

Centre for eResearch and Digital Innovation Annual Report 2016

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Foreword

Professor Leigh Sullivan, Deputy Vice-Chancellor, Research and Innovation

I am pleased to provide this foreword to the 2016 Annual Report of the Centre for eResearch and Digital Innovation (CeRDI).



A key role of universities is national capacity building through research activities, as well as teaching and learning activities. Engagement with industry is essential for university research and innovation to more effectively deliver technologies for the industries of the future.

CeRDI is a multidisciplinary research centre focused on innovations in the use of advanced information and communication technologies (ICT) to build capacity in its partner organisations and to affect practice change through digital transformation.

Under the leadership of Associate Professor Helen Thompson, CeRDI continues to be an exemplar in its engagement with industry, government, communities and academia, as illustrated by the 2016 Annual Report.

At the national level, the long-term collaboration in Digital Agriculture between Federation University and the Grains Research and Development Corporation (GRDC) continued in 2016. GRDC is expected to significantly increase its investment in this partnership in 2017.

In 2016, CeRDI has led Federation University Australia's participation in two successful Cooperative Research Centre applications – the CRC for High Performance Soils and the Food Agility CRC. Participation in these CRCs represents a significant milestone for the growth of research at the University. The University looks forward to CeRDI's contributions in applied research and innovation in digital technologies as a result of its participation in these CRCs.

CeRDI continues to receive state, national and international recognition for its application of spatial technologies to change industry practices. Together with its partner GRDC, CeRDI received a Victorian Spatial Excellence Award for the Online Farm Trials project for innovations in the way farm research trial data is made available nationally to improve farming practice. Further, CeRDI, in collaboration with long-term partner the Corangamite Catchment Management Authority, received the Asia Pacific Spatial Excellence Award for its work on providing access to comprehensive information on soil health through the Corangamite Soil Health Knowledge Base project, and a Victorian Spatial Excellence Award for innovation in natural resource management and planning for the Corangamite Natural Resource Management Planning Portal.

As this Annual Report shows, CeRDI continues to be a strong contributor to the University's research across a diverse range of disciplines. CeRDI contributes strongly to the University's research metrics.

I would like to take this opportunity to thank Associate Professor Helen Thompson and the CeRDI team for their commitment and their contributions and look forward to CeRDI's continued success as it pursues the growth of its own (and the University's) research capacity.

Introduction

Associate Professor Helen Thompson, Director, CeRDI

2016 was an exciting and productive year for the Centre for eResearch and Digital Innovation (CeRDI), building on the growth in research and new partnerships evident in previous years.



A number of CeRDI projects have increased in strength and capacity during the year. Projects across all themes have continued to evolve and expand throughout the year, with ongoing research providing substantial new insights into the uptake and application of digital technologies within relevant communities.

CeRDI continues its strong track record as a leader in spatial technologies. The Online Farm Trails and Corangamite Soil Health Knowledge Base projects both received Spatial Excellence Awards in 2016; the Corangamite Soil Health Knowledge Base also received international recognition with a 2016 Asia Pacific Spatial Excellence Award.

A number of research and project milestones were evident across all areas of CeRDI during the year. Research reports for Historic Urban Landscapes (HUL) and Visualising Ballarat, Online Farm Trials, the Western Business Accelerator Centre for Excellence and the Great South Coast Digital Strategy highlight just a few of the completed research milestones.

Further, a number of new projects commenced with both new and existing industry partnerships. These included Waterwatch and EstuaryWatch, Visualising Victoria's Biodiversity and South Australia Tree Watch, and these projects increased CeRDI's strength in the Natural Environment research space. Online Farm Trials has also continued to evolve through the year, and ongoing impact research across this and other key CeRDI research projects has provided substantial insights about the uptake and application of digital technologies across relevant communities and stakeholders.

CeRDI continues to make great inroads in Digital Agriculture with OzDSM and Southern Farming Systems and Probe Trax enabling the CeRDI team to work on new projects and overcome industry-wide challenges in the digital technology space. Projects in health and wellbeing also continue to provide important research insights and service provision for the region. The Health Justice Partnership continued its successful operation throughout 2016, and the Rural Alcohol Culture and Change for Youth in the Wimmera is providing valuable insights that has the potential to initiate new models of change in relation to alcohol usage among young people in the Wimmera.

CeRDI welcomed five new post graduate students during the year, joining the ever-expanding CeRDI Higher Degrees Research program. In March, Chris Bahlo, Thomas Hill and Shirish Sharma commenced their PhD research, followed by Alison Ollerenshaw and Patrick Bonney in July and November respectively. This fulfils a longer-term plan for CeRDI to develop and grow their HDR cohort in which student research is closely aligned with key projects in CeRDI.

During 2017, CeRDI will continue to expand and develop its strong focus across its six research themes and through application of spatial knowledge and innovation. Research income focusing on these key areas will continue to be explored. The recent news about the success of two 2017 Co-operative Research Centre applications (the CRC for High Performance Soils, and the Food Agility CRC) in which CeRDI was a key partner places the Centre in a strong position for ongoing and extended research knowledge – and further successes.

About CeRDI



Overview

The Centre for eResearch and Digital Innovation (CeRDI) is located within the Office of the Deputy Vice Chancellor (Research and Innovation) at Federation University Australia.

CeRDI focuses on multidisciplinary research through the application of advanced information and communications technology (ICT), enabling digital transformations and practice change, together with enhancements in effectiveness and productivity in industry, government and academia. Significant effort has been directed towards extending CeRDI's spatial technology capabilities and eResearch in projects that are clustered around the six core themes of Natural Environment, Digital Agriculture, Hazard Planning and Resilience, Health and Wellbeing, Heritage and Culture, and Regional Development.

CeRDI has thus gained a reputation for:

- the application of ICT and the development of innovative, world-class knowledge management systems;
- significantly advancing the digital literacy and knowledge management capabilities of partner organisations;
- fostering partnerships for the development and implementation of eResearch with industry, government and academia;
- measuring the impact of eResearch and digital innovation through longitudinal research; and
- postgraduate research, with a cohort of HDR students conducting research within the Centre.

CeRDI is outcome-focused and committed to building capacity and engagement with partner organisations, as well as ensuring uptake of technologies that benefit and support research partners and their staff, stakeholders, and the broader community.

CeRDI delivers world-class innovations in technology by anticipating new technology directions and opportunities based on insights from research and partner engagement. These innovations generate beneficial partner outcomes and attract sustained research investment.

In 2016 the most significant advances have been linked to CeRDI's expanding engagement in spatial information systems, visualisation, knowledge management and data interoperability. CeRDI researchers have also implemented a longitudinal program of research to measure the impact of technology on improvements to decision making and practice change, through data captured from projects across CeRDI's research themes. This has been complemented by the commencement of five HDR students conducting research aligned to CeRDI's core research themes, including Natural Environment, Digital Agriculture, Health and Wellbeing, Heritage and Culture, and Regional Development.

CeRDI's research approach is characterised by the following attributes.

- Partner engagement listening skills and the ability to translate information from partners into projects with outcomes that stakeholder's value. CeRDI has a reputation for consistency, reliability, timeliness, credibility and excellence.
- Fostering long-term partnerships sustaining them beyond the period of initial grant funding (many partnerships have continued for more than 10 years) and undertaking practical and applied research that deliver on outcomes.
- A multidisciplinary team comprised of researchers with specific discipline expertise, technical and support staff and HDR students – the essential foundation for innovation, knowledge and technology transfer.
- A diverse portfolio stretching across a range of disciplines, with a multiplicity of organisations contributing to overall financial sustainability.
- Prioritising a high level of co-creation through close linkages and engagement with staff from partner organisations including researchers, government, industry and community, which catalyses knowledge mobilisation and ensures beneficial outcomes for partner organisations.
- Continuous innovation in knowledge management, publishing, spatial mapping and participatory geographical information systems.
- A leader in eResearch and spatial innovation adding value to areas of FedUni research strength, aligned with the national eResearch framework and the National Strategic Research Priorities.

CeRDI Team



The CeRDI team represents a multidisciplinary mix of researchers and skilled technical staff ensuring that CeRDI continues to be innovative while striving towards its research and technology goals across the six research areas.

In 2016, CeRDI comprised 35 (full-time; part-time; casual) staff across research (22), technical (10), and project management and administration (3). Profiles for CeRDI staff are included in this report. Recent staffing appointments ensure there is greater support for senior research and technical members, enabling them to focus and advance their expertise and skills in new developments and build the Centre's research profile. CeRDI's increasingly multidisciplinary research capabilities distinguish it from traditional research centres and ensure that the research undertaken has impact across a broad discipline base and in each of the six research themes.

Research advancement and outputs are summarised in this publication. For the technical team, 2016 included an expanded focus on new spatial technologies across key projects. This required extensive technology platform developments.

Five HDR (PhD) students commenced their studies with CeRDI in 2016, bringing the total number of current HDR students within CeRDI to seven. One student associated with CeRDI completed their degree during 2016.

eResearch

CeRDI defines eResearch as a set of activities that harness the power of advanced information and communication technologies (ICTs) for research.

Characterised by collaboration and facilitated by fast, high-capacity networks, the range of eResearch activities is diverse and multi-disciplinary. Key themes and drivers of eResearch include:

- data management and sharing;
- research collaboration;
- high performance computing; and
- customised discipline specific technologies to support research practices.

eResearch methodologies and capabilities have applications across all research disciplines. As an enabler of innovations and new discoveries, eResearch has the potential to boost research effectiveness through increased interaction between researchers, increased access to data and enhanced access to research outputs.

CeRDI's specific expertise in eResearch is characterised by its innovations in knowledge management, spatial mapping, data interoperability and participatory geographic information systems. These have underpinned CeRDI's growth since 2012. For example, for the Visualising Victoria's Groundwater (VVG) project CeRDI developed spatial data infrastructure that federates groundwater data from disparate database sources into a single web portal.

CeRDI uniquely defines eResearch as being comprised of three complementary directions:

- data discovery research;
- technological innovation research; and
- longitudinal impact research.

Data discovery research consists of two elements: the identification and analysis of research ready datasets (often historically hidden but once made accessible allow discipline-specific and cross-discipline research); and new discovery through crowd-sourcing and citizen science.



Technological innovation research at CeRDI includes the development of international open access standards, data interoperability methodologies and standards, data federation methodologies, three dimensional and four dimensional visualisation technologies, and digital tools to facilitate and support the development of crowd sourcing approaches and citizen science.

A key focus of the impact research is the measurement of shifts in knowledge, behaviour and attitudes within the practice context due to the technological innovation, and how these shifts have enhanced practice outcomes through informed decision making.

The eResearch methodologies developed by CeRDI are being applied across areas including agriculture, climate adaptation, emergency planning, health, heritage and culture, natural resource management and regional development.

CeRDI's expertise in eResearch is coupled with a model of research that is characterised by the conceptualisation of discipline-specific investigations within the broader societal context – a dual function of all CeRDI research. The approach adopted by CeRDI researchers includes a social perspective to the impact of eResearch. This allows for insights relating to practice change, decision making, research potential and capacity building that have not previously been adopted consistently within the context of eResearch.

