SESSION 2: CASE STUDY 4

Carbon and financial performance and opportunities for silvopastoral systems

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Abstract

Mitigating climate risk requires substantial changes to socio-economic systems, including livestock production, which accounts for approximately 14% of global anthropogenic carbon emissions. Growing pasture, trees and livestock on the same land management unit in silvopastoral systems provides opportunities to increase farm financial performance while substantially reducing the carbon-intensity of livestock production. In timber-producing silvopastoral systems, a timber income stream can be generated after carbon credit payments diminish. Case studies are presented for Australia and Fiji. Increased adoption of silvopastoral systems by landholders requires long-term rights to benefit from sustainable vegetation management, as well as the development of carbon credit methods that permit natural vegetation management and account for international and domestic leakage.

Introduction

Good morning. My name is Tyron Venn from the School of Agriculture and Food Sustainability at the University of Queensland. I want to share my research on the carbon and financial performance of silvopastoral systems — integrated systems that combine trees, pastures, and livestock.

In 2024, the world recorded its highest level of anthropogenic greenhouse gas (GHG) emissions. At this pace, we risk exceeding the 1.5°C carbon budget by 2030. Agriculture is a big part of this picture: it accounts for around 22% of global GHG emissions, with livestock alone contributing 14–18%. In Australia, the livestock sector is responsible for about 10% of annual emissions.

That reality means we must find ways to lower emissions from livestock systems. Silvopastoral systems, which integrate trees with grazing landscapes, are one of the most promising pathways.

What are silvopastoral systems?

In simple terms, silvopastoral systems integrate timber production, pastures, and livestock on the same land. Trees can be established either through planting or through better management of natural regrowth.

- **Planted trees**: expensive to establish, but they are recognised under carbon credit schemes.
- **Managed native regrowth:** far less expensive to establish, but many carbon markets — including Australia's — don't currently provide credits for active management. Instead, they often require strict conservation, which prevents thinning to maintain pasture production and the commercial harvest of timber as the trees mature.

This creates a dilemma for landholders. Should they clear regrowth for open pasture to maintain livestock income and land value? Should they lock up land in a carbon project, knowing that farm productivity and income will fall in the medium and long-term with potential negative implications for land value? Or should they try to manage regrowth into productive silvopastoral systems, combining livestock, timber, carbon and biodiversity benefits?

I believe the third option holds the greatest potential benefits for landholders and the planet.

Opportunities in Australia and Beyond

In southern Queensland and northern New South Wales, there are about 1.5 million hectares of post-1990 regrowth forests with commercially valuable timber species. These landscapes could be transformed into productive silvopastoral systems, given the right policy frameworks and incentives.

The benefits go beyond income:

- **Diversified revenue streams** (livestock, timber, carbon).
- **Biodiversity gains** at both domestic and global levels.
- **Reduced reliance on imported timber**, much of which comes from regions where illegal or unsustainable harvesting is common.
- **Improved climate resilience** for farming systems.

I have also had the privilege of working on silvopastoral projects in Fiji. On degraded sloping lands, we found that these systems can boost landholder returns by around 50% in the long run, while also acting as a carbon sink.

Evidence from Research

Our modelling and field studies show silvopastoral systems have the potential for strong carbon sequestration and financial performance. Using Queensland spotted gum regrowth as a case study, silvopastoral systems can store around 133 tonnes of CO_2 per hectare more than conventional periodic re-clearing for open pasture, over a 100-year lifecycle.

If only half of the native forest regrowth in southern Queensland and northern New South Wales were converted into silvopastoral systems, the sequestration potential would reach about 100 million tonnes of CO_2.

Financially, these systems can also outperform open pastures. A well-managed silvopastoral system can deliver higher long-run returns, though landholders must typically wait 15–30 years before timber income begins. This is why carbon markets, if properly structured, are crucial: they can provide the early revenue streams that improve the short- to medium-term financial viability

of silvopastoral systems.

Barriers and Challenges

If silvopastoral systems are so promising, why aren't they more widely adopted? In my experience, the main challenges are:

- **Insecure land tenure or property rights**: In Queensland alone, there were 40 amendments to vegetation management laws between 2000 and 2020. This level of uncertainty breeds mistrust and discourages investment.
- **Reduced short- and medium-term income:** Trees compete with pasture, lowering livestock yields as trees mature.
- **Policy and carbon market design**: Current frameworks often fail to reward managed regrowth, instead pushing landholders toward either clearing or strict conservation.
- **Long wait for timber returns**: Without interim financial incentives, many landholders simply cannot afford to wait for trees to mature.

What Needs to Change

To unlock the full potential of silvopastoral systems, three key reforms are needed:

1. **Secure long-term rights for landholders**
   Farmers must have confidence that investments in trees won't be undermined by sudden regulatory shifts. Stability in vegetation management law is essential.
2. **Carbon credit methods that allow managed regrowth**
   Approaches like Forestry Australia's proposed Enhancing Native Forest Resilience method would recognise the carbon sequestration in managed native regrowth silvopastoral systems, permit timber harvesting and facilitate ongoing agricultural production.
3. **Lifecycle-based carbon markets**
   Current markets often ignore leakage. For example, locking up grazing land in carbon projects can simply shift beef production — and deforestation — offshore. Proper lifecycle analysis would ensure integrity and avoid undermining global climate goals.

Conclusion

Silvopastoral systems are not a silver bullet, but they represent one of the most effective ways to align agriculture, carbon mitigation, and financial sustainability. They can reduce emissions, improve biodiversity, diversify farm income, and strengthen climate resilience.

But success depends on supportive laws, secure rights, and credible carbon markets. If we get the policy and legal settings right, silvopastoral systems could make a major contribution to Australia's — and the world's — journey to net-zero, while keeping farmers profitable and landscapes productive.

Dr Venn is a natural resource economist with a research focus on the design and evaluation of resource and environmental policy and practice to facilitate global action to conserve biodiversity, mitigate climate risk and address United Nations Sustainable Development Goals. This requires quantification of the complex and sometimes perverse domestic and international carbon,

biodiversity and socio-economic trade-offs (including leakages) that can be associated with well-intentioned policy. His research is highly interdisciplinary and collaborative with research institutions, government and industry, including ecologists, agricultural scientists, engineers and social scientists. Methods employed include stratified and replicated field experiments, cost-benefit analysis, lifecycle analysis of carbon, mathematical programming, simulation and applied environmental economics including non-market valuation. Specific research contexts include forest and wood product value chains, Australian Indigenous agribusiness, silvopastoral systems, wildfire risk mitigation and invasive species management.