



## Review

# Potential development of Irish agricultural sustainability indicators for current and future policy evaluation needs



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## ABSTRACT

There is a significant and detailed range of sustainability indicators for Irish agri-food production, but there remain areas where further indicator development or new indicators could prove valuable. This review provides an outline of potential developments in Irish assessment of agricultural sustainability following the latest research and in order to meet policy demands. Recent research findings have suggested means of improved quantitative modelling of greenhouse gas emissions, but additional dietary and soil data may be important for this, especially for the potential inclusion of any soil sequestration. This information could also benefit more detailed modelling of nutrient losses to water. Specific concerns over pesticide and antibiotic use may require additional survey work on the particular locations or types of farms of interest. Biodiversity monitoring could be improved by expanding the range of results-oriented agri-environment schemes or employing remote-sensing habitat monitoring, likely supplemented with targeted field surveys for specific objectives. Farm-level economic sustainability is largely well-covered, but additional data collection may be of benefit to address specific issues such as labour costs. Recent additional surveys on farm-level social sustainability have addressed important social indicators of isolation and access to local services, and could be rolled out on a larger number of farms in the future. Wider societal concerns such as animal welfare, genetically modified materials in foodstuffs and antibiotic resistance have limited indicators currently available, and could also benefit from additional surveys. The breadth and detail required in agri-food sustainability indicators present a significant challenge to survey design and implementation, but many developments can be achieved without additional surveys through the use of remote sensing and geospatial technologies and integration of existing datasets. Despite the important benefits of further developments in Irish sustainability indicators, consideration must also be given to farmer confidentiality and survey fatigue.

## 1. Introduction

Sustainability is an essential consideration in agricultural policy. In recent years, a number of studies have suggested potential indicators of agricultural sustainability, discussing indicator selection and development and considering how these indicators should be interpreted (Bockstaller et al., 2009; Lebacqz et al., 2013; Latruffe et al., 2016). Despite this research attention, the large-scale deployment and ongoing development of such indicator programmes has rarely been considered. In this paper we address this gap by describing some of the complexities of putting detailed agricultural sustainability indicators into practice, demonstrated in the Irish context. The paper provides a review of recent developments in the monitoring of agricultural sustainability and should prove useful to researchers and agricultural

stakeholders involved in designing programmes to meet and exceed policy requirements. As there are few comprehensive overviews of working indicator programmes, this paper also aims to establish a framework and evidence base which can be used to build the capacity for similar indicator developments in other countries. In line with the considerable research and policy attention directed at the environmental pillar of sustainability, much of this paper addresses this topic, however we also consider means of assessing economic and social sustainability to provide a full appraisal. The relative size of each section is not intended to reflect differences in the importance of each pillar.

All three main sustainability pillars (environmental, economic and social) must be considered for a true sustainability assessment (Lebacqz et al., 2013; Latruffe et al., 2016). While each pillar is important in its

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own right, even if approaching agricultural sustainability with an environmental focus it is important to have a systematic approach that reveals linkages between different aspects of sustainability. Potential synergies, such as a link between greenhouse gas emissions efficiency of production and farm profitability for dairy farms (O'Brien et al., 2015), may help communicate and encourage uptake of environmentally beneficial practices. For many environmental impacts potential associations with economic or social issues are unknown, and so having a holistic sustainability assessment may prove important to identify any unintended trade-offs between different aspects of sustainability, to design and implement a successful environmental policy, or to interrogate the wider context of why environmentally beneficial actions may not have been adopted.

In Ireland, the government and agri-food industry hope to realise ambitious growth targets up to 2025 and beyond (DAFM, 2015), and the sustainability of Irish food production is a key component of this strategy. There are, however, concerns about whether this growth can be achieved while minimising negative consequences (Wall et al., 2016). A range of detailed sustainability indicators will be needed to measure these potential impacts. As a European Union Member State, Ireland must also conform to European environmental legislation on, for example, water quality. Such legislation can entail specified sustainability indicators and/or direct indicator development to better drive policy compliance.

There is already a robust collection of indicators to assess the performance and sustainability of the Irish agri-food industry (Kelly et al., 2018), involving a number of stakeholders and programmes (see Table 1 for an overview of the most significant). However, several indicators could benefit from further development or data collection, and a number of relevant topics are not covered at present. This study describes the potential for new and/or improved indicators, including their scientific, policy or industry relevance, the possible means of indicator development, and data requirements. The focus of this review is to highlight opportunities to continue the development of indicators of agricultural sustainability in Ireland, which will also be of wider interest. Depending on the indicator, development may involve improved modelling of current indicators using already available data, expanded data collection in existing survey schemes, or additional surveys for certain sectors or farms of interest. We describe current best practice and discuss emerging issues, but do not intend this to be an overview of research needs or opportunities (although the indicator developments described could also benefit research).

