RESEARCH SHOWCASE

February 23rd, 2022

Online via the Teams platform

Research Highlights. 5-minute research highlight talks with 5 minutes of questions. Intended to showcase outcomes.

An opportunity for researchers across the Flow-MER Selected Area and Basin Scale programs to showcase finalised research outcomes to the CEWO and other guests.

Important information about CSIRO and MS Teams.

To join a CSIRO Teams meeting you need to be invited to join our Teams platform**. Please make sure you have accepted the calendar invitation and sent the response to the organiser.** If you have not previously used CSIRO Teams, you will receive an email inviting you to CSIRO Teams before the meeting. The meeting room will open at 9am so you can check you have access. PLEASE CHECK YOU CAN ACCESS CSIRO TEAMS BEOFRE THE MEETING STARTS AT 10AM. If you cannot join Teams, please try the following:

Open Teams. In the top right-hand corner, you will see your initials. Click on that and sign out of your organisational account. Then sign in with your CSIRO account and join the meeting. If you are unable to join, please email nikki.thurgate@csiro.au or text 0467747023 and she will try to assist you. Please be patient.

We look forward to seeing you on the day!

Flow-MER Research Showcase Agenda

Wednesday 24th February 2022

Meeting attendance via MS Teams

10.00am – Teams room opens – coffee and chat

10.15am Welcome and Introduction (Ross Thompson)

10.20am Research Program Overview (Ross Thompson)

10.30am Research Highlights talks

10.30 am Doody, Gao, Davies, Pritchard, Nolan

A spatial model to monitor the response of woody vegetation to environmental water

10.40am Campbell, Capon, Thompson, Lovett, and Dyer

Moving beyond 'just add water': perspectives on the challenges, needs and opportunities for environmental flows for vegetation outcomes

10.50am McGinness, Lloyd-Jones, Langston, Robinson, Piper, Davies, Hodgson, Martin, Kingsford, Brandis, Doerr, and Ralph Mac Nally

Satellite tracking ibis and spoonbill movements to inform wetland and water management

11.00am Van Dyke, McPhan, Hamilton, Ross, Briggs, and Watts

Role of winter environmental watering in supporting declining freshwater turtle populations

11.15am Bovill and Webb

Methods to improve in-channel habitat and complement environmental flows

11:25 am – Break (15 minutes) and conversations with speakers

11.40am Research Highlights talks

11.40pm Lester, Holt and Macqueen
Basin-scale modelling framework development and demonstration

11.50pm Hitchcock, Gilling, McInerney, Thiem, Hadwen, Rees, Mika, Frost, and Thompson
Basin food web model development

12.00pm Thiem, Zampatti, Fanson, Stuart, Butler, Harding, Woods, Tonkin, Koster, Lyon, Bice, Carpenter-Bundhoo, and Baumgartner
Regional and inter-regional fish movement responses to varying river discharge

12.20pm Bice, Giatas, Ye, Catalano, Furst, Oliver, Shiel, Zampatti, Gibbs and Revill

From productivity to Murray cod recruitment in the Lower Murray

12.30pm Todd, Wootton, Koehn, Stuart, Thiem, Ye

MER fish populations models

12.40pm Gower and Sutton
Edward/Kolety River physical habitat research

12:50 pm – Lunch (30 minutes) and conversations with speakers

1.20pm Research Highlights talks

1.20pm Whitelaw and Wassens.
Using audio visualisations and other media to create engaging digital portrayals of wetland ecosystems

1.30pm Higgisson, Tschierscke, Cobb and Dyer.

The role of environmental water and reed bed condition on the response of Phragmites australis reed beds to flooding

1.40pm Duncan, Walburn, Blackman, Thiem and Watts

Monitoring range expansions following delivery of e-water using eDNA

1.50pm Allan and Watts

Stakeholder perspectives on using water for the environment in the Edward/Kolety-Wakool river system

Wednesday 24th February 2022
2.00pm. Brooks *Scaling diversity from ecosystems to the Basin* **2.10pm Research Reflections – TBC** **2.30pm Research Reflections – CEWO** **2.40pm Next Steps (Ross Thompson)** **2.45pm Close**

