

From paddock to catchment: Sustainable agriculture as a river health strategy in the Tweed

Eli Szandala¹ and Aiden Sloman²

¹ Tweed Shire Council, Murwillumbah, NSW, 2484, Email: eszandala@tweed.nsw.gov.au

² Tweed Shire Council, Murwillumbah, NSW, 2484, Email: asloman@tweed.nsw.gov.au

Key points

- The paper argues that agriculture in the Tweed is tightly linked to catchment health because farm management influences runoff, sediment, nutrients, and waterway condition across a highly productive but environmentally sensitive landscape.
- The paper positions local government as a critical intermediary combining agricultural support, waterway management, strategic policy and advocacy, grants, and community engagement in the Tweed Shire in ways that are uncommon in Australian local government practice.
- The Tweed program shows how ‘farming with nature’ can function as an upstream river health intervention by improving soil, pasture, biodiversity, and landholder capability while building a community of practice for long-term catchment-scale change.

Abstract

Agricultural land use is a major driver of hydrology, sediment, and nutrient movement in the Tweed River catchment. The Tweed Shire Council Sustainable Agriculture Program was established to address a critical gap: the need for locally relevant, farm scale interventions that reduce diffuse pollution while improving understanding of how soil, pasture, and biodiversity management influence river and stream health and farm productivity. The program responds to environmental challenges including soil degradation, erosion, nutrient runoff, floods, and acid sulfate soil impacts by strengthening collaboration between landholders, scientists, and council.

The program employs a place based, extension led approach combining soil health benchmarking, grazing and groundcover management planning, pasture diversification, and targeted biodiversity initiatives such as diverse cover cropping, syntropics, dung beetle identification and monitoring. The work builds baseline knowledge and advisory materials, coupled with farmer-to-farmer mentoring that support adaptive management without overstating benefits. Farm scale assessments, small projects, and on ground trials generate visible demonstration sites with practical datasets, mapping outputs, and landholder guidance that link agricultural practices to catchment processes.

Early findings highlight improved landholder capability in soil and pasture management, greater adoption of practices that minimise runoff and erosion, and strengthened understanding of landscape function. The program influences landholder behaviour by translating scientific insights into methods that can be applied on working farms. This work demonstrates how a sustainable agriculture framework can operate as an upstream river health intervention. The Tweed experience offers a transferable model for local governments seeking to integrate agricultural extension, community partnerships, and catchment management to improve stream condition at scale.

Keywords

Sustainable agriculture, catchment management, river health, agricultural extension, local government, Tweed, regenerative agriculture

Introduction

The Tweed is a productive agricultural landscape embedded within a catchment of high ecological value. The Tweed River estuary catchment covers approximately 1,055 km² representing 80% of the Tweed Shire's Local Government Area (LGA) with over 700km of creeks and rivers. Agriculture is one of the main land uses in the Tweed, attributing to approximately 600 km² of the LGA. The Tweed sustains a broad range of agricultural industries including sugarcane, beef, dairy, and fruit and vegetable production. About half of the LGA is covered by highly diverse bushland areas (685 km²), from internationally recognised subtropical rainforest to wet and dry sclerophyll forests that support significant biodiversity. Tweed Shire Council recognises that the viability of farming in the region depends on the healthy condition of the natural resource base, including soils, waterways, biodiversity, and ecosystem services (Tweed Shire Council, 2016).

The interdependence of farming and nature makes agricultural management in the Tweed inseparable from catchment condition. Public water quality reporting by Tweed Shire Council shows marked spatial variation in river and creek health, with the lower estuary generally performing well while tributaries and upper reaches are more affected by runoff, degraded creek banks, nutrient enrichment, and broader land-use pressures (Tweed Shire Council, 2021). Council reporting has identified runoff from developed land and degraded small streams in the upper catchment as important influences on downstream water quality, while the Rous River and tributaries to the Terranora and Cobaki broadwaters have recorded poorer outcomes associated with nutrients and creek condition.

