Private Sector Pathways (PSP) Program

Challenge Statement Form

Streamline data processes to support Queensland ecological research and management

Challenge Statement

This Private Sector Pathways (PSP) Challenge aims to provide opportunities for innovative Queensland-based organisations to assist the Queensland Herbarium and Biodiversity Science group (QHBS) within the Department of Environment, Science and Innovation (DESI) to efficiently process, analyse and store large biodiversity data.

DESI currently manages an extensive volume of imaging data. This data comes from remote camera deployments across the state, aiming to conduct research on Queensland flora and fauna, while monitoring ecological factors including the effects of bushfire, grazing, and pest and weed management. Currently, the manual process required to identify species from these images is labour-intensive and forms a bottleneck that hampers timely data analysis.

To address these issues, DESI invites innovative solutions that can support the following general steps:

1. **Process** large flora and fauna data sets captured from camera deployments across Queensland.
2. **Analyse** processed data to identify Queensland species within a range of habitats.
3. **Store** large data sets within a DESI integrated platform while maintaining Queensland Government security standards.

Current tools are not adequately tailored to Australian wildlife, particularly for species specific to Queensland (including rare and threatened), leading to identification inaccuracies. Additional issues such as data security, processing capacity and storage, and analytical behaviours present challenges that place workload strain on DESI employees with manual and repetitive tasks. The goal is to provide a cost effective solution that supports scientists and wildlife image collectors/data managers in delivering tailored biodiversity management science, enhancing ecological and biodiversity research, informing policy, and improving operational efficiencies.

If you have innovative solution/s to efficiently process, analyse and/or store large biodiversity data, regardless if you are in the Biodiversity sector or not, we would welcome your proposal.

Challenge Owner

The challenge owner is the Queensland Herbarium and Biodiversity Science group (QHBS) within the Department of Environment, Science and Innovation (DESI).

The DESI team have partnered with Advance Queensland to seek out innovative solutions that will streamline and improve data management of Queensland wildlife using leading scientific, behavioural and data insights to improve decision-making and actions.

This collaboration aims to address key DESI objectives:

- To be effective leaders and partners in managing, protecting, restoring and promoting Queensland's natural environment, cultural heritage, and in enabling innovation for a future economy.
- Conserve and restore Queensland's unique biodiversity, heritage and protected areas.
- Strengthen and harness Queensland's scientific excellence.

Challenge Context

The Current Situation

DESI is tasked with handling approximately 16 TB of existing imaging data, translating to more than 10 million images and other data types. Presently, the DESI relies on labour intensive manual identification, supplemented with AI tools like 'Megadetector' and others. This practice is time-consuming and specifically lacks precision for reptile and amphibian identification. Additionally, processing is done on local PCs which have limited processing capacity, resulting in delays and inefficient use of staff time. Significant time is required to process and extract data from the images into statistically usable formats, prior to entry into departmental wildlife databases. DESI is constantly collecting additional data which increases the backlog of images requiring analysis.

The current data management platform is modelled on the Azure Synapse end-to-end architecture, where Azure Artificial Intelligence (AI) and Machine Learning (ML) services are available. Departmental wildlife databases are connected to / available within the platform. The platform currently meets the security needs of dealing with sensitive species information.

Efficient processing of these images is vital for maintaining a baseline inventory of species, their habitats and threatening processes, which is essential for effective management and policymaking. Additionally, the ability to effectively detect cryptic species such as small mammals, skinks and geckos is paramount for the conservation and recovery of poorly known threatened species. For example, the solution may have the ability to identify little known species with minimal training sets and assist in species recovery projects by potentially being able to differentiate between individual animals; i.e. is it one animal in ten images or ten different animals.

There are solutions available in the market that offer processing and analysing of imaging data. However, outsourced solutions have shown to be generally less desirable due to sensitivity of data related to threatened species, the inability to identify poorly known species, and reduced adaptability for DESI users to customise the solution for their unique end purposes.

Challenge Imperative

Transitioning to a robust, user-friendly, and customisable service will achieve several key benefits. Firstly, it will considerably reduce time taken and increase the accuracy of identifying species within their habitats, significantly improving DESI's capacity to detect and monitor species. Additionally, the centralisation of data will ensure the security, ownership, preservation and discoverability of valuable ecological datasets, which can be leveraged for future ecological investigations. The solution must be able to be tailored and operated by DESI staff for individual projects, improving user control over data processing and analysis. Furthermore, the solution should be scalable, and adaptable, enabling the processing of non-image (acoustic) data and the inclusion of additional species into the model as needed.

