NSW DECARBONISATION INNOVATION HUB
Land and Primary Industries Network Strategy 2023-2026

Mission

The Land & Primary Industries Network (LPI), as part of the NSW Decarbonisation Innovation Hub (Hub), brings together emissions reduction expertise in research, industry, community and government to coordinate and align efforts in the next wave of sustainable primary industry practices. The land sector is a significant contributor to NSW's emissions, but also offers significant near-term abatement opportunities based on existing or near-ready technologies and practices. Our mission is to grow a community of practice that fosters innovation and accelerates commercialisation and adoption of technologies, products and services with the greatest potential to combine material carbon abatement with co-benefits for the NSW economy, environment and people, **accelerating the role of NSW land and the primary industries it supports in contributing to NSW decarbonisation targets, while generating a range of positive outcomes for the State.**

Scope

NSW landscapes and primary industries can support substantial, deep cuts in NSW net carbon emissions. Carbon sequestration through management of ecosystem-based carbon sinks is currently the only viable and scalable option to offset remaining emissions in the transition to a decarbonised economy and society. A suite of known, land-based abatement options are available, but behavioural and knowledge barriers, as well as policy and regulatory constraints, currently limit scaled uptake. In addition, access to tools, services and demonstrations to support land managers to identify feasible abatement options which can be viably integrated into farm, forestry or other primary industry businesses/organisations, capitalising on co-benefits, remains very limited and difficult for individuals to access and navigate.

Overcoming these barriers and constraints to assist landholders and companies to leverage existing decarbonisation solutions, accelerating their adoption, is a key opportunity and focus of LPI. There are also near-ready and emerging technologies and practices creating a pipeline of opportunity for future land decarbonisation.

- LPI work will work with members and stakeholders across the innovation ecosystem to identify options where coordination across research institutions, industry and government has the greatest potential **to accelerate research and development, commercialisation and uptake**, resulting in emission reductions and economic prosperity.
- **Capacity building and extension activities** building on the end-user networks, education and training programs and infrastructure such as demonstration farms hosted by our partner organisations will serve to promote uptake of proven solutions and prime the land sector to deploy future technologies and practices.
- **Place-based, end-to-end demonstrations** enabled through partnerships with land holders, enterprises and SMEs will have a key role in articulating and promoting the value proposition for the adoption of clean technologies and sustainable land practices.
- As an integral part of NSW Government net zero policy and programs, with access to access to extensive expertise across members and affiliates across the land sector innovation community, LPI will offer sector-specific **advice to**

NSW Government on legal issues and carbon-aligned policy and regulatory frameworks in support of a rapid and effective deployment of low carbon solutions.

Most feasible decarbonisation solutions that might be envisaged for our State depend on the land and the natural capital it hosts. Therefore, LPI activities will extend beyond **productive land and primary industries to diverse non-agricultural landscapes, and urban and peri-urban environments**, also interacting with the Hydrogen and Powerfuels and Electrification and Energy Systems Networks of the Hub with regard to cross-cutting themes such as the sourcing and production of biomass as feedstock for green energy production, land use to host energy infrastructure, and decarbonisation of linking and dependent sectors such as transport and construction.

Organisation

The organisational structure of the LPI Network has been designed to reflect the complexity of its scope, and the key decarbonisation approaches and opportunities it aims to advance, at least initially. Themes, Cross-Theme Programs and Impact Missions, collectively termed Streams, make up the organisational structure (Figure 1).

Each Stream is led by a lead or 'champion' from one of the Core Partner Organisations who will take responsibility for monitoring and guiding network activities in that stream, and for promoting relevant opportunities and activities. Stream leads will facilitate and expand capability within the stream's scope by spearheading the building of effective partnerships aligned with initiated activities and goals.

- **Themes** correspond to key sectors and decarbonisation approaches/opportunities to achieve LPIN's mission.
- **Cross-Themes** map onto areas that cut across sectors and approaches or where integration across Themes is critical to success.
- **Impact Missions** will drive enabling activities to disseminate knowledge, pilot and scale new technologies, and advise on legal issues and offer advice to NSW Government on policy options and criteria in support of a rapid and effective deployment.