In addition to erosion and nutrient movement, the Tweed floodplain is affected by acid sulfate soils, which can produce sulfuric acid and release heavy metals when disturbed or drained. Such disturbance can harm plants and animals, damage infrastructure, and contribute to severe water quality problems and fish kills when acidic discharges enter waterways. Research has clearly linked acid sulfate soil runoff from floodplain drains to low pH conditions in the Tweed River and associated fish health concerns, underscoring the degree to which floodplain and agricultural land management can influence aquatic ecosystem resilience (Easton, 1989; Donner and Melville, 2002; Wilson et al., 1990).

These conditions point to the need for responses that do more than regulate impacts after they occur. They require forms of extension and governance that help landholders understand how soil condition, pasture cover, grazing pressure, biodiversity, drainage, and farm infrastructure shape water, sediment, and nutrient movement across the landscape. Tweed Shire Council is unusually active in this space: it provides water quality monitoring, erosion control, revegetation, river health grants, and a dedicated Sustainable Agriculture Program that offers grants, field days, resources, advocacy, and on-farm support.

This paper examines the Tweed Shire Council Sustainable Agriculture Program as a model of local government-led agricultural extension that operates simultaneously as a farm support service and an upstream river health intervention. It argues that the Tweed experience demonstrates the value of farming with nature as both a practical land management approach and an institutional framework for linking agricultural productivity, community capacity, and catchment outcomes. This framing is consistent with Council's Sustainable Agriculture Strategy (Tweed Shire Council, 2016), which defines sustainable agriculture as farming within land capability while conserving soil, water, and biodiversity, and explicitly emphasises natural processes and the natural resource base as foundations for economic and community resilience.

Catchment and land-use context

The Tweed catchment is both productive and highly modified with agriculture and urban development both contributing to land-use pressures across the system. The hydrology of the Tweed connects paddocks, drains, creeks, floodplains, riverbanks, estuarine reaches, and coastal waters, meaning that land-use practices on farms can have effects well beyond property boundaries.

The agricultural economy of the Tweed depends on the same landscape processes that underpin waterway health. The Tweed Sustainable Agriculture Strategy 2016 identifies soils, water, biodiversity, and ecosystem services as key elements of the natural resource base that support agricultural viability and the wider community. The strategy also recognises that agriculture in the Tweed faces social, economic, and environmental pressures, including changing land uses, climatic variability, ageing producers, and threats to the environmental capacity of farmland.

In this context, many natural resource management issues are dual-purpose issues: they affect both farm productivity and environmental condition. Soil exposure and overgrazing increase the risk of erosion and nutrient loss, while poor groundcover, weak riparian protection, and stock access to waterways can degrade creek banks and reduce water quality. Council's earlier estuary and water quality work has identified actions such as improving agricultural drain water, restricting stock access to riverbanks, and revegetating banks as important responses to river health pressures (Tweed Shire Council, 1996). The challenge, therefore, is not simply to reduce pollution but to improve the functioning of agricultural landscapes so that productivity and ecological resilience are strengthened together.

Why local government matters

The Tweed case is significant because it highlights an often under-recognised role for local government in agricultural transition. Agriculture is a major land use, a contributor to the local economy, and an important domain of environmental stewardship. Council has also invested in a long-term strategy for sustainable agriculture, developed in consultation with farmers and industry, and has created delivery mechanisms that include policy work, advocacy, field days, grants, workshops, and free on-site farm consultations.

This is noteworthy because dedicated local government agricultural extension remains uncommon in Australia. Tweed Shire Council's Sustainable Agriculture Small Grants Program is one of the first of its kind in Australia, and the broader Sustainable Agriculture Program offers a level of direct producer engagement that is still unusual in council practice. The significance of this institutional role is twofold. First, councils are well placed to work across environmental and community outcomes because they already operate in planning, waterways, floodplain management, biodiversity, and local engagement. Second, local governments can tailor interventions to specific geographies and production systems rather than relying solely on generic state- or industry-level guidance. This place-based advantage is evident in the Tweed program's farm walks, small grants, natural resource management extension advice and support, and region-specific biodiversity initiatives. The program's investment in social infrastructure and community of practice, through mentoring, farmer networks, and peer-to-peer learning, is a strong example of exactly the kind of collective social capital that others argue is needed to advance stream and catchment management in Australia (Russell et al., 2026).

