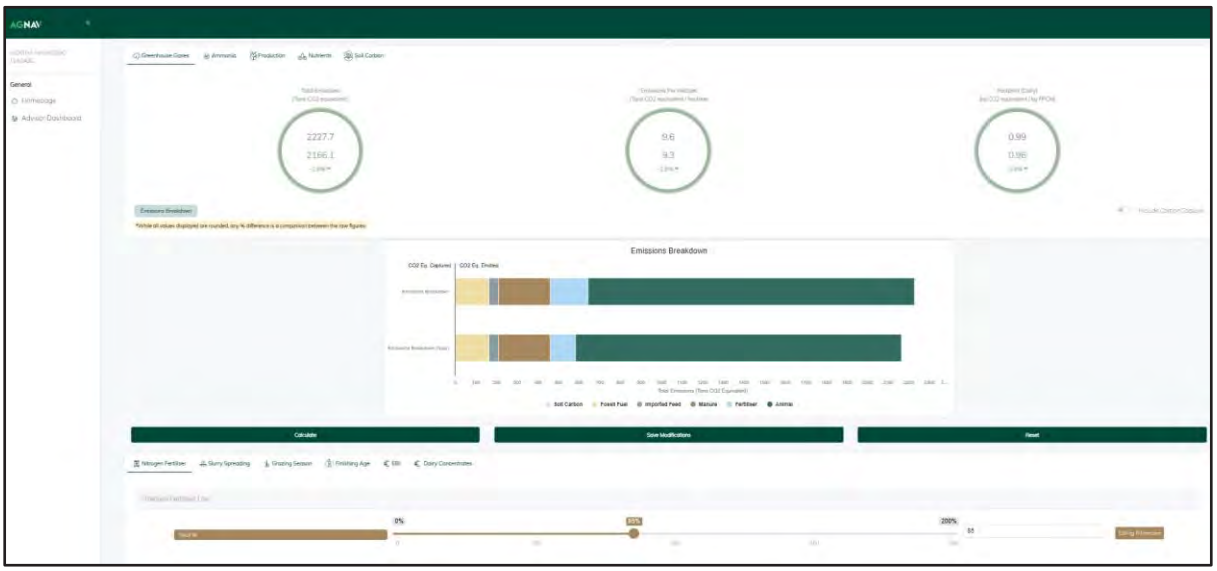

Figure 4. AgNav – Analyse: Investigating the impact on emissions of different farm management practices.

Carbon sequestration through soil

Farmers can record certain data relating to the sequestration potential of soil on their farm including: total land area, land user information, land management and soil type (Figure 5).

This sequestration potential can be incorporated into the calculation of the overall Carbon Footprint of the dairy produce generated by the farm.

Nutrient surplus

The nutrient surplus indicator was launched on the AgNav platform in response to industry requests as part of national water quality initiatives. Nutrient surpluses are an indicator of nutrient loss risk to water. Nutrient surpluses are associated with greater risk, and can help identify management practices that may improve efficiency and decrease loss risks. Nutrient surpluses are calculated as the differences between nutrients (nitrogen and phosphorus) imported and exported from a farming system and are expressed on a per hectare basis (Figure 6).

On AgNav, farmers can identify the nutrient sources contributing to a given farms nutrient surplus. The user will also be able to assess the effect of measures on nutrient surpluses using the forecaster (Figgure 7).

Action Plan

Following analysis of the effectiveness of different mitigations practices, the farmer can navigate to the Action Planner, and in consultation with their advisor, choose from a menu of options (Figure 8).

In the example in Figure 8 the user has opted to use protected urea. They are then instructed to select specific actions to help them achieve this and to set a target date for completion.

The Action Plans are saved on the AgNav system to allow for monitoring and further follow up with their advisor.

Figure 5. AgNav – Recording land use and soil type.

