

Institution: University of Aberdeen

## Unit of Assessment: 5 (Biological Sciences)

Title of case study: Making the link: environmental sustainability and dietary guidelines

## Period when the underpinning research was undertaken: 2010-2019

Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed
Jennie Macdiarmid	Professor Sustainable Nutrition and Health	2006-present

#### Period when the claimed impact occurred: 2013-2020

#### Is this case study continued from a case study submitted in 2014? N

## **1. Summary of the impact** (indicative maximum 100 words)

Prior to research carried out by the Rowett Institute, dietary guidance focused almost exclusively on nutritional value. With food production being a major contributor to greenhouse gas emissions (GHGE), Professor Jennie Macdiarmid recognised that new methods were required to combine nutritional information with data on environmental sustainability. Working with the World Wildlife Fund (WWF-UK) to combine a mathematical modelling approach with dietary requirements for health, she explored how adapting dietary intake could reduce the impact of greenhouse gas emissions and developed a realistic, cost-effective meal plan.

The research underpins the WWF's policy tool: the 'Livewell Plate'. This tool has been used to inform dietary guidelines in the European Union (EU) and internationally, leading to the United Nations Food and Agriculture Organisation's diet-related recommendations on how to link healthy diets with environmental impacts. The research has also encouraged global retailers IKEA and Sodexo to launch sustainable meat-free dietary alternatives.

#### 2. Underpinning research (indicative maximum 500 words)

The food system in the UK accounts for 20-30% of GHGE which means that drastic changes in dietary habits are required if commitments such as the Paris Agreement and UK Government's Net Zero target are to be met. However, any changes to dietary habits that favour sustainability need to be consistent with nutritional advice. The concept of combining sustainability with nutrition in treating the human diet is not entirely new, however it remains a complex issue. Many dietary guidelines still do not include recommendations for management of environmental sustainability; this is despite the fact that many of the UN Sustainable Development Goals (SDG) are explicitly entwined with food. This lack of guidance has resulted in inconsistent dietary advice to consumers, industry and health professionals.

Research at the University of Aberdeen, carried out by Professor Macdiarmid, sought to identify sustainable diets by linking health with environmental impact, producing consistent dietary advice and in turn, developing a programme of research on nutrition security focusing specifically on healthy, sustainable diets. Importantly, Macdiamid's research has shown that it cannot be assumed that diets that meet dietary requirements for health will necessarily have lower GHGE and that it is equally possible to create a healthy diet by using a different combination of foods with a high GHGE [3]. For this reason, her work has highlighted that it is important that these both issues to be considered together in the development of dietary guidelines.

# Connecting healthy diets with GHGE (2010)

In 2010, Macdiarmid collaborated with WWF-UK, alongside the University of Aberdeen Medical School and Biomathematics & Statistics Scotland in order to explore the link between healthy and environmentally sustainable diets, while also providing a communication tool for policymakers and



other end users [P1]. Macdiarmid used mathematical modelling (linear optimisation) to test the compatibility of diets that meet dietary requirements for health with the dietary changes needed to reduce GHGE. Through the creation of an extensive database, GHGE data for individual food and drinks commodities were linked with food and drink categories – this meant that each food item was represented by both GHGE data as well as nutrient-composition data [2]. Rather than simply generating combinations of quantities of different food groups, Macdiarmid and the wider research team were able to prepare a sample menu with detailed nutritional information and comprehensive product life-cycle analysis – this type of analysis is used to assess environmental impacts of individual products, including food items. This was the first example of life cycle analysis being applied to healthy diets, allowing the research team to assess whether the food lists were realistic (real-to-life), acceptable, and affordable for the general population. As a result of this work, Macdiarmid demonstrated that it was possible to generate affordable diets, capable of meeting dietary recommendations for health, whilst minimising GHGE [1].

The second phase of the work in [P1] assessed whether the database created in [1] could be linked to existing dietary advice, streamlining messaging about healthy and sustainable food choice. Macdiarmid worked with WWF-UK to link the database to the UK Eatwell plate, a dietary tool produced by the Food Standards Agency (FSA, 2007) for the public. By doing so, they created a database with a list of 82 individual food groups (each aligned to one of the five Eatwell plate segments) to ascertain whether the guidance could be adapted to include the environment. Through this work, Macdiarmid and team successfully introduced an 'Eatwell-adjusted' plate, which was used by WWF-UK to develop a robust pan-EU set of dietary guidelines [2]. These guidelines, known as the Livewell Plate, were designed to illustrate the balance of food and drinks required for a healthy diet, whilst accounting for GHGEs [2]. The 'Livewell' project as a whole highlighted the need to integrate wider issues of sustainability into the modelling process and to develop broader dietary advice – thereby presenting the first dietary guidelines and highly visible platform of its kind to link nutritional data to GHGE data in order to provide practical dietary guidelines for government and industry.