Implementing such a solution would streamline DESI's processing pipeline, providing rapid, accurate data that can directly influence the protection and management of Queensland's rich biodiversity.

Intended objectives/outcomes

While not exhaustive, the example imperatives listed below significantly contribute to the success of innovative technology solutions to address the need to improve data capture and processing time.

Your innovative solution may resolve one, multiple or non-listed imperatives identified below:

Imperative	Short Summary
Reduce Processing Time	Reducing processing time must significantly cut down the duration from data collection to analysis and reporting. This reduction will enhance efficiency while increasing productivity for staff. Faster, processing will enable more timely decision-making, resource allocation, and reduced costs. Improved processing time must not be at the expense of accuracy, as reliability of data is paramount to conduct research and monitor ecological factors correctly.
Customisable	While remaining user-friendly, the solution must be transparent in its workings such that experienced users can control, adapt and improve the model for their bespoke needs. The solution must be able to be tailored for individual projects, offering users the ability to train models themselves. The solution should also include model improvement capabilities, enabling the training/re-training of future species identification models and accommodating emerging needs within DESI.
Data Management	The solution must simultaneously process, analyse and store large-scale data sets while maintaining high security standards to prevent data loss or leaks. It should seamlessly integrate with existing DESI data platforms and provide usable outputs (e.g. dashboards, reports). Consideration should be given to ensuring ease of accessibility through various formats, such as web browsers and apps, while also adhering to Government IT policy requirements (*see section: Technical Considerations*).
User-Friendly	The solution must be user friendly to accommodate different skill levels across departments and teams within DESI. While predominantly used by scientists, the solution must cater to multiple disciplines and staff such as Rangers, Researchers, Ecologists, Scientists and Wildlife image collectors with ease. It should be easy to use with minimal upfront training, and include ongoing support from the tech provider, ensuring continuous training and assistance for users.

Scalability	The proposed solution should strongly consider application across multiple teams and departments to allow for cross collaboration and reduce repeated tasks. Scalability should also consider processing acoustic data, thereby tapping into a broader range of biodiversity monitoring tools. The system should be designed to handle increasing volumes of data and users without compromising performance or reliability.

The Stakeholders Involved

In the diverse ecosystem of biodiversity management, numerous stakeholders play an integral role in the processing, analysis and management of data, and therefore the successful implementation of the solution. The stakeholders below uniquely contribute to delivering ecological and biodiversity research and policy.

Scientists/Researchers: Scientist and Researchers are the primary end-users who will utilise the processed data to derive actionable insights, conduct ecological studies, and develop biodiversity management strategies to inform policy. Engaging scientists and researchers throughout the development and deployment process ensures that the solution aligns with scientific methodologies and ecological objectives. Their expertise and feedback are vital in ensuring that the solution meets the specific requirements for accuracy, usability, and relevance to biodiversity management. Furthermore, their ability to translate processed data into meaningful scientific output directly impacts the success and credibility of the implemented solution.

Park Rangers: As frontline custodians of natural habitats, Park Rangers will use the processed data to monitor wildlife, manage conservation efforts, and respond to ecological changes in real-time. Their practical experience and on-the-ground insights are invaluable, driving a need for the solution to be user-friendly, efficient, and adaptable to field conditions. The solution must be tailored to support their daily tasks, enhance their decision-making capabilities, and ultimately contribute to preserving and protecting natural ecosystems.

Policy developers: Policy developers are responsible for creating regulations and guidelines that govern biodiversity management and conservation efforts. The advanced, processed data and analytical insights generated by the solution will equip policy developers with the evidence-based information needed to make informed decisions. This, in turn, will help shape sustainable environmental practices and legislative frameworks. With access to accurate and timely data, policy developers can create more effective policies that support long-term biodiversity conservation and management strategies, ensuring that regulatory measures are both scientifically sound and practically applicable.

Education / Research Centres: Education and research centres are important stakeholders in developing a technically capable and user-friendly tool. In particular, universities offer a wealth of expertise in both biodiversity-related areas and AI. Collaboration with these stakeholders can facility the development of AI-driven tools that enhance the accuracy and efficiency of biodiversity assessments. Leveraging research centres' multidisciplinary teams and computational resources may enable the refinement of a bespoke solution.