This approach places CeRDI in a unique position within the Australian eResearch environment.

CeRDI capability: Interoperability

The vast majority of CeRDI's eResearch is invested in the development of spatial data portals.

For researchers, these portals address the increasing problems associated with the sheer range of information sources and volume of data that is now available (i.e. in the Era of Big Data). In Australia, for example, information and data on agricultural soils is distributed via dozens of web-portals, web-based geographic information system (GIS) tools, password-protected portals, cloud storage, portable storage devices, hardcopy maps, theses, reports, newsletters, documents, videos and podcasts. Outside of the research community, however, this vast source of data is largely ignored, as few people have the time or the skills to consolidate available data.

To address these concerns, spatial data infrastructure (SDI) has been developed and deployed to federate data from disparate database sources into a single web portal, thereby making data more easily discoverable. Globally, the systems developed by Natural Resource Canada provided the initial exemplars that were developed using open geospatial standards and technologies. Other examples include the European Commission's INSPIRE network, the New Zealand SMART system, and those developed by the United States Geological Survey, the French Bureau de Recherche Géologiques et Minières (BRGM), Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Bureau of Meteorology.

CeRDI actively collaborates with these leading organisations by sharing open source technologies and developing open standards. Seamless international information exchange of complex domain data, such as groundwater or soil data, relies on agreed formats, communication protocols and schemas for serving, querying and consuming data, along with agreed content (known as semantic interoperability).

CeRDI Capability: Systems Architecture

The Spatial Data Infrastructure (SDI) deployed by CeRDI was initially developed by CSIRO, and is known as the Spatial Information Services Stack (SISS).

At the core of the SISS are the open source spatial data engines Mapserver (www.mapserver.org) and Geoserver (geoserver.org), which are used for the geospatial processing and service delivery using Open Geospatial Consortium (www.opengeospatial.org) standards. Vector data are commonly stored within a MySQL or PostGIS database, and raster data are dynamically processed from its native format. To deliver complex web feature services (WFS), the Geoserver app-schema extension has been deployed. Geonetwork (geonetwork-opensource.org) is used as the public-facing metadata catalogue for the portals.

The general systems architecture and data flow from custodians to end users is illustrated in Figure 1.



Visualising Victoria's Environment portals: proposed Spatial Data Infrastructure (generalised)

FIGURE 1: CeRDI'S GENERAL SYSTEMS ARCHITECTURE AND DATA FLOW FROM CUSTODIANS TO END USERS. (SOURCE: DAHLHAUS & THOMPSON, 2016).

Key components of the system include the following.

- The data resides with the data managers (ensuring currency and validity).
- They are intuitive to use (similar to Google Maps).
- All forms of data are included (vector, raster, text and multimedia).
- Data downloads are allowed (subject to data custodian's consent).
- Spatial data links to original source (documents and images).
- Spatial data links to real time data (data loggers, webcams).
- They are capable of analysing the interoperable data on the fly.
- Interactive 3D visualisations can be created for user-selected scenes.
- Users can add, edit or update data (subject to quality assurance and quality control).
- The spatial data and models are credible to the user.

The key principles underlying all technical innovation and development at CeRDI include:

- ensuring end-user tools and applications are fast, intuitive and easy-to-use,
- making sure that applications work seamlessly across a variety of platforms, operating systems and browsers to the extent possible,
- use of open-source and standards compliant software and technologies, wherever possible,
- building upon existing collaborative software initiatives and contributing enhancements/tools back to the community,
- ensuring the flexibility of the developed system to consume data from a variety of sources so as not to interfere with existing provider work practices, and
- use of software based in the cloud: no end-user requirement for software, updates, computation power or plug-ins.

The CeRDI technical team adopts best practices for web development to ensure systems are responsive and accessible to the needs of users. Members of the CeRDI technical team have had extensive training as well as relevant qualifications, capabilities and industry experience to ensure optimal project outputs, to enable delivery of scalable and customised applications to meet the unique requirements of various project partners.

CeRDI adopts an agile path for software and spatial knowledge systems development. Rapid prototypes of products are developed in conjunction with project partners, stakeholders and researchers, to ensure their technical requirements are met at each development stage

NATURAL ENVIRONMENT

Waterwatch and EstuaryWatch

In 2016, CeRDI completed significant redevelopment work on two prominent Victorian citizen science programs: Waterwatch, and its sister program, EstuaryWatch.

The Waterwatch and EstuaryWatch portals are companion sites supporting two citizen science programs that monitor the health of Victorian waterways and estuaries. The portals provide essential resources for all members to access current information and data, as well as providing the public full access to data and knowledge generated by the programs. Both Waterwatch and EstuaryWatch are well-established, important community engagement programs promoting interest in water issues including sustainability, water management and the health of local waterways and connecting local Victorian communities.

Waterwatch facilitates citizen science and community involvement in river health and sustainable water practices: community members are encouraged to become participants in their local environment through waterway monitoring and ongoing activities. EstuaryWatch promotes the monitoring of estuary health at 21 active Victorian estuaries, and is supported through involvement of local catchment management authorities. Both programs rely heavily on community and volunteer contributions to assist with regional data collection and recordings of water quality across Victoria's rivers and associated waterways.

Both the Waterwatch and the EstuaryWatch sites now provide access to innovative technical tools and data portals. Core to their functionality are re-designed databases, rapid data interrogation tools and interactive maps for accessing and visualising region-specific data. Additionally, direct uploads and downloads of data about local waterways and estuaries will facilitate more rapid dissemination of each program's monitoring achievements. In addition to ease of access, the sites give future provision of the data as an application programming interface that will enable information to be quickly and easily exchanged between organisations and community groups.

The project is managed by CeRDI's Research Fellow, Birgita Hansen, with significant technical input from Paul Feely, Sudeera Abeywickrema, Heath Gillett and Peter Plucinski. CeRDI team members have worked closely with project partners and representatives from both programs throughout the redevelopment. This arrangement proved highly successful in unifying the direction of these developments, representing an Agile software development approach. This has included embedding of program co-ordinators within CeRDI to work closely with the technical and research teams.

The second stage for this project involves a longitudinal program of social research. CeRDI, in partnership with the Corangamite CMA, appointed a PhD student, Patrick Bonney, to conduct research focusing on the growth of citizen science as an approach for community engagement and the building of knowledge repositories to support practice change, inform policy and environmental management decisions. Patrick commenced his studies in November 2016.







Project Partner: Corangamite Catchment Management Authority



Waterwatch is available at: www.vic.waterwatch.org.au EstuaryWatch is available at: www.estuarywatch.org.au

Key Contact

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NATURAL ENVIRONMENT

Visualising Victoria's Biodiversity

Visualising Victoria's Biodiversity (VVB) is an online portal providing the Victorian community with access to a wide range of spatial information on Victoria's environmental values, conservation activities and research.

The portal federates and visualises environmental data from national, state, regional and local sources in an interactive spatial interface. WB consolidates access to spatial environmental datasets and information – created and managed by government agencies, organisations, community groups and individuals – into a user friendly and interactive web platform.

VVB is a CeRDI initiative that is overseen by CeRDI's Research Associate, Rob Milne, with funding support from the Helen Macpherson Smith Trust. It offers a single access point and spatial visualisation of environmental information and data from multiple sources not previously available for the Victorian community. VVB also provides the community with improved access to information that assists in building awareness of biodiversity values and issues in their area of interest and assists with decision making for conservation activities and planning.

The extensive spatial data catalogue available on the portal has been compiled from a wide range of sources including key state and national data repositories such as Victoria's data directory (www.data.vic.gov.au, the Victorian Biodiversity Atlas (www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas) and the Atlas of Living Australia, (www.ala.org.au), as well as local and regional information shared by community groups and individuals.

With over 45 map layers currently available, VVB is revealing the depth and extent of the biodiversity knowledge and data that is available across Victoria. In commenting on the range of information presented on VVB, Rob Milne confirmed, "The key purpose of VVB is to offer the Victorian community and environmental sector improved and easy access to the vast amount of available environmental information to facilitate knowledge sharing, assist research and support decision making".

The creation of VVB has been informed by the State Wide Integrated Flora and Fauna Teams (SWIFFT), community members and other key organisations and agency stakeholders. VVB is a partner site to SWIFFT (www.swifft.net.au), which is a citizen science and knowledge sharing platform that aims to maintain, develop and share knowledge and skills within Victorian communities for the protection and management of threatened species and biodiversity conservation.

CeRDI will continue to develop and improve the VVB portal with input from the community, stakeholders and users. Further interoperability and integration with other key information systems remains a priority for this project.







Project Partners:

State Wide Integrated Flora and Fauna Teams Helen MacPherson Smith Trust







Visualising Victoria's Biodiversity is available at: www.vvb.org.au

Key Contact

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NATURAL ENVIRONMENT

South Australia Tree Watch

In 2016, the CeRDI team commenced development of a new web portal enabling citizens in the Coorong and Tatiara regions of South Australia to document the health of their local trees.

This portal, called South Australia Tree Watch, has been developed in collaboration with researchers from FedUni's Faculty of Science and Technology (FOST), and with support from project partners the Coorong District Council, Tatiara Council and the Coorong Tatiara Local Action Plan.

The Coorong and Tatiara regions are located south east of Adelaide, and incorporate the Murray River and other significant environmental sites, including Lake Alexandrina and Lake Albert. This region has experienced substantial environmental challenges in recent years, including dryland salinity and poor tree health. Many of the region's trees, which are iconic features of the natural and agricultural landscape, are experiencing significant health problems: some trees are dying or showing significant signs of stress and poor health.

To help address this problem, CeRDI in collaboration with FOST researchers Nicholas Schultz and Megan Good have designed a web-based platform that allows local citizens and the broader community to rapidly and easily document observations of occurrence and symptoms of tree decline. The portal features a mapping interface for users to locate trees on a satellite image and add information on their observations of tree type, ill-health symptoms and land use, as well as upload photos. This information, together with other relevant spatial datasets, populates a custom-built spatial database, which will be used to construct visualisations.

Information collected from the community and landholders will be analysed alongside existing spatial and non-spatial datasets relating to tree ecology, land use and landscape features (e.g. soil type, waterways, wetlands and roads). By dynamically linking all relevant datasets with crowd-sourced tree observations, the portal will enable identification of factors influencing tree health. This will facilitate development of appropriate management actions for reversing tree decline.

This project represents a Federation University Australia collaboration between CeRDI, and FOST researchers Dr Schultz and Dr Good. It draws upon foundational work undertaken by Dr Schultz and Dr Good describing the problem and likely causes (Schultz and Good 2015). The project is being led by CeRDI's Research Fellow, Birgita Hansen, and further CeRDI contributions in the development of the portal with technology features including data entry forms and mapping interface created by Peter Plucinski and Craig Briody.

South Australia Tree Watch was launched on 2 May 2017.