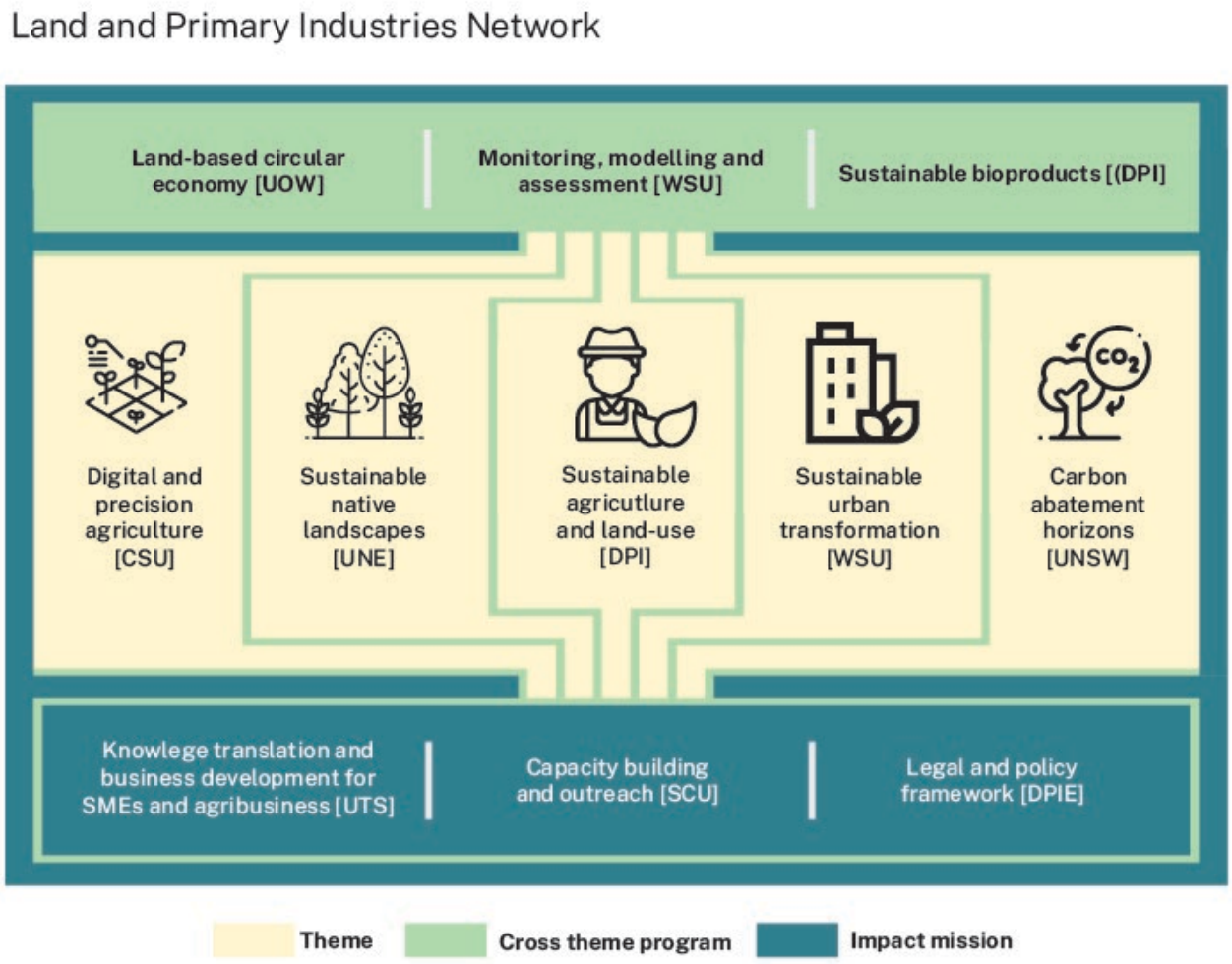

Figure 1. LPI activities are organised and delivered via five Themes, three Cross-theme Programs and three Impact Missions (collectively called 'streams'), each championed by the LPI Network Partner organisation indicated.