Challenge Solution

Outcomes Desired

The solution will aim to streamline and enhance the efficiency of biodiversity data processing, analysis, and storage for DESI, ensuring that ecological data is accurate, timely, and easily accessible. We want to reduce the barriers faced during the biodiversity monitoring process, which may include but are not limited to lengthy data processing times, limited local processing capacity, and inaccuracies in species identification.

As part of the PSP program, the successful application will directly pilot their solution with DESI. The applicant needs to consider how their solution may be implemented following the pilot process, e.g. how end-users may utilise the solution moving forward.

Technical and/or Regulatory Considerations

Data Security and Integration: The solution must ensure data security to prevent data loss or leaks. It should comply with existing data protection regulations and seamlessly integrate with DESI's current data management platform, which uses Azure data platform services. This ensures a seamless transition and prevents disruption to current workflows, while also maintaining the ability to scale and incorporate new types of data, such as acoustic data. Data ownership must remain with DESI and data sovereignty requirements should be respected.

IT Policy Requirements: The solution must adhere to any specific guidelines or protocols related to data confidentiality and secure storage set out by QLD Government IT policy requirements. More specifically, the Information Security Policy IS18.

Local Processing Capacity: The solution must address the limitations of local processing capacity. Current processing is done on local PCs, which results in delays. Therefore, the new system should either enhance local processing capabilities or leverage cloud-based solutions to ensure efficient speed and handling of large data sets.

Design Benefits

Customisability: The solution should be flexible and customisable by DESI staff to meet the various needs of different end users. It should provide transparency in its workings so that experienced users can adapt and improve the model for their bespoke needs.

Accuracy and Reliability: DESI has hundreds to thousands of labelled images available for training. The solution must maintain or improve the accuracy of data processing, ensuring high reliability in species identification, including cryptic species such as small mammals and skinks. It should be capable of handling various types of data, including those specific to Queensland species and habitats.

User Friendliness and Training: The system must be user-friendly for diverse stakeholders including scientists, park rangers, policy developers, and other staff. It should require minimal upfront training and include ongoing support to ensure continuous usability and adaptation across various teams within DESI.

Commercial Opportunities

Partnerships and Collaboration: Successful implementation within DESI could lead to partnerships with other government agencies, research institutions, and environmental organisations, creating opportunities for broader adoption and influence in the field of biodiversity management.

Licensing: There is potential for commercialisation and licensing of the technology. Once proven effective, the solution could be marketed to other organisations and governments facing similar challenges, providing a scalable business model and potential revenue streams through licensing and service agreements.

How to apply

Applications can be submitted via here and should include the following:

- A clear description of the solution, including its key features, benefits, and value proposition.
- A roadmap for implementation, including timelines, resources, and milestones.
- A plan for measuring the impact and success of the solution, including metrics and evaluation criteria.
- A budget that outlines the financial requirements for implementing and maintaining the solution.
- A summary of the team's qualifications and experience, including relevant skills and expertise.

Shortlisted applicants will be invited to pitch their solutions to a panel of experts and the successful applicant/s will enter a contract and pilot their solution with the Challenge Owners.

Successful Applicant(s)

The winning proposal(s) will be selected based on its innovation, feasibility, impact, and alignment with the challenge objectives. The successful applicant will receive grant funding of up to $100,000 (excluding GST) through the Advance Queensland initiative, to develop and pilot their proposed solution for up to 6-8 months with DESI.

Project Duration

The duration of the project is estimated to be up to 6-8 months. If a suitable solution to the challenge is found, project commencement is most likely to start in November/December 2024.

As part of the assessment process, shortlisted applicants will be notified and invited to a Solution Presentation Day. This will be an opportunity for you to present your proposed solution (either in person or remotely) to the Challenge assessment panel. This will most likely occur in mid to late October 2024.

Presentations are expected to be up to 10=15 minutes long, with time afterwards for Q&A. Full details will be provided in due course.

More information

The Advance Queensland Private Sector Pathways (PSP) program aims to solve corporate challenges with solutions generated by proven innovative Queensland small to medium enterprises and scaleups. For more information about the PSP Challenge, contact Advance Queensland's Private Sector Partnerships team at partnerships@dtis.qld.gov.au.

Further information about DESI strategies can be found at:
- DESI Strategic Plan 2023-27

Join us in this endeavour to streamline DESI's ability to deliver biodiversity management science and influence the protection and management of Queensland's rich biodiversity.