Project Partners:

Dr Nicholas Schultz and Dr Megan Good, Faculty of Science and Technology, FedUni Coorong and Tatiara District Councils



South Australia Tree Watch is available at: www.satreewatch.com.au

Key Contact

Dr Birgita Hansen, CeRDI Research Fellow: b.hansen@federation.edu.au

NATURAL ENVIRONMENT

Tracking the Migration of the Latham's Snipe

A research project using light-level geolocators to obtain information on migratory patterns of the Latham's snipe (*Gallinago hardwickii*), a shorebird species that breeds in Japan and migrates to Australia for the austral spring-summer, successfully produced the first ever full migration track for the species.

The project, which was initiated to better understand the ecology and habitat use of Latham's snipe, is being co-ordinated by CeRDI's Research Fellow, Birgita Hansen. The project is a collaboration with the Lathan's Snipe Project Team, Woodlands and Wetlands Trust (Canberra), and colleagues from the Wild Bird Society of Japan.

The Latham's snipe research commenced in October 2015 following a preliminary species count conducted around the Port Fairy and Warrnambool regions in south-west Victoria during 2014–15. This count helped determine the relative importance of urban wetlands like the Powling Street wetlands and revealed that over 95% of the population occurred in urban wetlands during the day.

During 2015 the project expanded to include a capture and tagging program aimed at investigating migration and movements. Data loggers called geolocators, which record day length, were deployed on birds with the capture and tagging of Latham's snipe in Port Fairy. The geolocator studies have been successful in recapturing a single bird (T0), 12 months after the first geolocator was fitted: the recapture of birds is required to retrieve the light data from the logger and reconstruct the migration route. The device from T0 yielded a full year of light data, which has since been analysed to determine the latitude and longitude of the bird over that period.

This project provides the first ever full migration track for the Latham's snipe. The research also confirms early the hypothesis – based on years of observation by the South Beach Wetlands and Landcare Group Project Team members – namely that some snipe return to Powling Street wetlands in Port Fairy each year. This finding, together with data originating from field studies conducted at Jerrabombera Wetlands in Canberra, confirms that some snipe are very site faithful and use the same sites over their non-breeding season in southern Australia.

During the course of the project, important collaborations have been forged with the Wild Bird Society of Japan, the Australia Japan Foundation and the Woodland and Wetlands Trust who, together with CeRDI, have supported this project. The relationship with researchers in Japan was further strengthened during a study trip to Hokkaido, Japan, in July 2016 by the Latham's Snipe Project Team. During the visit, the team assisted with snipe capture and exchanged knowledge about snipe ecology and conservation.



Research into the Latham's snipe will continue in 2017/2018 expanding on a pilot radio tracking program that began in spring 2016. This component of the research will be conducted by honours student Andrew Crossley, under supervision from Dr Hansen and the project team. This part of the project will enable more rigorous information on movement and home range size of the species, to be collected. Geolocator retrieval will be again attempted during the spring 2017 with options for deploying geolocators and radio transmitters at other sites to be explored. The success of the project has already enabled the research to be expanded to Canberra enabling the building of further information about the ecology of the species from a non-coastal location.

Project Partners:

South Beach Wetlands and Landcare Group

Victorian Wader Study Group Wild Bird Society of Japan

Woodlands and Wetlands Trust (Jerrabomberra Wetlands)

Australia Japan Foundation

Further information about the Latham's snipe project is available at: https://lathamssnipeproject.wordpress.com

Key Contact

Dr Birgita Hansen, CeRDI Research Fellow: b.hansen@federation.edu.au

DIGITAL Agriculture

Online Farm Trials

Online Farm Trials (OFT) research (www.farmtrials.com.au) applies digital technologies to provide access to a growing library of grains industry research for the first time.

It aims to improve the productivity and sustainability of farming enterprises through enhanced access to farm research trials relevant to the grains industry. This is expected to lead to better use of results and findings of past trials, and more rapid implementation of best practice farming approaches.

OFT is funded by the Grains Research and Development Corporation (GRDC), with the CeRDI team – under the leadership of CeRDI Research Associate, Rob Milne – developing the innovative online technologies to enable access to this research.

OFT began in late 2013 as an initiative to develop a user-friendly online resource for accessing information about grains research trials. This is achieved through two online research applications: the Trial Explorer and the Report Library. These applications are now assisting grain growers, agronomists, the GRDC, government representatives and researchers by providing effective access to trial and related climate, soil and natural resource information. Since its launch, OFT has expanded significantly to involving a wide range of stakeholders and data contributors.

OFT unlocks farm trials research that has previously been accessible only via hard copy or basic electronic documents, opening up information from Australian cropping trials across all three GRDC regions. OFT relies heavily on input from industry and stakeholder collaboration across the grain growing regions of Australia, with over 50 grower research organisations participating and contributing trial research.

In 2016, a substantial funding investment was made to OFT by GRDC, bringing the total research investment to \$2 million over four years. During the next 12 months, a number of objectives have been proposed for OFT, including:

- provision of continued support for grower groups, research organisations and individual researchers using OFT;
- initiation of further training and an extension program for researchers, agronomists and consultants to extend OFT adoption and use;
- continued integration of OFT with other GRDC products and services and administration systems to streamline information sharing across GRDC and other industry systems;
- building of new partnerships with grower and farming system groups, grower group networks and government agencies to increase information and data available via OFT;
- development of new applications for displaying decision useful information and data on OFT and research partner websites;
- continuation of improvements and support of the online OFT 'self-service' Administration Centre for uploading and managing trial information and data; and
- updates and improvements to the OFT website and online trial searching and information discovery tools.

Project Partners:

Grains Research and Development Corporation Grower Group Alliance (Western Australia) Victorian Grower Group Alliance Ag Excellence Alliance (South Australia) International Plant Nutrition Institute Nicon Rural Services

The extension to OFT funding ensures ongoing impact research can also continue. The impact research work was initiated in 2015 under the leadership of CeRDI's Senior Research Fellow, Angela Murphy, who, together with CeRDI colleagues, commenced an exploration of factors relating to the impact of OFT on decision making, practice change, farm development and environmental management processes. Data were collected from a range of stakeholders from across Australia, including grower groups, researchers and agriculture consultants. The research findings indicated strong growth in usage of OFT among key stakeholders, with key strengths in the design of OFT identified as ease of navigation; the search function; user friendly interface; speed of access, and the visual display and presentation. The work, which comprises a four-stage impact research program, will continue throughout 2017 and 2018 and will provide valuable, long-term research insights to direct future development of the OFT project.



Online Farm Trials is available at: www.farmtrials.com.au

Online Farm Trials short documentary film: www.youtube.com/watch?v=Xr6pIYRqrb0

Key Contact

For the OFT project: Mr Rob Milne, CeRDI Research Associate: r.milne@federation.edu.au

Key contract for OFT impact research: Dr Angela Murphy, CeRDI Senior Research Fellow: aa.murphy@federation.edu.au

DIGITAL Agriculture

Online Final Reports

Over a four year period, the Grains Research and Development Corporation (GRDC) commissioned CeRDI to develop a web-based digital repository of all Final Reports dating back to the early 1990s.

This project has enabled GRDC to evaluate, convert and collate reports into a consistent and accessible format for easy access and comparison. Innovative knowledge management approaches are supporting greater access to research and greater uptake of research findings across the grains industry. Harvesting the knowledge of the past is a priority for the GRDC.

The online Final Reports System (FRS) is a web-based technology with different levels of access providing GRDC with the information required to populate their internal and external web sites.

To support this process, CeRDI has utilised a selection of content management products to create the Final Reports publishing system for GRDC. Starting from the present and working backward, the workflow system has allowed GRDC to evaluate and approve all research to date according to its currency of knowledge, privacy and intellectual property issues, or other possible restrictions.

A responsive web design has also been applied to the Final Reports System public module to facilitate improved accessibility for mobile and tablet devices. This ensures farmers, growers and advisers have greater access to, and use of, the outputs of all historical and current research. This will be achieved through research, collaboration, collation and publication of historical and future final research reports and data.

Online Final Reports is one of a number of collaborative research programs between CeRDI and GRDC that also includes the OFT project and Diagnostic Agronomy. Online Final Reports has been linked to Online Farm Trials to support improved communication of extension and research outcomes.

CeRDI's work on this project is enabling GRDC to consolidate and extend and benefit from the significant research investment it has placed in the grains industry.



Online Final Reports is available at: http://finalreports.grdc.com.au/final_reports.php

Key Contact

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Project Partner:

Grains Research and Development Corporation

DIGITAL Agriculture

Southern Farming System ProbeTrax

The Southern Farming Systems (SFS) soil probe network portal (ProbeTrax) was launched in 2016, and is providing monitoring and assessing soil temperature and moisture conditions from 62 soil probes installed across the major soil types of the high rainfall zones of Victoria and Tasmania.

CeRDI played an important role in developing the web platform that displays the current and historical soil moisture and temperature values across the probe network and enables this information to be provided in a way which is decision useful for farmers.

As a well-established growers group, Southern Farming Systems have a 20 year history of delivering programs to farmers and advisors across southern Victoria and Tasmania. Recently, SFS have teamed with the Corangamite CMA to deliver projects and services through Landcare networks in the region. SFS is responsible for the successful completion of the two large projects that established a soil moisture probe network and initiated a fee-for-service arrangement with farmers to ensure the probe network is maintained.

Considerable amounts of scientific data are generated from the soil moisture probe network. The probes have been recording soil moisture and temperature in 10 cm depth increments down to a depth of 1 m below the soil surface every 15 minutes over the last two to three years. A research collaboration with CeRDI was subsequently initiated by SFS to identify how the utility of soil moisture probe data across south-eastern Australia could be maximised by better understanding the decision support required by farmers and their advisors and in developing a user friendly and decision useful format of data for farmers to access.

To achieve this, CeRDI is collaborating closely with SFS, farmers and their advisors to understand their information needs and to present probe data in decision useful ways. The end result enables farmers to monitor their local soils and make informed decisions about soil content and soils applications.

The project comprised four key phases:

- i. development of a user friendly decision support interface for web, mobile phone and tablets with SMS and email notification;
- ii. development and delivery of workshops to farmers, advisors and Landcare groups;
- iii. development of a 'how to guide' for the wider public outlining information about accessing data and decision support resources and to facilitate discussion; and
- iv. evaluation to understand the impact of the project and to enable further improvements.

An existing network of 62 probes located throughout southern Victoria and Tasmania is now disseminating real-time information about soil conditions, enabling critical decisions to be made about crop and pasture growth. Through this, the project is facilitating access to the decision support interface and tools that assist farmers in monitoring soil moisture conditions, interpreting results, setting alerts and taking action.









The SFS Soil Probe Network project also offers significant potential for learnings to be extended through future research and technology developments, and workshops directed towards other Internet of Things (IoT) technologies, such as weather station or drone data. There is also an opportunity for transference of learnings to inform practices in areas other than farming. Interest has already been received from state-wide authorities and organisations that monitor soil moisture data to assist in predicting potential fire risk or nutrient run-off into waterways and storages.

