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## Powering Ecological Research and Environmental Decision-Making: Inside TERN's Data Infrastructure

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The Terrestrial Ecosystem Research Network (TERN) is Australia's national collaborative research Infrastructure for long-term environmental monitoring, data-driven ecological research, and evidence-based decision-making. TERN provides an integrated, standardised, and openly accessible data infrastructure that facilitates collecting, curating, analysing, and distributing high-quality ecological and biogeophysical data across Australia's diverse landscapes.

TERN's data infrastructure is built on the FAIR data principles—Findable, Accessible, Interoperable, and Reusable—to ensure that its data sets are not only openly available but also are structured to be of value to researchers, data scientists, government agencies, and other stakeholders. The infrastructure integrates several data streams from ecosystem monitoring sites, automated in-situ sensors (flux towers, phenocams, acoustic), remote sensing platforms (satellite and drone), and model-derived data. These data products cover a wide range of ecological attributes like vegetation structure, soils, climate variables, biodiversity, biogeophysical metrics, and water and carbon fluxes.

TERN's data infrastructure provides tools and services for effective data lifecycle management. The TERN Data Discovery Portal is at the heart of TERN's data infrastructure, enabling discovery and access to all TERN published data collections with a free-text and map-based search. The portal facilitates robust filtering based on platforms and parameters, spatial and temporal extent, and visualisation through the data visualiser web application and download capabilities.

The infrastructure leverages a robust cyberinfrastructure stack that includes scalable cloud storage, geospatial data services, data pipelines in automation, persistent identifiers, and rich metadata frameworks based on international standards (e.g. ISO 19115, DCAT). All datasets are also available as RO-Crate, a lightweight approach to package research data with its metadata.

Furthermore, TERN enables access to systematic survey data through EcoPlots, a data integration platform. The platform allows for search and access to observation-level data from systematic surveys conducted from TERN observatories and states and territories. In addition, an image repository- EcoImages has been created to collect all ecological images collected by TERN observatories. EcoImages enables users to search, query and download pictures of the same or different image types.

TERN presents a unique opportunity for the data science community to develop and deploy analytical techniques to high-dimensional, multiscale, and longitudinal environmental data. TERN data can be used to train machine learning algorithms for ecological applications, validate satellite remote sensing products, support conservation and land management and contribute towards the state of the environment reports. TERN allows integration with multi-disciplinary external data platforms to support research and innovation. In collaboration with national and global research infrastructure initiatives (e.g. DataOne, NEON, FLUXNET, ARDC), TERN enables its data products to be discovered and utilised in broader environmental and data science communities.

The CoreTrustSeal-certified TERN data infrastructure bridges the gap between environmental monitoring and data science by providing high-quality, interoperable data and tools to enable scalable ecological analysis and modelling. With rising demands for data-driven solutions to address specific environmental challenges such as biodiversity loss, land degradation, and climate change, TERN enables research and innovation through

open, appropriately governed, and future-proofed environmental data infrastructure.

The poster will highlight TERN data infrastructure structure, governance, capabilities, and impact, showcasing how an open environmental data infrastructure would drive collaboration, innovation, and effective ecosystem management.

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