#### Connecting the methodology to food security overseas (2014-2017)

Macdiarmid adapted the method from [1], in a Wellcome-funded project in collaboration with London School of Hygiene and Tropical Medicine, to develop a model that could look at implications for climate change mitigation in India [P4]. By using a wide-range of agricultural activity data from across India at the farm-level and a state-of-the-art greenhouse gas accounting tool, the study analysed 17 single food items including crops and animal-sourced products. The research demonstrated that increased consumption of animal-based products and cereal production resulted in increased GHGE emissions [4, 5].

#### Using the methodology to model land use for food production (2015-2019)

As part of the 2015 'Delivering Food Security on Limited Land' project, Macdiarmid (and PhD student, deRuiter) used the method adopted in [1] and using the dataset developed in the WWF-UK funded project to create a new database that added land use associated with the UK diet. [P5] The research, undertaken in collaboration with Professor Pete Smith (School of Biological Sciences, University of Aberdeen), linked agricultural yield statistics with UK-specific food composition data to analyse the land use efficiency of food items for 23 different nutrients. The findings demonstrated that, from a land use perspective, roots & tubers and vegetables are the most land-efficient producers for these 23 nutrients. The research focussed on a wide range of nutrients, thereby broadening understanding in the research community about efficient use of land compared to previous analyses, which had solely focused on dietary energy and protein [4].

#### Modelling affordability of healthy and sustainable diets (2019)

In 2019, Macdiarmid introduced a financial constraint to method adopted in [1] to identify diets that would be affordable to all income groups. By examining the greenhouse gas emissions for different income groups, Macdiarmid found that current diets of all income quintiles had similar total GHGE, but that the source of GHGE differed. By reducing animal-based products and increasing plant-based foods in tailored ways, the study found that it was possible to create diets with a 57% reduction in GHGE that met dietary and cost restraints in all income groups [5].



#### **3. References to the research** (indicative maximum of six references)

## **References (citations via Scopus)**

- [1] Macdiarmid JI, Kyle J, Horgan GW, Loe J, Fyfe C, Johnstone A, McNeill G (2012) Sustainable diets for the future: can we contribute to reducing greenhouse gas emissions by eating a healthy diet? American Journal of Clinical Nutrition 96, 3, 632-639 doi: https://doi.org/10.3945/ajcn.112.038729, 228 citations
- [2] **Macdiarmid JI**, Kyle J, Horgan GW, Loe J, Fyfe C, Johnstone A, McNeill G (2011). Livewell: a balance of health and sustainable food choices. WWF-UK commissioned report, link: http://assets.wwf.org.uk/downloads/livewell report jan11.pdf.
- [3] Macdiarmid JI, Douglas F, Campbell J (2016) Eating like there's no tomorrow: public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet. *Appetite*, 96, 487-493, doi: <u>https://doi.org/10.1016/j.appet.2015.10.011</u>, 161 citations
- [4] de Ruiter H, **Macdiarmid JI**, Matthews RB, Smith P. (2018) Moving beyond calories and protein: micronutrient assessment of sustainable diets and land use. *Global Environmental Change*, 52, 108-116, doi: <u>https://doi.org/10.1016/j.gloenvcha.2018.06.007</u>, 4 citations
- [5] Vetter, S.H., Sapkota, T.B., Hillier, J., Stirling, C.M., Macdiarmid, J.I., Aleksandrowicz, L., Green, R., Joy, E.J., Dangour, A.D. and Smith, P., 2017. Greenhouse gas emissions from agricultural food production to supply Indian diets: Implications for climate change mitigation. *Agriculture, ecosystems & environment, 237*, pp.234-241, doi: <u>https://doi.org/10.1016/j.agee.2016.12.024</u>, 101 citations
- [6] Reynolds CJ, Horgan GW, Whybrow S, Macdiarmid JI (2019) Healthy and sustainable diets that meet greenhouse gas emissions reduction targets and are affordable for different income groups in the UK. *Public Health Nutrition*, 22(8):1503-1517, doi: <u>https://doi.org/10.1017/S1368980018003774</u>, 22 citations