Further information about the SFS ProbeTrax is available at: www.sfs.org.au/ProbeTrax_MoistureProbeNetwork

A video explaining the SFS ProbeTrax program is available at: www.youtube.com/watch?v=qLCiSscIzXw

Project Partner: Southern Farming Systems

Key Contact

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DIGITAL Agriculture

Digital Soil Mapping in Australia (OzDSM)

Digital Soil Mapping in Australia, known as OzDSM, is a collaborative workspace for researchers working on digital soil mapping (DSM) in Australia.

The workspace was developed to support a PhD project in DSM (completed in 2016) and is a collaboration space with the Australian Advisory Group on Digital Soil Assessment, a working group of the National Committee on Soil and Terrain. The principal purpose of OzDSM is to develop and test digital soil mapping products and functions.

The OzDSM website and mapping portal provides an effective means for collaboration and testing of DSM products. The platform allows domain experts to more easily share data and seek feedback on their work. Tools for interrogating the data are also developed and tested on the OzDSM platform before being rolled out to production environments. The site also provides a Wiki platform for geographically remote collaborators to work on shared initiatives.

OzDSM has also provided a home for other related project outputs to be provided in an alternative format to the normal static download approach. An example was a set of annual nutrient budget information for Australia, developed by the International Plant Nutrition Institute (IPNI).

Apart from enhancing and improving the features and functions of the OzDSM website, CeRDI has developed the web-based visualisation tools for viewing DSM soil properties (including error margins), at depth. New ways to access the DSM datasets has now been provided via a new CeRDI data portal (data2.cerdi.edu.au) and registration of these research datasets in the Research Data Australia Catalogue (researchdata.ands.org.au) operated by the Australian National Data Service.



Project Partners:

Australian Advisory Group on Digital Soil Assessment

International Plant Nutrition Institute (IPNI)





Further information about the OzDSM is available at: www.ozdsm.com.au

Key Contact

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DIGITAL Agriculture

Soil Interoperability Experiment

To celebrate the International Year of Soils (2015), the Agricultural Domain Working Group of the Open Geospatial Consortium (OGC) initiated a Soil Data Interoperability Experiment.

Details of this experiment can be found at:

http://www.opengeospatial.org/projects/initiatives/soildataie. As an active participant in the experiment, CeRDI constructed the demonstration portal which consumes soil data stored in three disparate databases in New Zealand, Australia and The Netherlands. Data are accessed via a universal schema (SoilML), which dynamically provides soil data for any of these databases in web feature service (WFS) format. Moreover, the data can then be dynamically modelled using pedotransfer functions via a web processing service (WPS). The portal rates as arguably the most ambitious interoperability project yet undertaken by CeRDI, and made a significant contribution to the success of the Soil Interoperability Experiment by demonstrating a web client that federated soil data from a number of web-based services in real-time.

The primary aim of the Soil Data Interoperability Experiment is to develop and test a global Soil Markup Language (SoilML), attempting to harmonise several international soil interchange formats, including the Australian/New Zealand schema (ANZSoilML), and incorporate established standards for observational data including TimeseriesML.

A key outcome of the demonstrator is the ability for clients to search and filter for sites that have soil observations meeting user-defined criteria (across state and national boundaries). This is important for clients who access soil data from global partners delivering complex WFS services. Refined filters enable clients to determine specific searches such as "Show me all the soil test sites which have observations of Soil pH below 3.5".

Integral to the demonstrator site is the use of a remote WPS implemented by ISRIC (World Soil Information, The Netherlands) which consumes defined soil parameters (as standard WFS) into pedotransfer algorithms developed in collaboration with the Italian Agribiology and Pedology Research Centre, and returns the modelled values to the portal user in real-time.

The Soil Data Interoperability Experiment Demonstrator was successfully demonstrated to the OGC Technical and Planning Committee conference in Sydney in December 2015. The results of the experiment were acclaimed by the OGC as an outstanding success. The results were presented in a Technical Report and presented at the New Zealand – Australian Soils Conference (December 2016).



Project Partners:

Landcare Research New Zealand Ltd (principal initiator)

CSIRO Australia (co-initiator)

ISRIC — World Soil Information, The Netherlands (co-initiator)

Agribiology and Pedology Research Centre, Italy US Geological Survey (USGS)

Joshua Lieberman, Harvard University, USA

US Department of Agriculture (USDA)-Natural Resources Conservation Service

Horizons Regional Council, New Zealand





Further information about the CeRDI Soil Interoperability Experiment Demonstrator is available at: http://data.cerdi.edu.au/soil_demo.php

The Technical Report on the Soil Data IE is available at: https://portal.opengeospatial.org/files/?artifact_id=68572

A YouTube presentation on the Soil Interoperability Experiment is available at: www.youtube.com/watch?v=oR-c7Viu19k

A demonstration video is available at: http://spatial.federation.edu.au/videos/SoillE_portal2/SoillE_portal2.html

Key Contact

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HAZARDS PLANNING AND RESILIENCE

Interoperable Spatial Knowledge Base for Integrated Fire Management Planning

The Barwon South West Interoperable Spatial Knowledge Base is a web-based portal supporting regional, local and community level planning to manage assets from the risk and consequences of fire and other emergency events. This collaborative project spatially maps existing data plus open source data overlayed on asset landscapes, in order to better understand risk and consequences associated with these events.

The Knowledge Base is a tool that assists with prevention, preparedness, response and recovery, with its main objective being to allow all stakeholders easy access to the most current data to improve fire risk management decision making. This collaborative, stakeholder-led project commenced in 2012 with the utilisation of existing data, plus open data overlayed on asset landscapes, to better understand fire risk and consequences across the prevention, preparedness, response and recovery spectrum. Initial funding for Knowledge Base has been provided by the Victorian Government. Significant in-kind contributions have also been made from a range of stakeholder and partner organisations.

CeRDI has played a crucial role in implementing a range of innovations and capabilities, including the web-based systems, for this project and applied a range of new Open Source systems to underpin the required functionality. These were integrated with CeRDI's existing GIS platform to develop a new product with significantly enhanced functionality and which allowed key project stakeholders to take ownership of the Knowledge Base. This ensured improvements to the traditional knowledge and enhanced communications approaches.

Another feature of the portal that CeRDI was instrumental in developing was customising information by date and incident category. Authenticated users can draw a custom area on a map and generate a report of incidents by type and rolling year counts for that area. This provided an advancement for static map generation, and replaced existing manual processes for generating these reports. Fire incident data may now be readily generated on demand, without the need for the re-generation of grid maps for each different stakeholder request. In addition, the use of dynamic spatial mapping and visualisation tools enhance the ability to obtain insights from the data.

The Barwon South West Interoperable Spatial Knowledge Base now offers an interoperable spatial information system designed to provide the most current relevant information, including fire risk data, in a manner that supports the community to develop their integrated regional and local fire management plans. The web-enabled Knowledge Base provides improved access to federated (aggregated) information by multiple stakeholders leading to significant productivity improvements, and in particular in enabling visualisation and reporting without the need for time consuming manual processes.



Project Partners:

Emergency Management Victoria Barwon South West Regional Strategic

Fire Management Planning Committee Victorian State Fire Management

Planning Committee provided Project

Country Fire Authority

Department of Environment, Land, Water and Planning (DELWP)





Further information about the Interoperable Spatial Knowledge Base for IFMP is available at: http://emv.cerdi.edu.au/emv.php

Key Contact

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HAZARDS PLANNING AND RESILIENCE

Colac Otway Shire Mapping Portal: Snapshot

CeRDI, in collaboration with the Colac Otway Shire (COS) and Emergency Management Victoria has created the Colac Otway Shire Mapping Portal. Colac Otway Shire's mapping portal is easily accessible and intuitive, providing interoperable data and visual information about properties in the shire.

The portal has been designed to empower decision-making by a range of stakeholders. Information can be accessed and used by individuals and organisations including community groups, government departments and agencies, other municipalities, regional authorities, emergency services, businesses and researchers.

Since January 2016, the COS mapping portal has been extended to assist stakeholders in sharing comprehensive information and mobilisation for recovery priorities following the Wye River–Jameson's Creek Bushfire in December 2015. Extensive additional information resources including aerial photography, reports and datasets are available to involved groups via secure password-protected logins. Extensive engagement with regional stakeholders has contributed to the success for this project and the improvements achieved in decision making evident on the redevelopment of the Colac Otway Shire Municipal Emergency Management Plan (MEMP).

The development of the COS mapping portal is now maintained and driven by the client. The mapping portal now facilitates the dissemination of complex spatial data for projects such as the 2016 Wye River and Jamieson Track Fire Recovery. The platform allows numerous agencies, consultants and committees to access sensitive data customised to their roles within the recovery effort.

Other council-led projects and committees are also using the platform to provide tailored access to the spatial data needed within their projects. Numerous aerial imagery layers and LiDAR-based products have also been pre-processed and delivered through the portal in web-friendly formats.

Through the mapping platform redevelopments, greater focus has enabled increased useability. The introduction of thematic maps and advanced features enables the end user to have greater control, thus facilitating the functionality of the portal, and providing the council and their stakeholders greater input and control over the portal.

The Colac Otway Shire continues to show leadership in this area, having identified potential areas for further portal enhancements. A priority will be to develop the portal to enable endusers to query and filter across multiple layers (both vector and raster), which will allow for more complex questions to be explored and answered from the data. Enhancing the use of 3D visualisation and time-series animations provides another area of interest for future updates.







Further information about the COS Mapping Portal is available at: http://cos.cerdi.com.au/

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HAZARDS PLANNING AND RESILIENCE

Corangamite Flood Portal

The Corangamite Flood Portal provides a gateway of information for stakeholders on floodplain management within the Corangamite Region. The portal was developed by CeRDI in close partnership with the Corangamite Catchment Management Authority (CMA).

The Flood Portal consolidates information for stakeholders on floodplain management within the Corangamite Region, including an interactive flood report. Additional features of the portal include planning overlays that relate to flooding, websites for warnings and emergency contact details for flooding and a 'Frequently Asked Questions' (FAQ) page for flooding and floodplain management. The portal also provides community stakeholders with opportunity to access and contribute to the Corangamite Regional Floodplain Management Strategy. The portal provides an example of the CMA enabling opportunities for communities to provide information and feedback. Local knowledge is critical to understanding flood behaviour and options for flood mitigation. Community information is integral to the development of the Regional Floodplain Management Strategy and setting regional and local priorities for flood management.

The Corangamite Flood Portal will assist the CMA to work in collaboration with the Victorian State Emergency Services and the nine local governments in the Corangamite region to develop a Regional Floodplain Management Strategy. The strategy is the starting point for councils and other stakeholders to identify priority flood management activities, which may include flood warning systems and flood emergency response to local needs, improving flood overlays in land use planning schemes, and dealing with riverine, coastal and urban storm water flooding issues.

This portal is one of a number of successful projects to have emerged from the longestablished, ten-year relationship between CeRDI and the Corangamite CMA. During this time, a number of significant, collaborative projects have been successfully implemented including the redevelopments of Waterwatch and EstuaryWatch, the Corangamite Soil Health Knowledge Base, and Natural Resource Management (NRM) Planning.