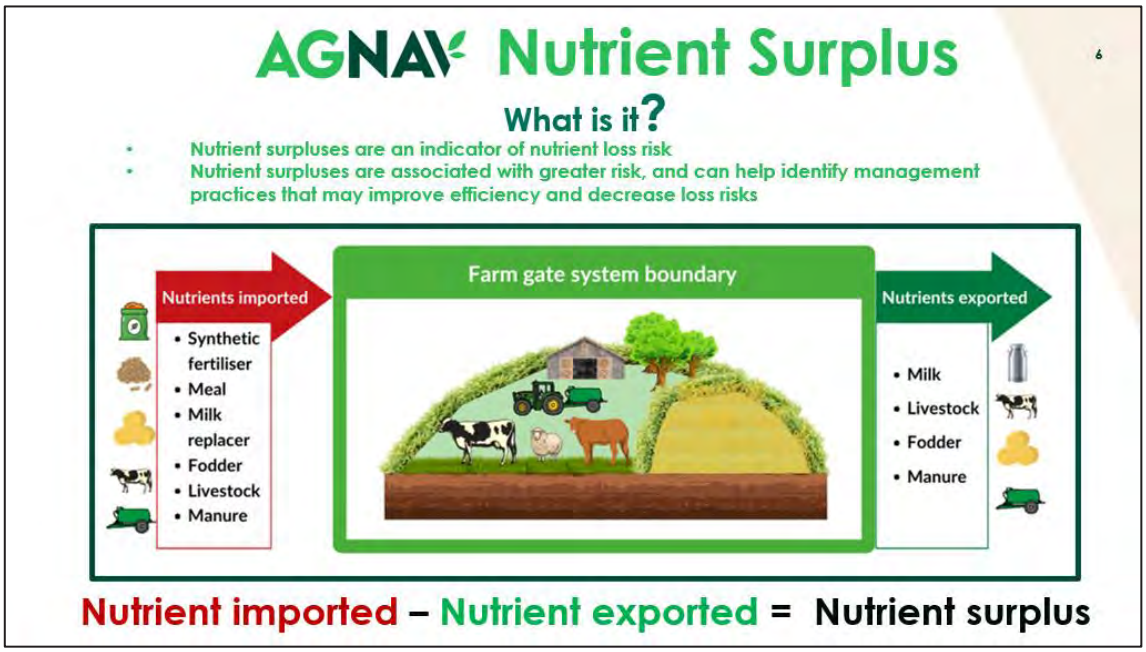

Figure 6. AgNav – Farm specific nutrient surplus (including sources).

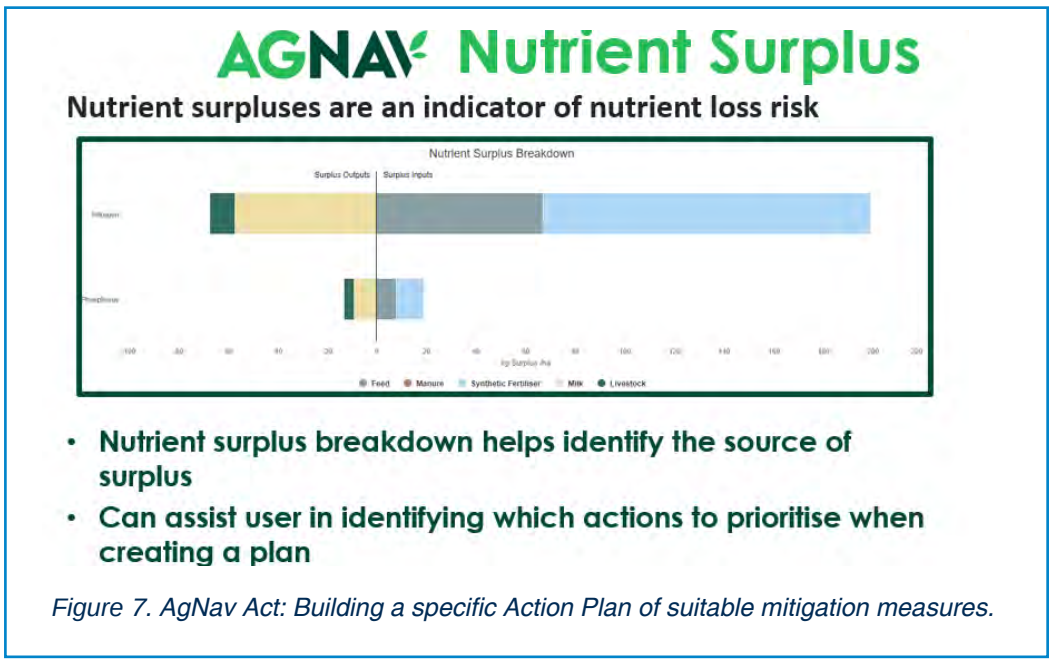

Figure 7. AgNav Act: Building a specific Action Plan of suitable mitigation measures.