LPI Network Partners

- Western Sydney University (WSU)
- Charles Sturt University (CSU)
- NSW Department of Primary Industries (DPI)
- NSW Department of Planning and Environment (DPE)
- Southern Cross University (SCU)
- University of New England (UNE)
- University of New South Wales (UNSW)
- University of Technology Sydney (UTS)
- University of Wollongong (UoW)

Priority focus areas

The identification of **priority focus areas (PFA)** to guide the scope of activities in line with LPI's mission is part of an on-going co-design process among LPI Partners and prospective members, also informed by review and mapping of the literature and innovation ecosystem. **The priority focus areas will frame strategy and activities for the initial 3 year phase of LPI (2023-2026).** The PFA's cut across LPI's organisational structure (Figure 1) and may also involve linkage to other Networks of the Hub. However, one LPI stream is designated as primary carriage for coordinating and facilitating proposals, projects and outreach relevant to each PFA. Co-design activities linked to a call for project proposals in July/August 2023 will bring LPI partners and external members together to develop initial activities (projects) aligned with each PFA, with a view to projects commencing in Q4, 2023.

1. Accelerating adoption of sustainable practices in productive landscapes

Primary carriage: LPI Theme 1 – Sustainable agriculture and land use (lead DPI)

Synopsis: Sustainable land management approaches for emissions reduction from agriculture, and that combine retention and enhancement of carbon sinks in vegetation and soil with viable extraction/production levels and sustainable use of land resources, offer the highest opportunities for scaled contributions to the short-term (2030) Net Zero target, given widespread adoption by land holders. While important knowledge, data and technology gaps exist, key elements of suitable farming, forestry and fisheries systems across regions of NSW are understood and proven, but are not yet widely applied by land managers. An important bottleneck is that clear guidance on viable opportunities relevant to the farm business are often lacking or difficult for farmers to access. Current decision-support tools are also highly fragmented. To addressing these bottlenecks it is proposed to develop improved, more holistic and targeted decision support tools that make full use of available data as well as targetted, on-farm measurements and current modelling approaches. By delivering targeted advice to key landholder groups, improved tools are an important lever of change to facilitate accelerated adoption of sustainable practices, while contributing to Net Zero Plan targets. In the longer term, there is an opportunity to enhance commercial and environmental outcomes by incorporating the production of novel sustainable bioproducts in mixed farm systems. Overall, a major outcome for this priority area will be enabling the stacking of multiple abatement, production and environmental benefits for NSW farms and regions through the deployment and demonstration of new emerging technologies and practices, accelerating uptake via improved decision-support for early adopters.

Example projects:

- MRV-Plus: integrated decision support tools for land decarbonisation and sustainable management
- Mapping pathways to carbon neutrality for diverse farming sectors e.g. through livestock management, fertiliser applications, subsoil constraints etc.
- Review and link highly-instrumented research and demonstration farms (CSU, UNE, DPI) to showcase best practice land carbon and emissions monitoring, inform models and quantify benchmarks
- Coordinated knowledge and brokering of targeted, evidence-based guidance to land holders and managers
- Pilots, trials and demonstrators of regenerative agriculture practices for carbon sequestration, emission mitigation and multiple co-benefits
- Integrating biomass crops in mixed farming systems

2. Harnessing nature-based solutions: native and semi-natural ecosystems

Primary carriage: LPI Theme 2 – Sustainable native landscapes (lead UNE)