ABSTRACTS (in running order)	
Talk 1	**A spatial model to monitor the response of woody vegetation to environmental water**
Authors and affiliations	Tanya Doody, Steve Gao, Micah Davies, Jodie Pritchard, Martin Nolan (CSIRO)
Brief Abstract	The key objective of this project, 'remote sensing responses of woody vegetation to environmental water', was to develop a fine scale remotely sensed data time series which permits investigation and monitoring of tree responses to water availability. To underpin such investigation, total tree water use (or evapotranspiration) was monitored across a number of sites in both Red Gum and Black Box species in the southern Murray-Darling Basin continuously over several years. Tree evapotranspiration provides an indication of real-time tree responses to changed water availability in tree stands, such as provision of environmental water or drought. Evapotranspiration data also reduces 'response lags' commonly seen in visual canopy assessments. Tree evapotranspiration field data in combination with remotely sensed evapotranspiration layers and machine learning was used to develop a spatial 'floodplain tree response' model, where tree water use data was generated for every 30m Landsat pixel of Red Gum and Black Box in the Murray-Darling Basin from 2000 to current at monthly intervals and with high accuracy. This dataset provides a mechanism to further investigate tree responses to environmental watering over the past 20 years and to aid prioritisation of environmental water into the future.
Talk 2	**Moving beyond 'just add water': perspectives on the challenges, needs and opportunities for environmental flows for vegetation outcomes**
Authors and affiliations	Cherie Campbell[1], Sam Capon[2], Ross Thompson[1], Siwan Lovett[3], Fiona Dyer[1] 1. Centre for Applied Water Science, Institute for Applied Ecology, Faculty of Science and Technology, University of Canberra, Bruce, Australian Capital Territory, Australia 2601. 2. Australian Rivers Institute, Griffith University, Nathan, Queensland, Australia, 4111. 3. Australian River Restoration Centre, Canberra, Australian Capital Territory, Australia, 2601.
Brief Abstract	Managing environmental flows for vegetation outcomes has anecdotally been described as challenging, largely because of diverse and dynamic

	vegetation responses to variable flow regimes. To better understand these challenges this study was interested in eliciting perspectives from a range of people working in environmental water management. There are many steps involved in the management of environmental water including planning, delivery, monitoring and evaluation, and reporting to inform future watering actions and policy. This process involves input from a wide range of people from broad sectors of the community, including government, university / research sectors, traditional owners, other community and stakeholder groups, not-for-profit, and private consultancy sectors. We used an online survey to gain insights into i) environmental flow outcomes for non-woody vegetation (NWV), ii) challenges evaluating outcomes, and iii) risks and priorities for the management of NWV. Environmental flows are perceived as providing numerous benefits to NWV, however benefits depend on a broad range of influencing factors, including flow and non-flow drivers. There are divergent opinions as to the limitation of factors that may be challenging to evaluation of vegetation outcomes, however, altered flow regimes and climate change were identified as clear risks. The broad range of identified priorities reinforces the diversity of factors influencing NWV outcomes and the need for more than just water. These findings have implications for future research, approaches to monitoring and evaluation, adaptive management, as well as policy considerations.
Talk 3	**Satellite tracking ibis and spoonbill movements to inform wetland and water management**
Authors and affiliations	Heather M. McGinness[1], Luke Lloyd-Jones[2], Art Langston[1], Freya Robinson[3], Melissa Piper[4], Micah Davies[1], Jessica Hodgson[1], John Martin[5], Richard Kingsford[6], Kate Brandis[6], Veronica Doerr[1], Ralph Mac Nally[7,8] *[1]CSIRO Land and Water, Canberra ACT 2601, Australia* *[2]CSIRO Data61, Brisbane QLD 4102, Australia* *[3]CSIRO Health and Biosecurity, Canberra ACT 2601, Australia* *[4]CSIRO Agriculture, Canberra ACT 2601, Australia* *[5]Royal Botanic Gardens Sydney NSW 2052, Australia* *[6] University of New South Wales, Sydney NSW 2052, Australia* *[7]University of Canberra, Canberra ACT 2615, Australia*