[The portal] will assist the CMA to work in collaboration with the Victorian State Emergency Services and the nine local governments in the Corangamite region...

Project Partner:

Corangamite Catchment Management Authority Further information about the Corangamite Flood Portal is available at: www.ccmaknowledgebase.vic.gov.au/flood

Key Contact

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HAZARDS PLANNING AND RESILIENCE

Southern Gippsland Agricultural Climate Resilience Project: Impact Research Study

During the second half of 2016, CeRDI was commissioned by South Gippsland and Bass Coast Councils to conduct extensive impact research into the Southern Gippsland Agricultural Climate Resilience Project (ACRP).

This research was undertaken to examine the outcomes from the Southern Gippsland Agricultural Climate Resilience Project (ACRP) which was developed as a local government partnership to build climate resilience across the food production community in Southern Gippsland.

The aim of the South Gippsland ACRP was to improve resilience to climate risks through better decision making and effective action on the ground. A range of engagement, educational and information sharing activities were implemented to communities across the region through the ACRP, which was funded by the Victorian Government's Department of Environmental, Land, Water and Planning (DELWP). The research undertaken by CeRDI sought to examine the outcomes from this two year project.

An extensive impact research study was implemented by CeRDI's Angela Murphy, who, together with a team of CeRDI researchers, examined the implementation and uptake of the program across the region. Wide ranging research methods were adopted enabling the researchers to explore the approaches – implemented through the ACRP – that were most effective in supporting the community. The research explored the extent to which project delivery aligned with the original aims of the program.

The findings from this research confirmed that the program had achieved a measure of success in building levels of awareness of climate change issues and providing strategies to enhance agricultural resilience among participants through engagement activities including place-based learning, partnerships and network building. The range of educational topics and learning approaches were highly valued by program participants while the diverse strategies for awareness building also contributed to the success of the project and developed the community's engagement through the program.

Following on from the research, a series of recommendations were prepared to assist with the future development of similar programs. It is expected that the outcomes from this research will be of particular value to key project stakeholders, with the research learnings offering broader insights that can be implemented to inform other agricultural resilience projects, in the future.





Project Partners: South Gippsland Council Bass Coast Council

Further information about the South Gippsland Agriculture Climate Resilience project is available at: http://sustainabilitygippsland.com/group/agricultural-climate-adaptation-project-southern-gippsland

Key Contact

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HEALTH AND WELLBEING

Health Justice Partnership for Youth

The Central Highlands Health Justice Partnership for Youth delivers an integrated health justice service to improve the legal, health and wellbeing outcomes for disadvantaged young people.

The project is led by CeRDI in collaboration with Ballarat Community Health and Central Highlands Community Legal Centre. The project has been funded by a major grant from the Victorian Legal Services Board.

Facilitating early intervention and raising awareness of the impact of legal issues on health and well-being for the region's youth is a key objective of the program. The program was established to integrate vital legal services within healthcare programs for at-risk youth and where, in Victoria, and especially in rural and regional areas there exists a high incidence of young people with mental health, drug and alcohol issues experiencing multiple legal problems.

A core feature of the Central Highlands Health Justice Partnership for Youth is the provision of early intervention by delivering an integrated medical and legal service, with a lawyer from Central Highlands Community Legal Service based at Ballarat Community Health, which is a convenient, trusted and safe environment. Co-locating legal services at this location was recognised for its potential to facilitate the early identification and management of legal issues for young people. It was important that the knowledge and skills of agency staff was enhanced to assist them in understanding and responding to these issues.

Researchers at CeRDI led by Margaret Camilleri, have implemented an extensive program of research to capture detailed insights about service usage and uptake. This research will provide further understanding about health justice partnerships within the Australian context and offer new insights to support the delivery of ongoing services for at-risk youth in our region.

Since the program's commencement, over 130 young people aged 15–25 years have received services through the program; many attended the program with at least one legal problem – and in some instances, with two or three issues. The legal issues of young people attending the service have been wide ranging and include criminal, civil and family matters. Survey data collected for this research indicates that for many of the young people accessing this service, the legal problem was having an impact on other aspects of their lives.

The research data also identifies a strong commitment to the project, through internal and external agency referrals. This further indicates the breadth of awareness and understanding of the project. Many staff from these agencies also shared many positive insights about the service through their observations of the young people they have referred to the service.

A final wave of research data is to be collected for the program at the end of 2017.







Further information about the Health Justice Partnership is available at: www.stuck.org.au

Key Contact

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HEALTH AND WELLBEING

Rural Alcohol Culture and Change for Youth in the Wimmera

CeRDI researchers undertook an important pilot study in the Horsham region during 2016, to identify strategies and interventions that have the potential to shift cultural norms in the consumption of alcohol by young people.

The Rural Alcohol Culture and Change for Youth in the Wimmera Project, was part of VicHealth's Alcohol Culture Change Grants for Local Councils and enabled Horsham Rural City Council (HRCC) to collaborate with CeRDI to conduct research and promote cultural change for alcohol use by youth in Horsham.

Horsham Rural City Council was one of eight councils across Victoria to receive funding for this pilot study. HRCC assessed alcohol culture and identified potential health interventions leading to cultural change and safer, reduced alcohol consumption for young people in the region. The project was aimed at better understanding current alcohol consumption and alcohol misuse for young people in the region, and to identify opportunities for cultural change to reduce alcohol use.

Under the research leadership of CeRDI's Angela Murphy, together with CeRDI project officers, Meghan Taylor and Jennifer Corbett, the first stage of the pilot involved a comprehensive review of the published literature. This yielded important insights about best practice strategies and interventions for the prevention and intervention of alcohol misuse amongst young people. Successful strategies involved collaboration with a wide range of committed stakeholders from within affected communities. Social marketing was also found to be successful in both addressing alcohol misuse and promoting positive behaviour change.

Another core research activity associated with this project included extensive data collection from representatives across the Horsham community. Interviews and forums were conducted with young people and representatives from sports association, youth services, local government, police, health and community services, ambulance and education providers. Surveys were also widely disseminated across the community. This data assisted in constructing an understanding of the current practices of alcohol consumption and alcohol misuse for the region. The research data was also used to inform the final phase of this project and the development of a model to promote a shift in existing alcohol culture among rural young people. The model provides a multi-level strategy targeting key stakeholders; young people, parents and the wider community.

A final report for this research was completed in early 2017 with the research findings used to support another funding submission to VicHealth to conduct stage two of the project. Notification has recently confirmed that stage two funding of \$300,000 has been granted to this project and for accompanying research. The will enable a model to be established to shift youth alcohol culture for the region.



Project Partners:

Horsham Rural City Council Grampians Community Health (Wimmera Drug Action Taskforce and Nexus Youth Centre) Victoria Police Wimmera Primary Care Partnership Wimmera Region Sports Assembly Wimmera Region Sports Assembly Wimmera Southern Mallee LLEN Wimmera UnitingCare Wimmera Health Care Group Ambulance Victoria Department of Health and Human Services





Further information about the Rural Alcohol Culture and Change for Youth in the Wimmera project is available at: www.vichealth.vic.gov.au/programs-and-projects/alcohol-culture-change-initiative

Key Contact

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HERITAGE AND CULTURE

Historic Urban Landscape Ballarat and Visualising Ballarat

CeRDI and the City of Ballarat collaborated to develop the Historic Urban Landscape (HUL) Ballarat web portal. The portal is one of the strategies developed for Ballarat, as a member of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Historic Urban Landscape Global project, to ensure the city continues to retain its character, landscape and cultural significance as it grows.

Using innovative spatial mapping and knowledge management tools, CeRDI and the City of Ballarat worked together to develop an interactive web portal that engages the community and enables users to easily access authoritative and credible information. HUL Ballarat is helping to create an awareness of the urban landscape and its cultural significance and will empower community members and local organisations to contribute to Ballarat's future development.

Visualising Ballarat is an associated project that is embedded within the HUL web portal. Visualising Ballarat offers state-of-the-art knowledge management and urban planning tools to assist in assessing and monitoring change. It provides end users with direct access to complex data sets from a single point of access and to participate in the localised knowledge building process. The data sets available include data relating to historic landscapes, trees, parks, views, and landmarks, natural landscapes, geology, services and infrastructure, boundaries and regulatory tools.

Both HUL Ballarat and Visualising Ballarat have been designed to assist stakeholders, community members, practitioners and researchers to come together and identify community values, landscape values and acceptable levels of change.

Impact research has commenced to capture data that supports the assessment of longerterm impacts of HUL Ballarat and Visualising Ballarat. Conducted by CeRDI's Angela Murphy and colleagues, the first wave of research was completed during 2016 and included input from a diverse range of stakeholder participants. The findings identified that the portals are beginning to be adopted as a platform for collaboration in the process of urban planning and development.

Research examining the impacts on practice across and within community, planning, business and research environments will continue during 2017.









Further information about HUL Ballarat is available at: www.hulballarat.org.au

Further information about Visualising Ballarat is available at: www.visualisingballarat.org.au

Key Contact

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City of Ballarat

REGIONAL DEVELOPMENT

The Great South Coast Digital Strategy

In 2016, CeRDI in collaboration with Lateral Plains Pty Ltd were contracted by the Regional Development Australia – Barwon South West Committee to develop the digital strategy for the Great South Coast Region.

The Great South Coast Digital Strategy was undertaken to assist local governments in the Great South Coast region of Victoria to identify the potential for digital technologies to contribute to regional growth. Activities associated with the research to inform this strategy were aimed at determining the regional business uptake of digital solutions that enhance productivity and profit, the level of digital maturity in businesses and exemplar businesses that are contributing, or have the potential to contribute, to the growth of the region's economy. The region of focus comprised the local government areas of Colac Otway Shire, Corangamite Shire, Glenelg Shire, Moyne Shire, Southern Grampians Shire and Warrnambool City Council.

CeRDI Director, Helen Thompson, and Research Officer, Jennifer Corbett, worked closely with George Fong, Director of Lateral Plains to conduct research to inform the strategy and the final report. Data collection methods for the research involved surveys and interviews with key stakeholders. This enabled data to be collected that would inform the current levels of digital uptake and included discussions with regional businesses that had already established strong digital initiatives.

The Great South Coast Digital Strategy provides an overview of the economic and digital technology context for each local government in the Great South Coast region, supported by insights from key business stakeholders. The report highlights many business and technology innovations evident across the region and showcases the successful uptake of new technology within traditional industry sectors, such as agriculture and tourism. The strategy also outlines the key issues and challenges for the region and includes recommendations for building stronger linkages between regional goals and local, state and federal government policies.

This strategy extends previous research undertaken by CeRDI and Lateral Plains in 2011 for the Great South Coast Communication Strategy, which was undertaken to support the National Broadband Network roll-out in the region.

The Great South Coast Digital Strategy report provided the impetus for an implementation strategy workshop/round table in Warrnambool in mid-July 2016. Both Helen Thompson and George Fong presented the findings to delegates at the forum.