The Council's broader waterway work reinforces this role. Tweed Shire Council undertakes annual water quality reporting, large-scale erosion control, revegetation, and river management planning, and was recognised internationally in 2021 as one of three finalists for the Thiess International Riverprize for its Tweed River work. The Sustainable Agriculture Program sits within this wider institutional landscape, making it possible to connect on-farm practice change with catchment-scale goals.

Program rationale and design

Tweed Shire Council's Sustainable Agriculture Program is a collaborative service that works with local farmers to encourage farmland sustainability and productivity while enhancing environmental values. Its delivery tools include grant funding, educational field days, resources, policy work, advocacy, and direct engagement through a Sustainable Agriculture Network and on-site consultations. This design is consistent with extension models that prioritise trust, demonstration, peer learning, and repeated contact rather than one-off information transfer.

The program's current form builds on two decades of strategic and project-based work that originated in response to acid sulfate soil problems from the late 1980s. It operates under the premise that improving both the viability and environmental capacity of Tweed farmland requires better integration of natural biological cycles and controls in agricultural systems. The present program can be understood as an operational expression of a longer council commitment to align agriculture with catchment stewardship.

This paper describes the program as addressing a critical gap in locally relevant, farm-scale interventions to reduce diffuse pollution while improving understanding of how soil, pasture, and biodiversity management influence river and stream resilience and farm productivity. Council's agriculture projects include drought resilience work focused on grazing planning, biodiverse pastures, rotational grazing, dung beetles, and biological inputs such as compost and biochar, as well as newer regenerative farming initiatives that combine practical advice, peer-to-peer learning, and locally relevant training. A defining feature of the program is its farming with nature orientation.

Extension methods and on-ground activities

The program's extension method is practical, place-based, and multi-modal. It combines field days, workshops, grants, demonstration projects, advisory resources, and direct producer support. The Small Grants Program, established in 2018, supports producers to trial improved land management practices that benefit the farm, community, and environment, including fencing, revegetation, water quality improvements, weed control in high biodiversity areas, and the use of soil amendments such as compost and biochar. Over 40 grants have been awarded to local farmers for activities such as strategic fencing to exclude cattle access to waterways and areas of high biodiversity value; tree plantings in gullies and landslips; multi-species pasture trials including drone seeding and techniques to combat pasture dieback; the installation of nest boxes and biological controls, and the purchase of fencing and water troughs to support rotational grazing and improved pasture and land management practices.

Soil, grazing and groundcover

One stream of work has focused on grazing enterprises and the relationship between soil function, pasture productivity, runoff, and biodiversity. Council's Sustainable Grazing in the Tweed project built producer capacity in soil health, productive pastures, on-farm biodiversity, and practical farm planning. Sustainable grazing requires an understanding of soils and their capabilities, monitoring tools, flexible stocking rates, groundcover management, and fencing to limit stock access to waterways. The project resulted in better grazing management with less erosion and runoff, healthier livestock, and a healthier environment, aligning with broader catchment objectives.

More recently, Council's Future Drought Fund-supported project on drought resilient dairy and beef farms included holistic planning, rotational grazing, biodiverse pastures, dung beetles, and biochar feeding trials. The project demonstrated the environmental and economic benefits of biodiverse winter pasture cropping, illustrating the program's use of on-ground trials to generate practical, local datasets rather than relying only on imported recommendations.

Biodiversity and beneficial biological processes

The program also treats biodiversity as a functional part of agricultural systems rather than an external conservation add-on. This is evident in its support for cover cropping, agroforestry, dung beetles, and farm biodiversity protection through the grants program and associated extension work. For example, a Council-supported syntropic farming case study documented the transformation of a 1,500 m² lantana- and camphor-infested site into a productive food forest in less than nine months by integrating native species, fruit and nut trees, annual crops, manual weed management, mulch generation in situ, and soil-supporting inputs. The case study framed syntropic agriculture as a way to combine food production with agroforestry while maximising photosynthesis and symbiotic relationships between plants, animals, and microorganisms above and below ground.