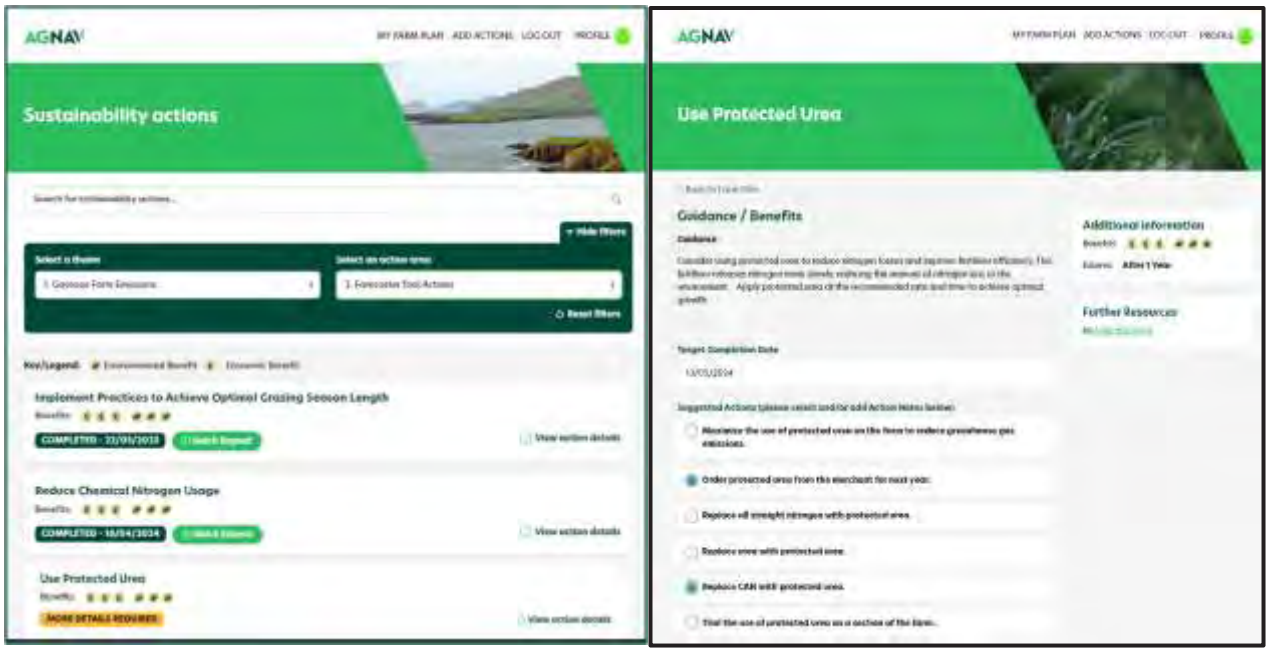

Figure 8. Advisor dashboard.

Farm advisors dashboard

All access to data is controlled by the farmer. Once a farm advisor has been granted access to a farm's data, they can manage their engagement with that farmer along with their other clients, through the Advisor Dashboard (Figure 9).

Rollout and further development

The development of the AgNav platform began in 2022 building on existing integrations and co-operation between the three agencies. It involved co-design workshops with pilot groups that included farmers and advisors.

It is now included in the training of climate advisors as part of the wider Teagasc Signpost Advisory programme. The Signpost Advisory Programme is a national advisory programme that aims to engage with 10,000 farmers each year from 2024 in the area of climate action and sustainability with a target of 50,000 farm plans by 2030 (Figure 10).

AgNav remained in closed pilot phase through 2023 and early 2024 to allow for training of advisors and the gradual onboarding of farmers involved in the Signpost Advisory Programme.

From mid 2024 this engagement increased, with over 10,000 livestock farmers working with their advisors to develop a farm sustainability plan on AgNav.

So far over 8,400 farm actions plans have been recorded with over 29,000 actions specified.

The top 5 mitigation actions chosen by farmers are shown in Table 1.