Project Partners:
Lateral Plains Pty Ltd
Colac Otway Shire Council
Corangamite Shire Council
Glenelg Shire Council
Moyne Shire Council
Southern Grampians Shire Council
Warrnambool City Council
Regional Development Australia – Barwon South West Further information about the Great South Coast Digital Strategy is available at: www.cerdi.edu.au/cb_pages/ the_great_south_coast_digital_strategy.php

Key Contact

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REGIONAL DEVELOPMENT

Western Business Accelerator and Centre for Excellence

The Western Business Accelerator and Centre for Excellence (Western BACE) is a multifunction facility, built with the aim of fostering business, education and innovation in Melbourne's West.

Located in Melton, the Western BACE was launched in May 2015 and offers a range of business services and tenancy programs for start-up businesses (through the business accelerator program; co-working space) and anchor tenancy for established businesses. Education and training opportunities are also offered at the facility.

In 2013, the Western BACE Research Group was established to undertake research, monitoring and evaluation activities in parallel with the planning, design, construction and operating phases of the Western BACE. CeRDI partnered with the City of Melton and Victoria University in conducting research across each of the three development phases and has now completed a range of research projects focusing on the Western BACE.

Most recently, CeRDI Research Fellow Alison Ollerenshaw conducted research to gauge the motivations, impressions and expectations of the program by new tenants at the Western BACE tenants. The findings highlighted the diversity of experience of this first cohort of tenants at Western BACE. The breadth of their collective experiences indicates a strong connection between tenants and the business accelerator program, which is closely aligned to expectations for their business, and anticipated business growth. Complementing this is the support they have received since commencing in the program.

These outcomes offer initial insights into the tenant experiences in incubators and accelerators. Ongoing research, drawing widely upon the experiences of tenants over the longer-term emerged as a core recommendation from this research.

An industry-based PhD scholarship was established in 2016 to extend the research program with the Western BACE. CeRDI's Alison Ollerenshaw was the successful applicant, and commenced her studies in July. Alison is conducting research examining the relationship between business incubator services and the psychological capital of tenants.





Project Partners:

Melton City Council Victoria University Commonwealth Government Department of Environment Further information about the Western BACE is available at: www.westernbaceresearch.com.au

Key Contact

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Staff Profiles

Research



Associate Professor Helen Thompson, Centre Director

Doctorate of Business Administration, Bachelor of Commerce (Accounting) with Distinction

Helen has led Centre activities since 2002 and is responsible for the achievement of all CeRDI organisational objectives in respect of research, project management, partner projects, business development and financial management. Under Helen's leadership, CeRDI has become one of the University's most successful research centres, establishing a reputation for excellence at the regional, national and international level. Helen has organisationwide leadership for eResearch. She is engaged in research into the use of ICT and is involved in a range of activities which contribute to the economic and social development of regional and rural Victoria. Helen was appointed as one of 20 National Broadband Champions 2011-13. She is a member of GovHack Ballarat Working Group; Chair of the Committee for Ballarat Maximising eHealth Taskforce; Governance Group member for the Federation for Advancement of Victorian eResearch and Committee Member for the **Regional Universities Network Regional** Futures Conference.



Associate Professor Peter Dahlhaus, Principal Research Fellow

PhD, Master of Applied Science, Bachelor of Applied Science

Peter joined CeRDI in 2012 as an experienced researcher and geologist. He has a comprehensive knowledge of the geology, geomorphology and hydrogeology of south west Victoria, where he has been influential in applying his scientific knowledge to direct policy on salinity and soil health management as an author of catchment action plans and strategies, and municipal planning overlays. Peter is well-known by community groups as a science communicator and as an advisor to various catchment management authorities, water authorities and municipalities in the region. Together with colleagues at CeRDI, Peter's current research focuses on spatial data interoperability and visualisation to ensure that natural resource management data, information and knowledge is globally available to researchers, government agencies, municipalities and the public. Peter is the lead researcher for the Visualising Victoria's Groundwater (VVG) project.



Dr Angela Murphy, Senior Research Fellow

PhD, Graduate Diploma Education, Graduate Diploma Criminology, Bachelor of Arts (Social Sciences)

Angela joined CeRDI in late 2014 and has extensive research and engagement experience, having previously worked across a number of research centres at FedUni as a private consultant and within the public health and welfare sector. Angela has managed over 40 research projects and consultancies. Her current focus is on developing evidence-based research to measure eResearch impact and practice change.



Dr Birgita Hansen, Research Fellow

PhD (Conservation Genetics), Bachelor of Science (Evolutionary Ecology)

Birgita brings to the CeRDI team extensive experience in ecology and environmental management, contributing to improving the management and dissemination of biodiversity knowledge. Her research to date has focused on understanding the ecological response of birds to modification of their habitat, which has included studies into riparian restoration in agricultural landscapes and waterbird monitoring at local and continental scales.



Dr Margaret Camilleri, Research Fellow

PhD, Master of Social Science (Social Policy), Graduate Diploma Community Development, Bachelor of Arts (Multicultural Studies)

Marg has worked in the community legal sector and the justice system for over 25 years. Much of her work in the criminal justice area has focused on access to justice, particularly for people with disabilities. Marg recently joined CeRDI to lead the Central Highlands Health Justice Partnership project, which aims to improve legal, health and wellbeing outcomes for disadvantaged young people. The project, funded by the Legal Services Board, includes project partners Ballarat Community Health and Central Highlands Community Legal Centre.



Alison Ollerenshaw, Research Fellow

Master of Applied Science, Graduate Diploma of Applied Science (Professional Psychology), Bachelor of Arts, Diploma Project Management

Alison joined CeRDI in 2012 and provides support on CeRDI projects including the Central Highlands Health Justice Partnership project, and the Western BACE project. Alison has collaborated on many regional projects that have a health and community development focus. Alison commenced her PhD during 2016.



Robert Milne, Research Associate (Environmental Science) Bachelor of Applied Science (Environmental Management)

Rob joined CeRDI in 2013. He has specialist skills in geographic information systems and data management and has extensive project management and stakeholder engagement experience gained during his extensive career with FedUni and as partner in the family farming business.



Jennifer Corbett, Research Officer Bachelor of Management (Honours) (Marketing)

Jennifer joined CeRDI in 2009. She provides research support across a range projects including regional ICT studies and projects in the agriculture sector.



Kirsten McKenna, Research Officer Bachelor of Science (Geology)

Kirsten joined CeRDI in 2013 after working as a hydrogeologist in Melbourne. Kirsten assists with groundwater and soil related projects, including Visualising Victoria's Groundwater and the Corangamite Soil Health Knowledge Base projects.



Meghan Taylor, Research Officer

Meghan commenced at CeRDI in 2011 and provides research support across various projects, including the HUL Ballarat and Visualising Ballarat and Online Farm Trials research. Meghan is currently studying for a Bachelor of Science/Bachelor of Biomedical Science.



Amy Tsilemanis, Research Officer

Master of Arts

Amy is an artist, producer and researcher working across the arts and heritage fields. She joined the CeRDI team to assist with research and development around the HUL portal, and is passionate about innovative ways of bringing local history to life.



Rick Pope, Research Associate

Graduate Diploma in Land Rehabilitation

Rick started working with CeRDI in 2015 and has extensive expertise in geographic information systems (GIS) and global positioning systems (GPS). Rick has a close working relationship with Local Government, the spatial industry as well as Landcare networks in Victoria, Queensland and Western Australia.



Xenon Ellis, Administration Officer, Research Officer Bachelor of Arts (Media and Communication)

Xenon joined CeRDI in 2014 to work in a support role for the Online Farm Trials research. Growing up in a rural environment, Xenon brings an understanding of agricultural life and a drive to promote sustainable farming practices to the Online Farm Trials research.



Jessica Lockyer, Administration Officer, Research Support

Jessica joined CeRDI in 2014. She provides research support across various projects, including the GRDC Online Final Reports research. Jess is currently studying for a Bachelor of Management.



Dr Judi Walters, Administration Officer, Research Support PhD (Forest Ecology), Master of Science, Bachelor of Forest Science (Honours), Certificate IV (Professional Writing and Editing)

Judi commenced at CeRDI in 2015 having worked extensively within the field of scientific research, publishing and editing from within a range of organisations and universities spanning fields such as forest ecology, bushfire research and contaminated lands auditing. Judi joined the OFT team and provides support services within CeRDI.



Jessica Sautner, Education Officer

Masters of Education Studies, Graduate Diploma of Education, Bachelor of Science.

Jessica completed work for CeRDI in 2016. Jessica provided support across various CeRDI projects and provided advice on the development of education curriculum resources.



David Ebbs

Bachelor of Engineering (Chemical) (Honours), Masters of Business Administration

David commenced his PhD with CeRDI in 2015 after more than 25 years working predominantly in the manufacturing sector. A Chemical Engineering degree and MBA equipped him well for engineering and factory management, specialising in productivity improvements. His research is now on alternative water supplies, and investigating a triple bottom line analysis of alternative methods for using stormwater to supplement a city's water supply. David also works part-time in CeRDI.



Chris Bahlo

Bachelor of Information Technology (Honours), Bachelor of Information Technology (Professional Practice), Bachelor of Business

Chris commenced her PhD at Federation University Australia in early 2016, as part of the RUN Precision Agriculture Flagship, researching data interoperability in Precision Agriculture. She works part-time at CeRDI and as a sessional at Federation University Australia. In 2013 she graduated with a Degree in Information Technology from the University of Ballarat, being awarded the Ballarat University Medal. This was followed by a research Honours year. In 1995, she completed a Business Degree at Charles Sturt University and prior to that, an Agricultural Science Diploma. Chris has worked in information technology and agriculture roles, and also has business experience.



Patrick Bonney

Bachelor of Science, Master of Science (Zoology)

Patrick commenced his PhD at CeRDI in 2016 and is also employed parttime in the Centre. Patrick is undertaking research examining citizen science and public policy. Both his studies and his part-time employment involve working with volunteers, environmental groups and government and non-government agencies involved with Citizen Science and Natural Resource Management. For his PhD, Patrick is working closely with the Corangamite Catchment Management Authority to measure and explore the issues and opportunities of the Waterwatch Victoria and EstuaryWatch Victoria programs.

Technical



Andrew Macleod, Manager Technical Projects Honours Applied Science (Information Technology), Bachelor of Computing

Andrew joined CeRDI in 1999. He provides technical leadership for all Centre activities. Andrew has been instrumental in developing the technology innovations, data interoperability and knowledge management approaches demonstrated through CeRDI spatial initiatives.



Paul Feely, Senior Programmer

Bachelor of Computing (Honours)/Bachelor of Commerce

Paul joined CeRDI in 2003. He specialises in PHP and MySQL development and has been the lead programmer on major projects including Sport and Recreation Spatial and Online Farm Trials.



Craig Briody, Web Developer Bachelor of Computing

Craig joined CeRDI in 2002. Craig specialises in the development and implementation of web-based projects as well as having significant experience in the development and delivery of comprehensive client training programs.



Heath Gillett, Programmer

Bachelor of Computing

Heath joined CeRDI during 2009. He has extensive experience in design, programming, implementation and support of various IT systems. Heath has been a lead developer on key projects including the Barwon South West Knowledge Base and GRDC Online Final Reports project.