Dung beetle work is another example of using ecological processes to address both farm and catchment issues. Dung beetles improve soil fertility and structure, increase water infiltration, enhance pasture production, reduce pest and parasite habitat, and decrease nutrient-rich runoff into waterways. Council and Southern Cross University also collaborated on a shire-wide monitoring project to assess the effects of seasonal variability and animal husbandry management on dung beetle populations, and in 2023 the program introduced the winter-active species *Onitis caffer* to six cattle properties. One year later, 50% of release sites showed signs of beetle survival and reproduction highlighting its potential to fill the current winter-gap in dung beetle activity.

Community of practice

A further strength of the Tweed model is its investment in peer learning and network development. Council's public program pages emphasise workshops, field days, community networking, and knowledge sharing, while the more recent Profitable Regenerative Farming Program adds subsidised mentoring from local regenerative farmers and community events for mentees and mentors to share what they have learned. The Tweed Regenerative Agriculture Information Network, launched as a farmer-led online space, further formalises this community-of-practice approach by supporting local knowledge exchange and ongoing discussion among producers.

This emphasis on community of practice matters because practice change in agriculture is rarely achieved through technical advice alone, and particularly from government sources. It is strengthened when producers can see methods demonstrated locally, discuss risks honestly, learn from peers, and adapt practices to their own landscapes and enterprises. The Tweed program's public materials repeatedly highlight these forms of engagement, suggesting that its value lies not only in individual projects but in the social infrastructure it builds around adaptive management.

Observations and discussion

The Tweed Shire experience has improved landholder capability in soil and pasture management, greater adoption of practices that minimise runoff and erosion, and stronger understanding of landscape function, although formal impact evaluation is not yet widely published. Council's 2025 regenerative farming pilot found that participating mentees found one-to-one mentoring highly valuable because it helped them translate previous learning into practical action, clarify priorities, and build confidence in next steps. Council case studies from the small grants program also document landholders using funding to adopt best land management practices, protect waterways and remnant vegetation, and trial innovative production systems with biodiversity benefits and positive outcomes for local waterways.

What emerges from the Tweed case is not a claim that every intervention produces immediate, universal, or easily quantified improvements, but rather that locally grounded agricultural extension can make catchment processes more legible to producers and create conditions for cumulative change. This is important because environmental improvement is often gradual and shaped by large variables such as rainfall, flood events, and legacy landscape modification. In such settings, the most credible pathway to long-term water quality improvement may be to build durable producer capability, improve management decisions at farm scale, and create feedback loops between science, observation, and practice.

The Tweed model is also significant as a governance innovation. Rather than treating agriculture as outside the remit of river health, it positions agricultural extension as part of catchment management. That is a useful reframing for local governments working in mixed-use landscapes where diffuse pollution, erosion, flood impacts, and biodiversity decline are closely tied to how farms function. The program therefore offers a practical example of how local councils can integrate their roles in waterways, biodiversity, community engagement, and landholder support.

Conclusions

The Tweed Shire Council's Sustainable Agriculture Program demonstrates how local government can support agricultural productivity and environmental stewardship through an integrated, place-based extension model. In a catchment where agriculture is a major land use and where runoff, erosion, nutrient movement, floodplain processes, and acid sulfate soils all influence waterway condition, farm-scale practice change is not peripheral to river health; it is central to it.

The program's distinctive contribution lies in its combination of practical support, ecological thinking, and social learning. By working through grants, field days, on-farm support, trials, biodiversity initiatives, mentoring and peer-to-peer exchange, it helps producers engage with the relationships between soil health, pasture management, biodiversity, hydrology, and resilience.

For other councils, the Tweed experience offers a transferable model: treat agriculture as part of environmental governance, invest in locally trusted extension, build a community of practice, and use on-ground trials and mentoring to translate science into workable farm decisions. This kind of service is valued by landholders and rare in local government. At a time when catchments face increasing climate variability, diffuse pollution, and pressure on productive landscapes, that model warrants closer attention.

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