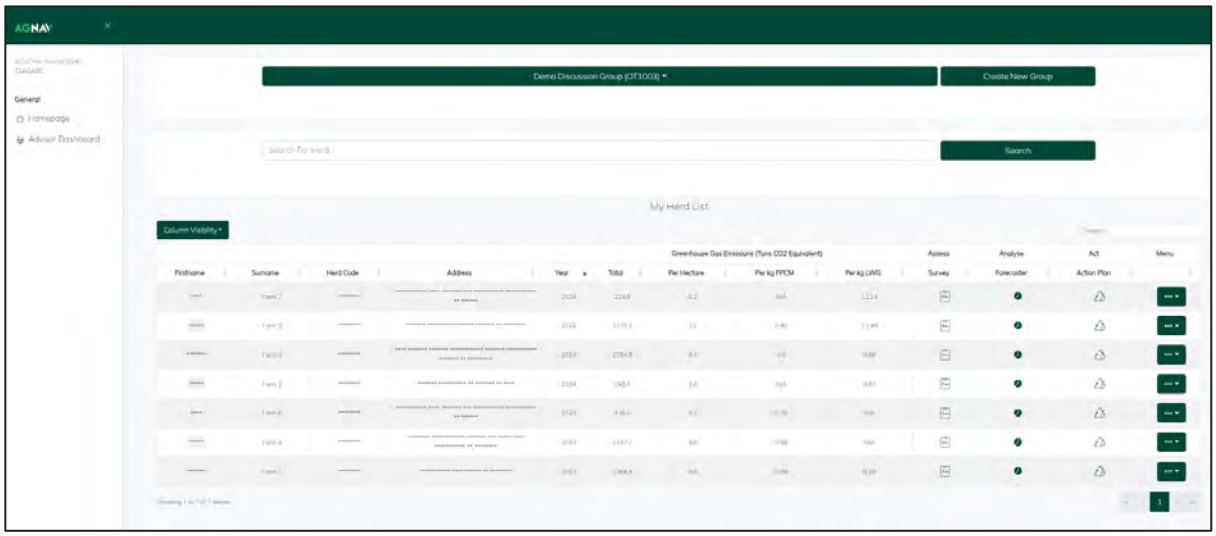

Figure 9. AgNav – From inception to national rollout.

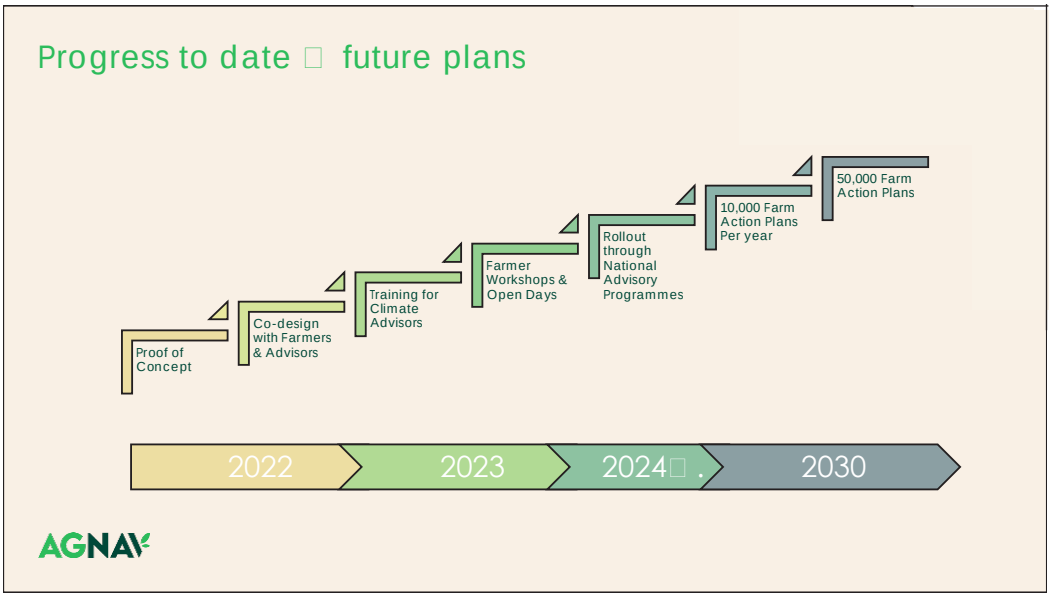

Fig 10. AgNav – from Inception to national rollout.

Table 1. AgNav - Mitigation actions chosen by farmers.

Mitigation action	Percentage of farms selecting this action
Use protected urea	59%
Application of Lime	41%
Application of P & K to optimise soil fertility	31%
Incorporate clover	22%
Low emission slurry spreading	22%
Reduce chemical nitrogen	22%

In Ireland, AgNav has received a lot of interest from Dairy Processors who see the potential to incorporate it into their own Sustainability Programmes. This reduces the burden of reporting on the farmer as they only need to record their sustainability actions in one place.

A module for tillage farms will be launched later in 2025 while future developments will see AgNav extend into the sheep, pig, poultry and horticulture sectors.

As AgNav allows for access to reliable estimates of carbon emissions on individual farms, including verification of mitigation actions, its role in the area of Carbon Farming will also be due for consideration.