Synopsis: The state's extensive national park and reserve estate but also rangelands and other semi-natural ecosystems within diverse landscapes, marginal or retired agricultural land, revegetation on various land tenures offer the options for nature-based solutions that combine protection and enhancement of natural carbon sinks, with co-benefits for biodiversity, as well as significant cultural values including for first nations people. More data are needed across the diversity of NSW landscapes and ecosystems to quantify existing stocks and fluxes of carbon and other natural capital. New data are similarly needed to understand and model impacts of proposed management strategies such as targeted native vegetation recovery and forest expansion, improved techniques for planting/assisted regeneration; native vegetation management/thickening; innovative approaches to grazing, native and feral animal management; identification and protection of areas vulnerable to the impacts of climate change/carbon loss; and incorporation of cultural burning practices in hazard reduction and ecosystem management. Soils data across NSW regions are a key gap for quantification of carbon stocks, CO_2 exchange and validation of carbon assessment models.

Example projects:

- Accounting tools for nature: database collation and measurements for land capability mapping, filling key data gaps for NSW vegetation and soils.
- Exploring benefits and trade-offs of alternative land uses in diverse landscapes (Ecosystem restoration, regeneration, improved management, grazing pressure control, burning etc.)
- Activating the aboriginal land estate and economies for climate solutions

3. Embedding sustainable bio-products in primary industry production and supply chains

Primary carriage: LPI Cross-Theme 3 – Sustainable bio-products (lead DPI)

Synopsis: The low-carbon economy will rely on extensive development of biomass-based products and feedstocks, replacing fossil-based sources in the energy sector but also in other sectors such as transport and construction. NSW has large volumes of under-utilised biomass resources, as well as significant potential to grow dedicated biomass crops.The establishment of new industries and markets offers opportunities for the NSW economy and for farmers and other landholders, including income from carbon credits and offsets, but relies on overcoming a range of technical, cultural, business and infrastructure hurdles. Ensuring sustainability outcomes via the adoption of sound chain of custody principles and guidelines will be critical. This priority area focuses on the use of biomass for traditional bio-energy applications including on-farm fossil fuel substitution, soil amendment (biochar), biomanufacturing such as cellulose-based construction materials, synthetic fuels including sustainable aviation fuels (SAF), and integration of biomass and recycled materials in regional circular economies. Trials using Aboriginal land could support the establishment of local bioproduct industries, providing economic opportunities for first nations people to remain on country.

Example projects:

- Broad assessment of commercial and decarbonisation potential of alternative bio-products for NSW
- Matching feedstocks with production technology to realise a sustainable fuels industry for NSW
- Identification and testing of novel opportunities for the use of bio-based materials such as engineered wood products in construction
- Activating the Aboriginal land estate for climate solutions and wealth generation

4. Frontiers in carbon sequestration

Primary carriage: LPI Theme 5 – Carbon abatement horizons (lead UNSW)

Synopsis: Non-traditional approaches to atmospheric carbon removal and storage in biological and geological reservoirs offer prospects for substantial deep cuts in net emissions if technological and other bottlenecks are addressed. Blue carbon systems, which include coastal kelp forest, estuarine seagrass, mangrove and saltmarsh communities, can sequester impressive amounts of carbon from the atmosphere relative to their areal coverage. Extensive portions of NSW's coastal and near shore marine ecosystems are degraded. Restoring these landscapes will store carbon with joint benefits for biodiversity, ecosystem function, landholders, and communities. Restoring these ecosystems can also mitigate hazards associated with sea level rise and flooding. Fugitive emissions associated with current and past mining are a significant component of NSW's total greenhouse gas (GHG) emissions. Feedlots, piggeries, meat works, farm dams, irrigated crops, liquid and solid waste management facilities, gas distribution systems and power generation can all be hotspots of GHG emissions if poorly managed. Improved monitoring using satellite- and aircraft-based GHG analysers will be used to detect the most significant plumes, model the rate of emissions from facilities and subregions, and guide implementing abatement measures. There is considerable uncertainty associated with NSW's emissions reported to the UNFCCCC. The uncertainty for some categories can be plus/minus 50%. This theme will guide the development of atmospheric GHG gas observation products that will be used for: inventory verification, identification of quick-win mitigation opportunities, tracking Net Zero progress, and quantifying the land management and climate variability impacts on carbon pools. Technologies for direct air capture of CO_2 remain in early development but will become necessary for offsetting residual fossil fuel emissions as natural carbon sinks approach saturation. This theme will monitor national and international deployment of direct air capture approaches such as weathering materials generated from cement, aluminium steel production and coal combustion. We will identify industry partners who can scale these new technologies and encourage adoption.