# Grants

- [P1] University of Aberdeen, *One Planet Diet: Defining A Sustainable Diet*. WWF-UK. (2010-2011, GBP 21,000).
- [P2] Estimate of the greenhouse gas emissions of the Eatwell week. Food Standards Agency Scotland (08/2012-07/13; GBP 6,361).
- [P3] Guidance for caterers on children's menu, Scottish Government (02/2014-04/14), GBP 9,791)
- [P4] Sustainable and Healthy Diets in India (SAHDI) (in collaboration with London School of Hygiene and Tropical Medicine) Wellcome Trust (11/2014-06/18), GBP 409,600 (Aberdeen share: GBP 72, 943).
- [P5] Belmont Forum/FACCE-JPI International Collaborative Research Funding (2015-19). Delivering Food Security on Limited Land; linked to NERC project (NE/M021327/1) GBP391,889, <u>https://deliveringfoodsecurity.org/team.</u>
- 4. Details of the impact (indicative maximum 750 words)

Although climate change is widely accepted to be a factor in sustainability of diet, there has been limited awareness and understanding of how change can be integrated at public, policy or industry level in order to influence dietary habits. Macdiarmid's research with and beyond WWF-UK has provided a platform to start essential dialogue, not least by giving practical examples that can enable 'hands-on' engagement by end users. The work has been used to inform dietary guidance both in the UK and abroad. It has increased comprehension of sustainable food choice by informing debate and changed industry practices by 'de-risking' non-meat options and encouraging producers to differentiate the product offer.

#### Informing dietary guidance in Scotland

Between 2011- 2012, Macdiarmid led a project with Food Standards Scotland [P2] to estimate the GHGE of diets based on their own 'Eatwell plate', the results of which underpin their 'Eatwell Everyday' campaign [S2i, iii] and are cited in the 2015 SPICe briefing 'Good for climate, good for health' [S2ii]. Food Standards Scotland is now aiming to develop a new, online dietary guidance resource, which provides consumers with practical, pragmatic advice they can use to make changes to their dietary intake, this will be launched in summer 2021 [S2iii].

Based on her work on the FSA Eatwell plate [2], Macdiarmid was invited by the Scottish government in 2014 to provide recommendations on ways to make primary and secondary school meals more sustainable [P3]. Her recommendations (amongst others) were disseminated to all local authorities across Scotland as part of the 'Better Eating, Better Learning' policy. The materials are being used by 15 schools across Scotland and have been downloaded 57 times (*as of 03/2020*) [S1i]. Lead for Public Sector Food and Drink Policy (Scottish Government) has stated of Macdiarmid's involvement:

'This [research] provided the scientific evidence base that was essential to underpin the transformational change in public sector, especially school food provision that the Scottish Government was keen to implement' [S1ii].

## Livewell: defining dietary principles in the EU

Research outcomes [1, 2] from the Aberdeen-WWF collaboration, informed the development of a robust pan-EU set of dietary guidelines, called the 'Livewell' plate, which has now been updated and renamed 'Livewell: eating for two degrees' (2017), which aligns with the Paris Agreement [S4iii]. In this report, WWF-UK describes the Livewell Plate as being '*primarily a policy tool' that illustrates our recommendations'*. The report states: 'we use this and the six Livewell principles in our work to influence change and represented the first time an environmental non-governmental organisation (NGO) defined a sustainable diet'.

The WWF-UK initiative 'LiveWell for Low Impact Food in Europe (LIFE)', 2012-2015 was an expansion of the Livewell principles [S4i; S5i]. The main objectives of LiveWell for LIFE was to reduce GHG emissions from the EU food supply chain; demonstrate sustainable diets for EU Member States; develop pathways for the implementation of sustainable diets; and to disseminate the 'Livewell Plate' widely across the EU. The Director at the WWF European Policy Office when asked why the project had been rolled out:

*'[In] a university institute in Aberdeen, in Scotland the principle [...] that healthy diets for people could also be healthy diets for the planet [...] we take that concept and say does it work [...] where do we want to try it out? [...] we chose France and Sweden and Spain because they have different dietary backgrounds'* [S8i, ii].

The trials led to the launch of new dietary guidelines with inclusion of environmental factors by the Swedish Food Agency [S7i] and expansion of 'Livewell Plates' worldwide, including China [S4i. As part of the LiveWell for LIFE project, WWF-UK issued a call to action in 2015 (<u>https://www.wwf.eu/?uNewsID=242031</u>), demanding that the President of the European Commission develop a clear plan for a healthy and climate friendly European food system by 2030. The call to action was supported by Members of the European Parliament's major parties, a wide range of civil society organisations from public health, animal welfare and environment sectors, as well as several companies from major food sectors, including Alpro, Edeka, Marks & Spencer, Nestlé, Sodexo, and Unilever [S5iii].

