2015 WETLANDS RESTORATION RESEARCH FORUM, WINTON WETLANDS

Outcomes Report

WINTON WETLANDS

Summary Report
Wetlands Restoration Research Forum, Winton Wetlands
(Held 20th and 21st August 2015)

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1. Introduction

The research forum was established to provide support for research on the Winton Wetlands by highlighting recent developments in wetland restoration science and, over time, assisting scientists and managers gain data for a deeper understanding of the Wetland's ecosystem functioning and its management.

The aims of holding the forum were to:

1. Discuss past and current research (at Winton Wetlands and elsewhere) on wetland restoration science, discuss research outcomes and assess the implications of this research for Winton Wetlands;
2. Provide a mechanism for researchers and managers to be kept informed and share views on wetland restoration science;
3. Workshop future research and monitoring opportunities and requirements at Winton Wetlands; and
4. Establish the "Winton Wetlands Research Hub", which is envisaged as a collective of researchers and managers, facilitated by the WWCoM, which is interested in research on the restoration and management of Winton Wetlands (and elsewhere) The research hub will be formed to provide regular forums for researchers to meet and to share research information (wetlands in general and Winton Wetlands specifically), equipment, facilities, and resources, and to collaborate on research at Winton Wetlands (and elsewhere). Further, it will aim to bring the site and regions' managers together to identify shared research needs and interests.

1.1. Summary of Event

The event was well attended and regarded (from feedback forms). We had over 50 people there, representing universities, research agencies, managers, communities and various practitioners in wetland restoration from Victoria, NSW and Tasmania. Many thanks go to all the speakers, workshop facilitators, helpers, staff, ESAP members and Committee of Management members, as well as the participants in the workshops, which ensured great outcomes from the two days. The outcomes included:

- an excellent base for a research plan for our wetlands restoration program (which may also be applicable elsewhere);
- an agreement to establish a Wetlands Restoration Research Hub or Network (the exact details will become clear over time);
- the confidence to announce that we plan to run the 2nd Wetlands Restoration Research Forum at about the same time in 2016 (Tuesday 16th and Wednesday 17th of August, 2016).

This is a report which includes outcomes of the Forum as well as the speakers' talks and a summary of the workshop deliberations. This report will form the basis of our research plan which will be reviewed by ESAP and the Committee of Management, before being released, for your interest. We have already had research projects begin and Winton Wetlands are happy to hear of other specific ideas while we are preparing our planning documents.

1.2. Program

The program was established to meet the project aims and consisted of the following topics and speakers (see appendix 1 for copies of the presentations available):

Topic	Speaker
Welcome & information on the Winton Wetlands Committee of Management	Dennis O'Brien, Chair WWCoM
Introduction and history	Jim Grant, CEO, WWCoM
ESAP Background and Role Objectives and Structure of Forum	Max Finlayson, ESAP Chair
Managing and restoring wetlands of international importance	Professor Max Finlayson
Previous Works and Investigations Rehabilitation Plans Resources, facilities and data available for research	Lance Lloyd & Dr Lisa Farnsworth
Field Inspection: Key sites and works, research and investigation programs and their results (Bus)	Winton Wetlands staff
Close for the day – Summary of the Day; Program for day two	Jim Grant
Guest Speakers – Local Identities providing their memories of the ecology of the original wetlands and changes through time	Doug Bain Ray Nelson
Rehabilitation of Lagoon of Islands following dam removal: Challenges and Opportunities	Dr Carolyn Maxwell, Tasmania Hydro
Opportunities and approaches for restoring wetland hydrology - case studies from western Victoria	Lachlan Farrington, Nature Glenelg Trust
Disturbance and restoration ecology as applied to catchments and their waterways	Professor Sam Lake
Workshops ○ Future Scenarios – Ecosystem Restoration Goals ○ Threat Management research ○ Ecological Processes – kick starting restoration research needs ○ Wetland water regime research needs ○ Catchment and Land Processes research needs ○ Facilities and support for research at Winton Wetlands / Future Forums and Information Exchange	
Summing up – Ideas from speakers and workshops	Max Finlayson

1.3. Participants

We had over 50 people attend representing most of the major Victorian universities, research agencies, wetland and environment managers, community groups and various practitioners in wetland restoration from Victoria, NSW and Tasmania (see appendix 2).

2. Workshop Outcomes

Four workshop sessions were held covering four areas and multiple questions posed to workshop participants. The six broad areas to be covered included:

1. Future Scenarios – Ecosystem Restoration Goals
2. Threat Management research
3. Ecological Processes – kick starting restoration
4. Wetland water regime research needs
5. Catchment and Land Processes research needs
6. Facilities and support for research at Winton Wetlands / Future Forums and Information Exchange

2.1. Future Scenarios – Ecosystem Restoration Goals

2.1.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What are the future scenarios for Winton Wetlands to focus research and management upon? What should our Ecosystem Restoration Goals be?
- The Wetlands have been altered by flooding and draining and now changes to the catchment, inflows and sedimentation have changed the wetlands futures. What do we want the Wetlands to be in the future?

2.1.2. Workshop Notes

A scenario for whole system needs to be developed including riparian zones and indictors and break it down to the various units and identify which would be the most difficult to address.