Example projects:

- Enhancing blue carbon through tidal wetland restoration
- State-wide mapping of CO_2 and CH_4 emissions

- Feasibility and demonstration studies of blue carbon restoration and management
- Review and identification of implementation pathways for direct air-capture technologies

5. Embedding low carbon and nature-based solutions in vibrant cities

Primary carriage: LPI Theme 4 – Sustainable urban transformation (lead WSU)

Synopsis: Growth regions such as Sydney's Western Parkland City and the Hunter region offer opportunities for positive urban transformation that entail the prospect of a sustainable, equitable and resilient future for residents, local industries and the NSW economy, but also come with a range of complex challenges. Low carbon and nature-based solutions are available or emerging that combine energy savings with benefits for liveability and sustainability in the built environment, urban green spaces and biodiversity conservation in a peri-urban environment. Opportunities exist in urban green design, natural capital assessment and management, transport and energy infrastructure and emerging peri-urban industries such as high-value indoor cropping. Place-based demonstrators and exemplars have been identified as a key gap and opportunity to demonstrate the feasibility and advantages of relevant solutions to entrepreneurs, developers, urban planners, government, prospective residents and established industries. Place-based demonstrations are amenable to promoting the adoption and uptake of low carbon and abatement solutions, illustrating the challenges and benefits of coordination in planning and implementation, while also expediting the commercialisation of technologies and their integration in construction, horticulture, urban planning and other domains. Potential activities will leverage existing precinct developments that feature established industry links to LPI partners such as the WSU-hosted Hawkesbury Agri-Tech Hub, the Western Sydney Aerotropolis, and the Hunter Clean Energy Precinct.

Example projects:

- Climate-resilient urban forestry and heat mitigation: carbon, cooling and biodiversity benefits of urban trees
- Smart indoor cropping: high value, low emissions produce for discerning export markets
- Establishing living labs for sustainable solutions and innovation/demonstration precincts

6. Circular economy regional exemplars

Primary carriage: LPI Cross-Theme 2 – Land-based circular economy (lead UoW)

Synopsis: Circular economy (CE) is a promising direction in societal organisation that offers huge potential for reducing emission intensity and enhancing the sustainable use of resources while accelerating green jobs creation and economic growth. CE work so far is asset-focused (building, infrastructure) or product-focused (food, furniture, clothing), but there is an enormous opportunity to design and deploy more holistic and spatial approaches that cut across sectors and bring together knowledge providers with industries, businesses, communities and government. This priority focus area will leverage regional CE initiatives such as the Bega Circular Valley Initiative to showcase on-farm and in-community solutions that contribute to a land-based circular economy. This knowledge and its outcomes will be an evidence-based and action-focused framework to successfully implement land-based circular economy, suitable for sharing with other regions and communities of NSW to encourage new CE initiatives.

Example projects:

- Turning Land and Primary Industries waste into energy and bio-inputs on farm and for local communities
- Turning urban waste into valuable soil amendments for agriculture
- Embedding CE within living labs and innovation/demonstration precincts such as the Hawkesbury Agri-Tech Hub
- Developing life-cycle assessment based on data and insights from regional CE projects
- Harnessing ash from biofuel combustion as a cement replacement.
- Using of Artificial Intelligence (AI) and Internet of Things (IoT) sensing for land and primary industries sustainability applications.
- Explore the creation of a showcase event in Bega that brings together end-users, researchers and community engaged in circularity projects.

Further information and contact

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