#### Shaping industry practice across Europe

Aberdeen's contribution to the WWF LiveWell programme has been used to shape decisions and practice in industry. WWF-UK Food Policy Manager, has stated:

'[LiveWell for LIFE] enabled WWF to secure several major corporate partnerships all of which used the Livewell report as a basis for their programs on sustainable diets. This includes IKEA, who have just launched a plant based meatball in China; and Sodexo, who were the first UK food service company to have a sustainable diets policy in schools' [S4i].

Adding further detail in an interview conducted in February, 2021, the Policy Manager confirmed:



"IKEA stepped up and we started two and a half year food programme with them [...] when we looked at the meatballs, we realised that over half their sales were meatballs and about three quarters of the carbon footprint. [...] And we did end up working with them around could they produce a chicken meatball? Could [they] produce a plant based meatball? And now that's happening in every single country' [S4ii].

In 2015, IKEA (China) introduced meat-free alternatives to their meatballs. They have since developed an entire campaign (<u>https://bit.ly/3v1Ow2C</u>) around these meat-free alternatives, whilst creating a platform to highlight their intentions to find ways reduce their climate footprint [S4i, ii; S6].

The second key partnership was developed with Sodexo, one of the world's largest contract caterers with operations in over 80 countries across the globe. In 2020 and in collaboration with WWF-UK, Sodexo launched a family of sustainable plant-based meals that combined nutrition and sustainability as part of their 'Better Tomorrow 2025' commitments. This campaign aims to create healthy lifestyle options for 100% of their customers every day by 2025 [S4i; S7i] and formed the basis of their joint report, 'Catering for sustainability: making the case for sustainable diets in foodservice' [S7ii].

In May 2020, Macdiarmid was consulted by 3Keel, a leading UK management consultancy for sustainability who were working on a project on behalf of a major UK food retailer [*text removed for publication*]. Macdiarmid's involvement enabled 3Keel to shape their analysis with regards to the size and nature of dietary transition and how best to meet dietary targets as well as potential barriers. This in turn has provided the basis of a roadmap, accepted by [*text removed for publication*], to commit to a target of protein sales by 2030. 3Keel stated [S3]:

'Professor Macdiarmid pointed to some of the key drivers of dietary change (and barriers to be overcome) that prompted further research and analysis so that a clear roadmap of actions could be presented to the client. As our conversation with Professor Macdiarmid occurred at the beginning of the project (May 2020), these insights were one of the key framing inputs to the work.'

#### Guiding the international debate - UN-FAO & WHO guidance

In 2018, Macdiarmid was invited to join the International Expert Committee to develop international dietary guidance for sustainable and healthy diets. Her co-authored paper, 'The role of healthy diets in environmentally sustainable food systems' (also published separately in the *Food and Nutrition Bulletin* in December 2020), draws heavily on her earlier research - one of five papers from an international consultation that were used to underpin the FAO/WHO key outcome, *Sustainable Healthy Diets: Guiding Principles*', published in 2019 [S9ii]. Macdiarmid's research to the key outcome has been defined by Director of Nutrition at the FAO as follows:

'Since the publication of the FAO/WHO Guiding Principles on Sustainable Healthy Diets, it has sparked a debate at the Committee on World Food Security (CFS) Open-ended Working Group on Nutrition [...]The idea of linking heathy diets with environmental impacts is new for many of our members. I commend Professor Jennie Macdiarmid for her work on this topic, making it clear that our dietary choices not only impact our health but also the health of our planet' [S9].

5. Sources to corroborate the impact (indicative maximum of 10 references)

- [S1] (i) Metrics from campaign; (ii) statement from lead for Public Sector Food and Drink Policy
- [S2] (i) FSS 'Eatwell Everyday' campaign website; (ii) related SPICe Briefing 2015; (iii) email correspondence with FSS corroborating Macdiarmid's role as project lead
- [S3] Testimonial from 3 Keel
- [S4] (i) Testimonial from WWF-UK Food Policy Manager; (ii) interview and interview transcript; (iii) Eating for 2 degrees report (2017)
- [S5] (i) Livewell for LIFE; (ii) policy recommendations and (iii) call to action
- [S6] Details of IKEA plant-based alternatives, campaign and related media
- [S7] (i) Better Tomorrow 2025' commitments (Sodexo campaign); (ii) report with WWF-UK
- [S8] (i) Video and (ii) transcript from Director at WWF EU Policy Office
- [S9] (i) Testimonial from Director of Nutrition at the FAO; (ii) Sustainable Healthy Diets: Guiding Principles, https://doi.org/10.4060/CA6640EN