	[8] *School of Biosciences, The University of Melbourne, Parkville 3052, Australia (http-//orcid.org/0000-0002-4473-1636)*
Brief Abstract	Increasing waterbird populations and maintaining waterbird diversity are important goals for wetland and water managers, but there are knowledge gaps that affect our ability to understand and predict waterbird population responses to management at appropriate scales. One of the largest of these gaps in knowledge is waterbird movements. Since 2016, we have been using GPS satellite telemetry to track the movements of colonial-breeding wading birds of three species of threskiornithids: straw-necked ibis (*Threskiornis spinicollis*), Australian white ibis (*T. molucca*), and royal spoonbill (*Platalea regia*). These GPS data are being analysed together with other spatio-temporal datasets including satellite imagery to describe movement characteristics, habitat use, and implications of these for water and habitat management. The results emphasise the need for multi-scale and long-term thinking and coordination in understanding waterbird behaviour, in planning environmental water allocations, and in managing expectations regarding waterbird responses. Planning and response predictions need to account for different intra-population movement strategies and for differences within and among species in movements, site fidelity and habitat use. Life cycle stages and population dynamics that are difficult to monitor using traditional methods can be significantly better understood by following juvenile, sub-adult and adult birds via satellite telemetry. Overall, increased knowledge of the interactions of waterbirds with their environment, together with better knowledge of their movements and their entire life cycles is essential for informing management aimed at increasing numbers or maintaining diversity.
Talk 4	**Role of winter environmental watering in supporting declining freshwater turtles populations**
Authors and affiliations	James Van Dyke, La Trobe University Luke McPhan, La Trobe University Tracy Hamilton, Yarkuwa Indigenous Knowledge Centre Liticia Ross, Yarkuwa Indigenous Knowledge Centre Joseph Briggs, Yarkuwa Indigenous Knowledge Centre Robyn Watts, Charles Sturt University
Brief Abstract	Freshwater turtles are an important component of Australian freshwater ecosystems. They are major scavengers and nutrient regulators, especially during fish kill events. They are also important as food and as Totems for Traditional Owners throughout Australia. Despite their importance, most Australian freshwater turtle species are in decline. Foxes are often considered one of their primary threats due to sustained high rates of nest predation. At the same time, winter drying of wetlands where turtles are hibernating may be an important source of mortality,

	as the trapped adult turtles die of exposure. We tested whether winter drying was a major source of mortality using both trapping and acoustic telemetry, in the Edward-Kolety River system. We found that Macquarie River Turtles, *Emydura macquarii*, typically exit wetlands prior to winter, and overwinter in the adjoining river. Furthermore, all three species of local turtles exited a drying wetland in summer long before winter drying became a potential threat. *Emydura macquarii* rapidly re-entered 'home' wetlands the following spring. These results indicate that turtles that utlise wetlands on the floodplains of permanent river systems may be protected from winter wetland drying by their movement behaviour. By spending the winter in the river channel, they avoid the risks of a wetland drying around them as winter cold temperatures begin. The results indicate that winter environmental watering in permanent rivers to maintain wetland water levels may be unnecessary to protect turtles. However, this research highlights the importance of environmental watering to maintain winter base flows in rivers that experience winter operational shutdown, because continuous availability of habitat in winter is required to maintain habitat and sustain turtle populations.
Talk 5	**Methods to improve in-channel habitat and complement environmental flows**
Authors and affiliations	Wim Bovill & Angus Webb – The University of Melbourne
Brief Abstract	The Lower Goulburn team are conducting an integrated research project to evaluate the importance of in-channel slackwaters (shallow, slow-flowing areas) for the ecology of the river. We predict that in-channel slackwaters provide habitat and refugia for flow-sensitive organisms (aquatic invertebrates, small fish), and are places where essential resources of carbon (plant detritus) can accumulate and support food webs. A history of modified flows has simplified the Goulburn River channel and reduced the amount of in-channel slackwater habitat available. Further, many slackwaters lack physical structures, such as woody snags and vegetation to trap and detritus during elevated flows. Slackwaters may, therefore be regularly washed out by high flows that flush plant detritus and weak-swimming organisms downstream. We have established a field experiment test the hypothesis that slackwater areas with added woody structure will support higher densities of plant detritus and dependent organisms than control areas. The experiment was installed in June 2021, at four Flow-MER monitoring sites in the Lower Goulburn River. Woody structure was increased by driving dense stands of hardwood garden stakes into the riverbed in Treatment areas, with Control areas (no stakes) for comparison.