Scott Limmer, Systems Analyst Programmer Bachelor of Information Technology

Scott joined CeRDI in 2008 to provide assistance with expanding programming and web development activities. Since then he has introduced new multimedia and web2 technology skills to the team and has involvement in key projects including Land Your Career, Grain and Graze 3 and Dementia Pathways Tool.



Sudeera Abeywickrema, Web Developer Bachelor of Information Technology

Sudeera joined CeRDI in 2013, and contributes to the implementation of a range of web-based applications and systems and the integration of emerging technologies to enhance CeRDI outcomes.



Drew Collins, Technical Assistant

After completing work experience with CeRDI in 2011, Drew was later employed on a casual basis to provide technical assistance across a range of projects. Drew is currently studying for a Bachelor of Film and Television.



Jack Spencer, Technical Assistant

Jack joined CeRDI in 2015 and provides technical assistance across a range of projects. He works on a part-time basis in CeRDI while completing a Bachelor of Communication Design at Swinburne University.

Project and Administration



Greg McKenzie, Project Manager

Graduate Diploma of Education, Bachelor of Science, Project Management Professional (PMP®) Certified

Greg joined CeRDI in 2013 to provide leadership and end-to-end management of a number of concurrent projects. He also contributes to business development activities within CeRDI.



Kathy Gamble, Administration Support Officer Graduate Diploma of Education, Diploma of Fine Art

Kathy joined CeRDI in January 2013 after five years with the Federation Business School. Kathy assists the CeRDI team with administrative support across various projects and is the Personal Assistant to the Centre Director.

Current CeRDI HDR Students

Himalaya Singh (PhD)

PhD title: A geospatial analysis of sport/leisure injuries of Victoria, Australia

University partner:	Australian Centre for Research into Injury in Sport and its Prevention (ACRISP)
Faculty:	Health
Year Commenced:	2013
Supervisors:	Prof Caroline Finch (ACRISP); Assoc Prof Helen Thompson, Dr Lauren Fortington (ACRISP),
	Assoc Prof Rochelle Eime (Faculty of Health FedUni and ISEAL Victoria University)

David Ebbs (PhD)

PhD title: The impact of using stormwater to supply a city

Faculty:	Science and Technology
Year Commenced:	2015
Supervisors:	Assoc Prof Peter Dahlhaus, Dr Andrew Barton, Dr Harpreet Kandra

Chris Bahlo (PhD)

PhD title: Advancing data interoperability standards for animal welfare and production systems

Faculty:	Science and Technology
Year Commenced:	2016
Supervisors:	Assoc Prof Peter Dahlhaus, Dr Mark Trotter (CQU)

Shirish Sharma (PhD)

PhD title: Interoperable framework to integrate involuntary geospatial data in web based geoportals

Faculty:	Science and Technology
Year Commenced:	2016
Supervisors:	Assoc Prof Peter Dahlhaus, Dr Angela Murphy, Dr Iman Avazpour

Thomas Hill (PhD)

PhD title: Unheard farmers: exploring precision agriculture adoption

Faculty:	Science and Technology
Year Commenced:	2016
Supervisors:	Dr Angela Murphy, Prof Bernard Schroeder, Assoc Prof Helen Thompson

Alison Ollerenshaw (PhD)

PhD title: The relationship between business incubator services and the psychological capital of tenants

Faculty:HealthYear Commenced:2016Supervisors:Dr Angela Murphy, Assoc Prof Helen Thompson, Prof Suzanne McLaren

Patrick Bonney (PhD)

PhD title: Citizens as monitors - crowdsourcing for water policy development

Faculty:	Science and Technology
Year Commenced:	2016
Supervisors:	Dr Angela Murphy, Dr Birgita Hansen, Dr Claudia Baldwin (USC)

Completed CeRDI HDR Students

Nathan Robinson, PhD

Assessing productive soil – landscapes in Victoria using digital soil mapping			
Supervisors:	Assoc Prof Peter Dahlhaus, Assoc Prof Peter Vamplew and Richard MacEwan.		
Faculty:	Science, Engineering and Information Technology		
Completed:	2016		

Publications

Journal Publications

Al Mandalawi M, You G, Dowling K, **Dahlhaus** P (2016) Kinematic assessment of slopes at Handlebar Hill open cut mine, Mt Isa, Queensland, Australia. *International Journal of GEOMATE*, 10(1): 1575–1583. http://www.geomatejournal.com/node/329

Alpers D, Walker F, Taylor A, Sunnucks P, Bellman S, **Hansen** B, et al (2016) Evidence of subdivisions on evolutionary timescales in a large, declining marsupial distributed across a phylogeographic barrier. *PLOS One*, 11(10): e0162789. doi:10.1371/journal.pone.0162789

Clemens R, Rogers D, Hansen B, Gosbell K, Minton C, et al (2016) Continental-scale decreases in shorebird populations in Australia. *Emu Austral Ornithology*, 116(2): 119–135. doi:10.1071/MU15056

Currell M, Gleeson T, **Dahlhaus** P (2016) A new assessment framework for transience in hydrogeological systems. *Groundwater*, 54(1): 4–14. doi:10.1111/gwat.12300

Dahlhaus P, **Murphy** A, **MacLeod** A, **Thompson** H, **McKenna** K, **Ollerenshaw** A (2016) Making the invisible visible: the impact of federating groundwater data in Victoria, Australia. *Journal of Hydroinformatics*, 18(2): 238–255. doi:10.2166/hydro.2015.169

Eime R, Harvey J, Charity M, Casey M, Westerbeek H, Payne W (2016) Age profiles of sport participants. *BMC Sports Science, Medicine and Rehabilitation*, 8: 6. doi:10.1186/s13102-016-0031-3

Grace M, Malone J, **Murphy**, A. (2016). Transferability of the youth foyer model for women exiting the criminal justice system. *Journal of Social Work*, 16(4), 470-488. doi: 10.1177/1468017315579306

Grace M, Malone J, **Murphy** A (2016) WAND: an activity program for women in a rooming house. *Affilia*, 31(1): 84–97. doi:10.1177/0886109915574577

Greenslade P, Florentine S, Hansen B, Gell P (2016) Biases encountered in long-term monitoring studies of invertebrates and microflora: Australian examples of protocols, personal tools and site location. *Environmental Monitoring and Assessment*, 188(8): 491. doi:10.1007/s10661-016-5478-x

Ollerenshaw A, Graymore M, McDonald K (2016) Beyond the call of duty: the integral role of local government in emergency management. *Rural Society*, 25(3), 185–203. doi.org/10.1080/10371656.2016.1255476

Ollerenshaw A (2016) Review of the book: a very short, fairly interesting and reasonably cheap book about studying leadership, by B Jackson and K Parry. (Sage Publications, 2009). *Community Development*, 47(4): 580–581. doi.org/10.1080/15575330.2016.1187336

Robinson N, **Dahlhaus** P, MacEwan R, Alexander J (2016) Soil data for biophysical models in Victoria, Australia: current needs and future challenges. *Geoderma Regional*, 7(3): 259–270. doi:10.1016/j.geodrs.2016.03.004

Robinson NJ, Kitching, M (2016) The 3D distribution of phyllosilicate clay minerals in western Victoria. *Geoderma*, 284, 152-177. doi: 10.1016/j.geoderma.2016.07.006

Singh H, Fortington LV, Finch C (2016) Application of spatial epidemiological approaches to injury research: A systematic review. *Injury Prevention*, 22(2), A113-A114. doi: 10.1136/injuryprev-2016-042156.311

Singh H, Fortington LV, Thompson H, Eime R, Finch C. (2016). Geospatial analysis of sports and leisure injury hospitalisations in Victoria, Australia. *Injury Prevention*, 22(2), A347. doi: 10.1136/injuryprev-2016-042156.975

Singh H, Fortington LV, Thompson H, Finch CF (2016) An overview of geospatial methods used in unintentional injury epidemiology. *Injury Epidemiology*, 3(32), 1-12. doi: 10.1186/s40621-016-0097-0

Szabo J, Choi C-Y, Clemens R, Hansen B (2016) Conservation without borders – solutions to declines of migratory shorebird in the East Asian-Australasian Flyway. *Emu Austral Ornithology*, 116(2): 215–221.

Conference Papers and Presentations

Bahlo C (2016) Advancing data interoperability standards for livestock welfare and production systems. Poster session presented at the Federation University Australia HDR Research Conference, July, Mount Helen, Australia.

Bann G, Rengasamy P, **Dahlhaus** P (2016) Apparent dryland salinity on the Australian uplands: causes, mechanisms, effects, mapping and management. Presented at the 35th International Geological Congress, 27 August–4 September, Cape Town, South Africa.

Dahlhaus P (2016) Smart cities and smart regions: empowering citizens with data democracy. Presented at the Newtech Ballarat – Preserving heritage in a Smart City (SIBA and DELWP), 25 October, Ballarat, Australia.

Dahlhaus P, Grellet S, Brodaric B, Boisvert E, Simons B, et al (2016) The Groundwater Interoperability Experiment 2: developing an international groundwater data exchange standard. Presented at the 43rd IAN International Congress, *'Groundwater and society: 60 years of IAH'*, 25–29 September, Montpellier, France.

Dahlhaus P, **MacLeod** A, **Thompson** H (2016) Discovering the known unknowns: interoperably federating data to reduce the risk of past mistakes. Presented at the EcoForum conference and exhibition, '*Australasian Land and Groundwater Association*', 25–28 October, Freemantle, Australia.

Dahlhaus P, **Milne** R, Nicholson C, Midwood J, Breust P, Limmer S (2016) Soil sensor data for profitable agriculture. Presented at the joint conference of the New Zealand Society of Soil Science and Soil Science Australia, '*Soil, a balancing act downunder*', 12–16 December, Queenstown, New Zealand.

Dahlhaus P, Nicholson C, Ryan B, **MacLeod** A, **Milne** R (2016) Liberating soil data for profitable agriculture and catchment health in the Corangamite region, Australia. Presented at the joint conference of the New Zealand Society of Soil Science and Soil Science Australia, 'Soil, a balancing act downunder', 12–16 December, Queenstown, New Zealand.

Ebbs D, **Dahlhaus** P, Barton A, Kandra H (2016) Impact of urbanisation on groundwater and the downstream river: A Ballarat case study. Water and Communities, 38th Australian Hydrology and Water Resources Symposium, 3rd – 6th December, Melbourne, Australia.

Ebbs D, **Dahlhaus** PG, Kandra H (2016) Ballarat's Journey to a Water Sensitive City. Federation University HDR Conference, Federation University Australia, Mt. Helen

Ebbs D, **Dahlhaus** P, Kandra H (2016) Ballarat's journey to a water sensitive city. Presented at the RUN regional futures conference, '*Working together to build strong regional futures*', Central Queensland University, 21–24 June, Rockhampton, Australia.