The content covered in this paper, outlined in Table 2 below, is the result of a review of the current Irish agricultural sustainability programmes and consultation with a range of stakeholders about the indicator strengths and weaknesses, and priority areas for their improvement. Stakeholder consultations were held across 2016 and 2017,

and included representatives from the Irish government, business groups, and the research community (key individuals are thanked in the acknowledgements below). Based on these consultations, literature reviews were undertaken on the topics identified, building on discussion with other researchers, the authors' own expertise, and citation mining of existing work on agricultural sustainability.

## 2. Greenhouse gas emissions

### 2.1. Current recording schemes and coverage

Ireland is a party to international policy commitments to reduce annual greenhouse gas emissions, with binding emissions targets under the EU Effort Sharing Decision. Emissions reductions are set at national rather than sectoral level (with a distinction made for emissions generated in the production of energy, which are instead handled under the EU Emissions Trading System), but as agriculture is responsible for a large proportion of Irish emissions, it might be expected that the sector will be required to make reductions (Lynch et al., 2016a). Here, potential improvements to greenhouse gas emissions methodologies are considered until the point at which agricultural produce leaves the farm gate. Although further emissions may be incurred in food processing and distribution, and there is also interest in tracking and reducing these emissions in the Irish agri-food industry, consumer attention and the most pressing policy concerns focus on emissions associated with agricultural production rather than emissions accrued post farm-gate.

Farm-level greenhouse gas emissions are currently estimated as part of the Teagasc National Farm Survey (NFS), which fulfils Ireland's submission to the EU FADN (Farm Accountancy Data Network) and the Bord Bia Origin Green Quality Assurance (QA) schemes. Data are available to give robust farm-level estimates for cattle and sheep systems following IPCC (Intergovernmental Panel on Climate Change) and certified LCA (Life Cycle Assessment) accounting conventions (the distinction between these methodologies is returned to below). The Bord Bia QA schemes aim to cover 100% of products exported, with 49,000 beef farm and 13,000 dairy farm assessments performed as of 2016. The Teagasc NFS covers approximately 900 farms annually, representative of 82,000 + nationally, including a considerable proportion of farms not covered by QA schemes (25% of the sample in 2015).

Further data relevant to agricultural greenhouse gas emissions are also collected through the Teagasc - Bord Bia 'Carbon Navigator' (Murphy et al., 2013), a decision support tool highlighting the potential gains in farm profitability and emissions reductions if certain key management practices are undertaken. The Carbon Navigator is a requirement of the on-going Beef Data Genomics Programme (BDGP), through which funding is available to cattle farmers, and is linked with data collection for the Bord Bia QA schemes.

**Table 1**

A selection of the main Irish organisations and programmes connected to agri-food sustainability.

Organisation/Programme	Description
Teagasc, the Irish Agriculture and Food Development Authority	An Irish semi-state body with responsibilities in agriculture and food research, extension and education.
Teagasc National Farm Survey (NFS)	Annual survey of approximately 1000 farms, providing Ireland's submission to the EC Farm Accountancy Data Network (FADN). Primarily focussed on economic data but more recently expanded to include environmental and social sustainability indicators.
Bord Bia	Irish state agency responsible for assurance schemes and national and international promotion of Irish food.
Origin Green	Voluntary food and drink sustainability programme led by Bord Bia covering the supply chain from production to retail
Sustainable Dairy Assurance Scheme (SDAS)	Dairy farm quality assurance scheme rolled out in 2014. Operated by Bord Bia, it was the first component of the Origin Green programme. Now joined by Sustainable Beef and Lamb and Sustainable Egg Quality Assurance Schemes, with programmes in development for other sectors.
Environmental Protection Agency (EPA)	Independent public body with responsibilities in environmental monitoring and regulation. Key roles associated with Irish agriculture include compiling and reporting national greenhouse gas emissions, monitoring for and enforcement of water quality legislation, and pesticide use surveys.
Department of Agriculture Food and the Marine (DAFM)	Department of the Government of Ireland responsible for monitoring and control of food safety, animal health and welfare, and development and implementation of national and European agricultural regulation and policy.

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