	To date, stakes installed at the baseflow waterline (1000 ML / day) survived high flows in winter and spring (up to 14,400 ML / day). Early results suggest that Treatment areas retained more plant detritus through winter and spring than Control areas which, on average, lost detritus. Follow-up surveys are planned throughout summer 2022 to compare densities of invertebrates and fish between Treatment vs Control areas. **Applications to Management:** Our experiment offers a simple test of whether interventions to augment channel structure can complement flow management by bolstering aquatic habitat and communities against washout effects during elevated flows.
Talk 6	**Basin-scale modelling framework development and demonstration**
Authors and affiliations	Rebecca Lester, Galen Holt, Ashley Macqueen Deakin University
Brief Abstract	The Murray-Darling Basin is a vast and spatially heterogeneous area and the environmental water portfolio used within the Basin is designed to influence multiple desired outcomes. Deep knowledge has been gained from MER, EWKR, LTIM, and other projects across the Basin, but integrating this knowledge across scales and themes has remained a challenge. The primary objective of CC2 is the development of an integrative framework that provides a consistent approach across themes and operates at the basin scale, along with the systems thinking that goes into integration across Themes and the basin. Here we summarise the conceptual underpinnings of the framework, illustrating the ways in which it achieves those goals. We demonstrate the functioning framework for the example of wetland metabolism, illustrating outcomes at multiple scales across the basin. We highlight possible use cases and discuss key next steps. This research lays the foundation for tools to systematically evaluate the value and outcomes of Commonwealth environmental water, explore scenarios for environmental water delivery, and help understand the reasons for those outcomes.
Talk 7	**Basin food web model development**
Authors and affiliations	James Hitchcock (UC), Darren Gilling (UC), Paul McInerney (CSIRO), Jason Thiem (NSW DPI Fisheries), Wade Hadwen (Griffith), Gavin Rees (CSIRO), Sarah Mika (UNE), Lindsay Frost (UNE), Ross Thompson (UC), and others
Brief Abstract	In the Basin Scale Food Web research project we have conducted an experimental work program to help fill fundamental knowledge gaps on the relationships between environmental flows and food webs and have developed food web modelling framework to help reveal the contributions environmental water is making to basin food webs. In this talk a case study of the food web model for the Lachlan River will be

	presented demonstrating how outputs can be used to assess the contribution environmental water contributes from to individual groups or whole ecosystem. We will outline the strengths, limitations and future opportunities of the approach and highlight how selected area, experimental work and other knowledge can be utilised.
Talk 8	**Regional and inter-regional fish movement responses to varying river discharge**
Authors and affiliations	Jason Thiem, Brenton Zampatti, Ben Fanson, Ivor Stuart, Gavin Butler, Doug Harding, Ryan Woods, Zeb Tonkin, Wayne Koster, Jarod Lyon, Chris Bice, Luke Carpenter-Bundhoo, Lee Baumgartner
Brief Abstract	The movement of riverine fish throughout the landscape is essential for population persistence and is fundamentally linked to the hydrology and hydraulics of the habitat they occupy. Given the global declines of freshwater fish populations associated with river regulation, there is a need to improve our understanding of fish movement responses to changing river discharge to guide restoration activities such as provision of water for the environment. This information is typically generated from a single study undertaken at a local scale for a subset of hydrological and temporal conditions, limiting scaling up both spatially and for a broad suite of abiotic conditions. To redress this, we collated fish movement data comprising a time series spanning several decades and derived from existing i) acoustic telemetry, and ii) otolith datasets, to analyse local, regional and inter-catchment fish movements in relation to variable river discharge in the Murray-Darling Basin. Data were compiled for two native freshwater fish species, with a combined sample size of 2706 individual tagged golden perch (*Macquaria ambigua*) and Murray cod (*Maccullochella peelii*) and 784 individual otoliths. Telemetry data indicated that that event-based river discharge metrics had a significant positive effect on both the probability of movement and the spatial extent of movement of both species, although the effect size was substantially smaller for Murray cod. Location-specific differences occurred, including the presence of barriers limiting connectivity at low to moderate discharge rates in some rivers, although this result was more pronounced for distance metrics rather than the probability of movement *per se*. Otolith data revealed substantial age- and location-specific movements, with greater inter-regional movement primarily occurring in years comprising by high discharge events including overbank floods. Our results demonstrate the value of integrating multiple datasets to enable scaling up. In the context providing water for the environment we identify key aspects of the hydrograph that maximise the movement responses of two species of lowland river fish.
Talk 9	**From productivity to Murray cod recruitment in the Lower Murray**
Authors and affiliations	**Chris Bice[1],** George Giatas[1], Qifeng Ye[1], Sarah Catalano[1], Deb Furst[2], Rod Oliver[2], Russel Shiel[2], Brenton Zampatti[3], Matt Gibbs[3] and Andy Revill[3] [1]SARDI