Ebbs D, Kandra H, **Dahlhaus** P (2016) The journey to a Water Sensitive City – A case study of Ballarat, Victoria, Australia. Presented at the 56th New Zealand Hydrological Society, 37th Australian Hydrology and Water Resources Symposium and 7th IPENZ Rivers Group, *'Water Infrastructure and the Environment'*, 28 November–2 December, Queenstown, New Zealand.

Hansen B, Feely P, Abeywickrema S, Plucinski P, Gillett H, MacLeod A (2016) WaterWatch and EstuaryWatch portals: a collaborative research partnership to develop online tools to enhance citizen science, data collection and provision, and information sharing. Presented at the Australian Society for Limnology Conference, 26–30 September, Ballarat, Australia.

Hansen B, Fuller R, Watkins D, Rogers D, Clemens R, et al (2016) Revision of the East Asian-Australasian flyway population estimates for 37 listed migratory shorebird species. Presented at the Australasian Shorebird Conference, 1–2 October, Auckland, New Zealand.

Hansen B, Pitfield C, **MacLeod** A, Novak C, Nilsson K, et al (2016) South West Climate Change Portal: using internet knowledge sharing and novel visualisations to engage community with climate science. Presented at Climate Adaptation 2016, 5–7 July, Adelaide, Australia.

Milne R (2016) Online Farm Trials – a national grains research information resource. Presented at the Grains Research and Development Corporation Research Update Conference, 9 February, Adelaide, Australia.

Milne R, **Hansen** B (2016) Engaging communities for prioritising natural resource management and biodiversity conservation actions (Conference Paper). CEUR Workshop Proceedings 1570, 36-40.

Murphy A, **Dahlhaus** P, **Thompson** H (2016) Historic Urban Landscapes and Visualising Ballarat: citizen participation for sustainable urban planning and design. Presented at the Locate 16 Conference: Disruptive Technology for a Smarter Society, 12–14 April, Melbourne, Australia.

Murphy A, **Thompson** H, **Dahlhaus** P (2016) Making intangibles tangible: visualisation informing, engaging and empowering community for embedding cultural heritage within the public domain. Presented at EVAA 2016: Electronic Visualisation and the Arts Australasia, 5–6 March, Canberra, Australia.

Ritchie A, **Dahlhaus** P, Gregory L, **MacLeod** A, Medyckyj-Scott D, et al (2016) Developing a global soil data infrastructure – the Open Geospatial Consortium soil data interoperability experiment Presented at Joint conference of the New Zealand Society of Soil Science and Soil Science Australia. 'Soil, a balancing act downunder', 12–16 December 2016, Queenstown, New Zealand.

Schultz N, Good M, Hansen B, Milne R (2016) Tree decline in the agricultural landscapes of South Australia. *11th Australasian Plant Conservation Conference*. Melbourne Botanic Gardens, Melbourne, Australia, 14-18 November 2016.

Singh H (2016) Application of spatial epidemiological approaches to injury research: A systemic review. *Paper presented at the Safety Conference*, 18-21 September, Tampere, Finland.

Singh H (2016) Geospatial analysis of sports and leisure injury hospitalisations in Victoria, Australia. Presented at the 2016 Safety World Conference, 16–18 September, Tampere, Finland.

Steel K, **Thompson** H, Wright W (2016) Access to research data: effective collaborations between academics, librarians and eResearch. Presented at eResearch Australasia 2016, 10–14 October, Melbourne, Australia.

Thoms M, Reid M, Gell P, **Thompson** H, **Dahlhaus** P, et al (2016) A Regional Universities Network water flagship. Presented at the RUN Regional Futures Conference, '*Working together to build strong regional futures*', Central Queensland University, 21–24 June, Rockhampton, Australia.

Major Reports

Brodaric B, Boisvert E, Lucido J, Simons B, **Dahlhaus** P, Grellet S, Chery L, Kmoch A (2016) OGC WaterML 2. Part 4: GroundWaterML 2 (GWML2).Open Geospatial Consortium. Document 16-032r2, Version 2.2. (Ed. B Brodaric). Available at: http://www.opengeospatial.org/ standards/gwml2Dahlhaus P (2016) OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2). Open Geospatial Consortium. Document 16-032r2, version 2.2, Open Geospatial Consortium. 159p.

Dahlhaus P, **Thompson** H (2016) Visualising Victoria's environment: collaborative development of online tools for State of Environment reporting. Discussion paper, Centre for eResearch and Digital Innovation, Federation University Australia, Ballarat, Australia. 21p.

Dahlhaus P, **Thompson** H, Murphy A, Hansen B (2016) WaterWatch and EstuaryWatch portals: a collaborative research partnership to develop online tools to enhance citizen science, data collection and provision and information sharing. Discussion paper, Centre for eResearch and Digital Innovation, Federation University Australia, Ballarat, Australia. 21p.

Eime R, Harvey J, Charity M, **Feely** P (2016) Fishermans Bend sports facilities: benchmarks and needs of projected population. Report to Sport and Recreation Victoria, Federation University Australia. 19p.

Hansen BD, Fuller RA, Watkins D, Rogers DI, Clemens RS, Newman M, Woehler EJ, Weller DR (2016) Revision of the East Asian-Australasian flyway population estimates for 37 listed migratory shorebird species. Unpublished report for the Department of the Environment. BirdLife Australia, Melbourne.

Murphy A, Ollerenshaw A, Taylor M, Tsilemanis A, Corbett J, Thompson H, Dahlhaus P (2016) Historic Urban Landscapes (HUL) Ballarat Impact Analysis: eResearch (First Wave) Extended, Centre for eResearch and Digital Innovation. Federation University Australia.

Murphy A, **McKenna** K, **Milne** R, **Taylor** M, **Corbett** J, **Dahlhaus** P, **Thompson** H (2016) Online Farm Trials (OFT) impact research: eResearch (first wave) extended timeframe research study. Centre for eResearch and Digital Innovation, Federation University Australia (Ballarat). 107p.

Ollerenshaw A, **Corbett** J (2016) Central Highlands Digital Enterprise Program. Overview of research evaluation findings, Centre for eResearch and Digital Innovation. Federation University Australia.

Ollerenshaw A, **Murphy**, A., & **Thompson**, H. (2016). Tenancy Research Report: Documenting the initial experiences of tenants in the Business Accelerator Program at the Western BACE, Centre for eResearch and Digital Innovation. Federation University Australia.

Schultz N, Good M, **Hansen** B (2016) Final report on tree decline and death project. Submitted to the Coorong and Tatiara Local Action Plan. Federation University Australia. 82p.

Thompson H, **Corbett** J, Fong G (2016) Great South Coast Digital Strategy. Final report, Prepared by the Centre for eResearch and Digital Innovation and Lateral Plains, Federation University Australia, Ballarat. 54p.





Awards

2016 Asia Pacific Spatial Excellence Award: Corangamite Soil Health Knowledge Base.

2016 Victorian Spatial Excellence Award: Environment and Sustainability: Corangamite Natural Resource Management Planning Portal.

2016 Victorian Spatial Excellence Award: Spatial Enablement: Online Farm Trials.

Research Income

The following chart illustrates CeRDI's income from 2005 to 2016.

The key performance measure of research income continues to grow year on year.¹ Research income in 2016 increased from previous years.



FIGURE 2. CeRDI'S INCOME FROM 2005 TO 2016

The change in the University Funding component of income for 2015 shown above reflects the University's organisational change for the Corporate Web Team, which in 2015 was no longer under CeRDI administration.

1 Research income in 2012 was substantially higher than shown in the chart. The research income shown in 2012 was due to the method of income classification which was operating in Research Services during that period.

Research Partnerships and Collaborations

Ag Excellence Alliance (South Australia)

Agribiology and Pedology Research Centre, Italy

Ambulance Victoria

Australia Japan Foundation

Australian Advisory Group on Digital Soil Assessment

Australian Tourism Accreditation Program

Ballarat Community Health

Barwon South West Regional Strategic Fire Management Planning Committee

Bass Coast Council

Birchip Cropping Group

BirdLife Australia

Brimbank City Council

Central Highlands Community Legal Centre

City of Ballarat

City of Greater Geelong

Colac Otway Shire

Collier Charitable Fund

Commerce Ballarat

Commonwealth Government Department of Environment

Community Legal Centres NSW

Coorong and Tatiara District Councils

Corangamite Catchment Management Authority

Corangamite Shire Council

Country Fire Authority

CSIRO

Department of Economic Development, Jobs, Transport and Resources Department of Environment, Land, Water and Planning (DELWP)

Department of Health and Human Services

East Gippsland Catchment Management Authority

East Grampians Health Service

Emergency Management Victoria

Federation of Community Legal Centres

Fitzroy Legal Service

Foundation for Rural & Regional Renewal

Glenelg Hopkins Catchment Management Authority

Glenelg Shire Council

Goulburn-Broken Catchment Management Authority

Grains Research and Development Corporation

Grampians Community Health (Wimmera Drug Action Taskforce and Nexus Youth Centre)

Grampians Integrated Cancer Service

Grower Group Alliance (Western Australia)

Gunaikurnai Traditional Owner Land Management Board

Helen MacPherson Smith Trust

Horizons Regional Council, New Zealand

Horsham Rural City Council

International Plant Nutrition Institute

Interpath

ISRIC — World Soil Information, The Netherlands

Joshua Lieberman, Harvard University, USA

Landcare Research New Zealand Ltd

Lateral Plains Pty Ltd

Law and Justice Foundation

Legal Services Board

Legal Services Commission of South Australia

Leo Cussen Institute

Mallee Catchment Management Authority

Marschay Shorthorns

Melbourne Water

Melton City Council

Mornington Peninsula Shire

Moyne Shire Council

National Association of Community Legal Centres

Nicon Rural Services

North Central Catchment Management Authority

North East Catchment Management Authority

Peak Fitness

Pyrenees Hay Processors Co-operative

Regional Development Australia – Barwon South West

South Beach Wetlands and Landcare Group

South Eastern Melbourne Primary Health Network

South Gippsland Council

Southern Farming Systems

Southern Grampians Shire Council

State Wide Integrated Flora and Fauna Teams

TAFE Directors Australia

The Bear & The Whale

US Department of Agriculture (USDA) – Natural Resources Conservation Service

US Geological Survey (USGS)

Victoria Law Foundation

Victoria Legal Aid (Ballarat)

Victoria Police

Victoria University

Victorian Grower Group Alliance

Victorian Legal Assistance Forum

Victorian Legal Services Board

Victorian State Fire Management Planning Committee provided Project

Victorian Wader Study Group

Warrnambool City Council

West Gippsland Catchment Management Authority

West Wimmera Shire Council

Western BACE

Western Victoria Primary Health Network

Wild Bird Society of Japan

Wimmera Catchment Management Authority

Wimmera Health Care Group

Wimmera Primary Care Partnership

Wimmera Region Sports Assembly

Wimmera Southern Mallee Local Learning & Employment Network

Wimmera UnitingCare

Woady Yaloak Catchment Group

Woodlands and Wetlands Trust (Jerrabomberra Wetlands)



Contact CeRDI

For further details about CeRDI's diverse portfolio of research please visit our websites: www.cerdi.edu.au and http://spatial.federation.edu.au

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