Project Title - Enabling a More Sustainable Energy Future Through Silvopastoral Systems in Aotearoa New Zealand

Host University - Massey University

Industrial Partner - Verdi New Zealand

Academic Supervisor(s)

Prof. Sarah Jane McLaren
Massey University
School of Agriculture and Environment
s.mclaren@massey.ac.nz

Industrial Supervisor(s)

Nic Conland
Director, Verdi Limited
Nic.Conland@outlook.co.nz

Project Description

In Aotearoa New Zealand, a total of 713 sites and 1,279 large boilers still rely on fossil fuels as their energy source (EECA, 2024). This is incompatible with SDG13 (Combat Climate Change) and SDG7 (Sustainable Energy), and with Aotearoa New Zealand's aspirations to become net zero carbon by 2050 (MBIE, 2024). Many of these boilers can be converted to utilise processed woody biomass as an alternative fuel. Use of existing pine forest residues is being investigated (IEA Bioenergy, 2024); another option is integrating trees onto dairy farm pasture (silvopastoralism) and harvesting them as a biofuel.

Silvopastoralism has potential for delivering multiple enviro-economic benefits. Dairy farmers currently face challenges in dealing with seasonal droughts that constrain pasture growth (Marmont, Neal, & Minnee, 2024), potential heat stress associated with climate change (Cartwright et al., 2023), attracting and retaining skilled workers (Eastwood et al., 2018), and meeting increasingly stringent environmental requirements. Integration of dual-purpose tree species that provide shade and fodder (willow and poplar, for example), whilst also providing an ongoing biofuel source, represents a promising strategy to address these challenges. Such systems can produce a new energy feedstock without occupying new land, offset the carbon footprint of dairy products, enhance on-farm

biodiversity, diversify farm incomes, reduce production risks during feed shortages, and facilitate sustainable land-use transitions (dos Reis et al., 2023).

Building on our recent dynamic life cycle assessment (dLCA) research (Herath et al., forthcoming; McLaren et al., 2025; Weerasinghe et al., 2026), we will:

Identify the socio-economic drivers for these systems:

- Elucidate the enablers and barriers for using biomass from silvopastoral systems in converted fossil fuel-fired boilers, through interviews with stakeholders (dairy farmers, industrial facility managers, etc.).
- Engage with Verdi NZ's existing Māori Agribusiness partnerships to include perspectives of Ahu Whenua undertaking dairy farming.

Quantify the carbon footprint trade-offs of alternative systems:

- Use dLCA to quantify the carbon footprint of ongoing utilisation of harvested woody biomass from silvopastoral systems in converted fossil fuel-fired boilers.
- Model the geographical scales at which silvopastoral systems provide sufficient biomass to substitute local fossil fuel-fired boilers (e.g. in dairy processing facilities, hospitals, schools), including preferred processing routes (e.g. wood chips, pellets). This will be based on selected case study regions in Aotearoa New Zealand.

Develop enabling policy and governance scenarios:

- Identify changes required to the Emissions Trading Scheme for farmers to obtain carbon credits from silvopastoral systems, including the role of carbon credit pricing in determining their economic feasibility.
- Develop a prototype measurement and reporting scheme for silvopastoral systems alongside Verdi's existing services.

The project will be supervised by Professor Sarah McLaren (Professor of Life Cycle Management, Massey University) who has 30+ years' experience in LCA modelling of economic systems, and Nic Conland (Director of Technology and Product Development, Verdi Ltd), who has 25+ years' experience in applied science solutions. Dr Andre Mazzetto (Senior Scientist, Ethical Agriculture, New Zealand Institute for Bioeconomy Science Limited, formerly AgResearch) will join the supervisory team to contribute his expertise in dairy farming systems.

Student Time Split

University base for student (university, campus, department):
Massey University, Palmerston North, School of Agriculture and Environment

Industry base for student (company, site, address):
Verdi New Zealand, 235 Republican Road, Rd 3, Rerewhakaaitu, 3073

Expected Time Split Between University and Industry Partner (in months):
University 20 months; Verdi 16 months

Rationale for Time Split:
The student will spend six weeks each spring and autumn with Verdi's staff on dairy farms collecting

primary data on operation of silvopastoral systems and the associated enablers and barriers to farm system changes. The student will work one day a week at Verdi's office, developing the scope and outline for a measurement, reporting and verification framework for silvopasture on New Zealand farms.

Therefore, the proposed time split is 25% in the field collecting primary data, 20% in Verdi's office, and 55% undertaking research at Massey University. The rationale for the fieldwork is that the research needs to be underpinned by a practical understanding of the enablers and barriers to uptake of silvopastoral systems by farmers. The rationale for the Verdi-based placement is that Verdi's staff are experts in development of pragmatic measurement, reporting and verification programmes for delivering carbon-related benefits to farmers. The rationale for the University-based time is that, to be internationally recognized, the research must be conceptually sound and aligned with international environmental assessment standards (e.g. ISO 14040/44 on Life Cycle Assessment; ISO 14067 on Product Carbon Footprint).

Application

To apply for this project please first read the guidance document and then complete the application form on the Applied Doctorates Scheme website.