	[2]University of Adelaide [3]CSIRO
Brief Abstract	To guide water management and restoration in the Lower Murray, we are investigating the influence of flow on the sources and pathways of energy transfer through the aquatic food web. Specifically, we are investigating the diet of larval and juvenile Murray cod and the nature of contributions to growth from instream and littoral carbon sources. Both traditional (abundance counts, microscopy) and novel techniques (DNA metabarcoding, amino acid specific stable isotope analysis) are being applied. Molecular analyses of Murray cod gut content yielded complementary results to microscopy, and in some cases identified prey items not apparent via microscopy. The diet of larval Murray cod was dominated by microcrustaceans and rotifers, with interannual variability in prey composition likely in response to prey availability. A distinct shift in diet was present between ~15 and ~60d of age, with increasing dominance by shrimps. Fish ~90d to 1+ yrs of age exhibited little variability regarding prey species, while individuals ~120 d of age exhibited little annual variability from 2014–2020. Carbon isotopic values from juvenile Murray cod were generally consistent with that of their primary prey (shrimp). Instream (e.g. phytoplankton) and 'littoral' (e.g. Phragmites) sources both contributed to growth, with littoral sources most prevalent in juveniles ~60d of age, and the contribution of instream carbon increasing with age. Results to-date have identified key prey species and trophic pathways supporting larval and juvenile Murray cod. Within-channel flow pulses in the Lower Murray have been associated with improved recruitment of Murray cod and while typically associated with improvements to lotic habitat, may be complemented by littoral carbon subsidies. As such, flow variability may enhance both hydraulic and carbon-source diversity.
Talk 10	**MER fish populations models**
Authors and affiliations	Charles Todd, Henry Wootton, John Koehn, Ivor Stuart, Jason Thiem, Qifeng Ye, and others
Brief Abstract	Population models for Murray cod, golden perch and bony herring, are in a mature stage of development. For Murray cod, we have developed models for the Flow-MER Selected Areas and for golden perch we have developed a southern basin meta-population model and are combining this with a northern basin model. The bony herring model is a first-generation basin-scale build which can be further refined. For all three species, we have included a construct to represent blackwater influence and primary/secondary productivity. We present results from the golden perch model and Murray cod model as examples of the work and its

	management application. The talk will foreshadow how population models will further enable water managers to improve decision making at monitored (Selected Area) and unmonitored sites.
Talk 11	**Edward/Kolety River physical habitat research**
Authors and affiliations	Thom Gower and Neil Sutton, Streamology
Brief Abstract	We investigated the impacts of different flow events on the physical habitat of the riverbank in two reaches of the Edward/Kolety River and one reach in Colligen Creek. Drone photogrammetry was used to generate high-resolution 3D models of riverbanks, with measurements before and after flow events used to quantify changes in bank condition (erosion and deposition). In the Edward/Kolety downstream of Stevens Weir there is a deep notch in parts of the riverbank that corresponds with the prolonged invariable operational flow of around 2500 ML/day. The duration of inundation above the notch and drawdown speed of flow events were found to have a critical influence on the amount erosion from mass-failure events. Prolonged operational flows prepared the bank for erosion by creating a deep notch and leaving the upper bank to dry. Subsequent higher environmental or unregulated flows inundated the bank above the notch, leaving a large mass of unsupported, saturated soil prone to mass failure following the flow recession. The study showed the important role that flow event sequence plays when it comes to bank erosion, and demonstrated that the influence of environmental water actions or unregulated flows on bank condition cannot be studied in isolation. If the management of operational flows does not change, then the potential benefits to bank condition presented by environmental watering actions-will not materialise.
Talk 12	**Using audio visualisations and other media to create engaging digital portrayals of wetland ecosystems**
Authors and affiliations	Professor Mitchell Whitelaw Australian National University Associate Professor Skye Wassens Charles Sturt University
Brief Abstract	Digital engagement with the environment, through citizen science platforms, apps and websites, can be effective in cultivating attachments to nature. We developed a scroll-based interactive platform which presents seven days in the life of a wetland as it receives environmental water. The platform combines audio data visualised through spectrograms, imagery and narrative text to lead the audience step by

	step into the wetland while still encouraging exploration. A mixed methods evaluation, including web traffic analysis, social media engagement and audience analysis are being undertaken to evaluate the impact and value of this approach in comparison to conventional text and image communication.
Talk 13	**The role of environmental water and reed bed condition on the response of *Phragmites australis* reed beds to flooding**
Authors and affiliations	Dr Will HiggissonWill Higgisson, Alica Tschierscke, Adrian Cobb and Fiona Dyer Centre for Applied Water Science, University of Canberra (Lachlan SA)
Brief Abstract	This study investigated the role of environmental watering in the response of *Phragmites australis* reed beds to a large-scale flood. Data was collected from sites in the reed bed of the Great Cumbung Swamp in the lower Lachlan river system with drones and processed using machine learning. Prior to the flood event, sites which were managed with environmental water had a significantly greater cover of *Phragmites australis* compared with sites which were not managed which had a very low cover (<1%) of reeds which were in a critical condition. Following the flood event, sites managed with environmental water increased in cover and transitioned from a medium condition to good condition, whilst sites not managed had a variable response and transitioned from critical to a poor or medium condition following flooding. Environmental water plays an important role in filling the gaps between large flood events and maintaining the condition, and resilience, of reed beds.
Talk 14	**Monitoring range expansions following delivery of e-water using eDNA**
Authors and affiliations	Meaghan Duncan[a,b], Jackson Wilkes Walburn[a], Elka Blackman[a], Jason Thiem[a,b], and Robyn Watts[b]. [a]NSW DPI, Narrandera Fisheries Centre, PO Box 182, Narrandera NSW 2700, [b] Institute for Land, Water and Society, Charles Sturt University, PO Box789, Albury, NSW 2640.
Brief Abstract	Monitoring aquatic species using traditional methods can ineffectively sample rare or cryptic species. It is critical that the distribution of these species be accurately understood given that their continued survival will depend on appropriate water management. Sampling environmental DNA (eDNA) provides an indirect approach to detecting the presence of a species and can be used to describe the spatial distribution of threatened, uncommon and difficult to sample species. This could be used to inform on population expansions resulting from multiple targeted environmental watering events. Here we describe the development of eDNA assays to detect six threatened or iconic species

	that are known to occur in the to be within Edward/Kolety-Wakool system. We provide proof of concept for the use of species-specific eDNA assays to describe the distribution of threatened species in this river system and discuss how these assays could be applied to assess outcomes of interventions on rare species.
Talk 15	**Stakeholder perspectives on using water for the environment in the Edward/Kolety-Wakool river system**
Authors and affiliations	Catherine Allan and Robyn Watts Charles Sturt University
Brief Abstract	Adaptive management of environmental flows requires understanding of the biophysical AND social situation. Multi-disciplinary research in the Edward/Kolety-Wakool river system in the southern Murray-Darling Basin is illustrating how understanding the perspectives of a wide range of people can inform water management. A qualitative research project with river operators and managers revealed considerable evidence of adaptive management of environmental water in this river system. Further qualitative research in the area with additional stakeholders found four main 'framings' of environmental water, all with technical expert focus. We suggest this could potentially marginalise other ways of experiencing and knowing the river system, and recommend that people involved with the river system (especially those with authority or influence) seek to involve a wider range of frames to maintain adaptive capacity. Our most recent research involved surveying stakeholders via an on-line survey, to better understand their perception and acceptance of the use of Commonwealth environmental water. The depth of local knowledge about, and love for, the river system was confirmed by the results, and all respondents agreed that healthy rivers are essential for healthy societies. As all of this research is iterative, and undertaken in parallel with the biophysical monitoring, it has been informing adaptive planning and management through shared learning and understanding.
Talk 16	**Scaling diversity from ecosystems to the Basin**
Authors and affiliations	Shane Brooks
Brief Abstract	This study tests a new way to use satellite imagery to estimate changes in biodiversity associated with environmental watering and climate change. To achieve this we invoke the Spectral Variation Hypothesis (SVH) which states that spatial variability in spectral reflectance from satellite imagery is related to ecologically relevant habitat diversity and ultimately the biodiversity within. This is an assumption that is worthy

	of further testing, but as an initial step we have been able to calculate diversity across the Basin and compare recent wet years to the Millennium drought to show the measurements of diversity from satellite do appear to be responsive to water stress. Its possible to identify potential hot-spots of diversity in the Basin for which environmental water might be prioritised and provides a new approach for evaluating ecosystem diversity outcomes from water actions.