Vision

The group decided that research should be established to establish a vision of the site which would enable the site to become a long term "quantitative' monitoring site for– terrestrial, aquatic and hydrological research with international and local recognition, connecting with, and valued by, a broader community, which would be used for or by the following:

- Scientists- local and international
- Academic and agency staff
- Locals
- Visitors, recreation
- Wetland, biodiversity (e.g. birding groups),
- Volunteer/research activities
- Education

Goals

The site should encompass economic/ecological/social system (see UK model) to become a real community asset as a:

- Centre of learning
- Self-sustaining wetland requiring minimal intervention
- Site to manage iconic species
  - Cane grass
  - Red gums
- Site for longitudinal studies/data on:
  - Climate Responses
  - Weather events – drought, floods, fire, etc
- Framework for setting goals - adaptive management and evidence based – learn by doing

We should define time-bound goals

- 5 year goals
  - Wetlands – different character- different goals (ecological and social)
  - Dryland
- Long term – 50 and 100 year goals

We should investigate

- Hydrology; water quality; manage disturbance (resilience to shocks – drought, Politics)
- Erosion in creeks and shorelines and sedimentation in wetlands
- Species (flora and fauna)
  - diverse structure and genera but evolving
  - exotics
- Functional and physical connectivity – monitor this hydrology-> creates refuges
- Catchment connectivity
- Old natural vs new (novel) natural
- Flexible to set what we want it to be
- Build information into shifting stable states is it dynamically stable or an ecological trap?
- Identify what can be controlled and what might change by doing nothing
- Look for areas where we can get a result
  - Don't focus on areas that are already in a stable state
- Develop information on each unit (communities)
- Develop and support a suite of wetlands in a dynamic environment
- Understand ecological system prior to inundation and before
- Try to experiment in different parts
- Keep option of grazing as a management tool (well managed)
- Understanding the interaction between productive land and restoration
- Minimise notable weeds and pests that impact on restoration priorities
- Pest eradication or unforeseen new ones
- What are the key things that drive outcomes? - Riparian restoration?; Why are certain things not coming back - Which units (communities) are tough nuts?

Largest challenges

The largest challenges for restoration, and its assessment, will be the following:

- Box woodlands
- Northern Woodlands
- How to foster what is natural? (the end result will be a novel ecosystem)
- Resilience in the long term
- Acknowledging historical characteristics
  - a 'positive' realistic perspective
  - New ones are developing -> tourism
- Understanding and management of catchment influences including hydrology
- Social/ involvement of community – recognising it will change over time
- Climate change will influence what we do.
- Understanding hydrology
- Acknowledging existing terrestrial values
- Define what we don't want
- How to strengthen resilience

2.2. Threat Management research

2.2.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What are the threats to the wetlands?
- What sort of research is needed to support management of threats?

2.2.2. Workshop Notes

Threats were identified for the reserve itself (wetlands and drylands) as well as surrounding areas:

Ecological

- Weed invasion, Predation by introduced species, Pest, plants, animals inside and outside
- Hydrological change
- Nutrient loads
- Environment changing (unexpectedly), disturbance regime e.g. 10 year drought - intensity, duration
- Climate change – species persistence (native or weed) - mentioned twice
- Loss of certain Ecological Vegetation Classes (EVC's)?

Management and social

- Changing land use/ intensification
- Land use v around, Offsite disturbance, surrounding land uses (carp in dams), nitrification
- Development associated with the Hume Corridor
- Urbanisation and storm water – water quality, run off from roads
- Over usage (loved to death)
- Uncertainty of outcomes of management actions/processes

- Inappropriate fire regime
- Fire – Wildfires, arson and ecological burns
- Grazing – native and domestic
- Previous activities have left a legacy (inundation) and land practices (farming and indigenous)
- Continuity of management, consistency, loss of interest
- Changing demographics of local communities
- Huge expectations and managing them
- Political system changes – affecting continuity and amount of resources
- Social acceptance/perceptions/values - reduce expectations, unrealistic (within a conceptual model for the reserve)– ecological, social politics
- Social behaviour (recreational, compliance)
- New technology – DEM, drones, etc
- Knowledge gaps – groundwater, soil chemistry, carbon cycle

Research needs to support management

- Baseline – changes in edaphic (soils) conditions – structure, biota, nutrients
- What has 30 years inundation done?
- How to re-establish key species? Pre-conditions and where?
- What are the predators and prey (density, interactions)?
- What are the impacts of grazing?
- What is the hydrological regime? – Baseline – year on year hydrological variability.

2.3. Ecological Processes – kick starting restoration

2.3.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What are the key ecological processes for restoration?
- What are the research needs for restoration of ecological processes?

2.3.2. Workshop Notes

Ecological processes or ecosystem functions are the dynamic attributes of ecosystems, including interactions among organisms and interactions between organisms and their environment. Ecosystem functions and processes, along with the reproduction and growth of organisms, are what cause an ecosystem to be self-renewing or autogenic. A common goal for the restoration of any natural ecosystem is to recover autogenic processes to the point where assistance from restoration scientists is no longer needed. Restoration practitioners commonly assume that autogenic processes will commence once the appropriate species composition and structure have been re-established. This is not always a valid assumption, but it is a reasonable starting point for ecosystem restoration (SER Working Group 2002).

Abiotic to Biotic Processes.

- Hydrodynamics
  - Understand the water input coupled with the rainfall, evaporations, inflow
  - Enclosed system - the dynamic states (water level), what are implications of limited outflows?
  - Predictive water balance (need to understand this first) modelling (fundamental) – under different scenarios
- Sedimentation
  - Sedimentation (from catchment, soil to wetland, and within wetland--habitat).
  - Nutrients (from catchment, sediments, water to biotic uptake, cycling and return (N, P, Ca, Mg, Si, K etc) water quality as well as flux rates -> ecosystem services
  - Blue green algae and event-based inputs
  - Plant growth/phytoplankton/zooplankton
  - Process – dry/ rewetting cycles and their role in restoration
  - Carbon assimilation (biotic uptake, storage, and decomposition)
  - Soil structure/chemistry/degradation processes
- Structural and Vegetation Habitat
  - Successional changes – RRG – new level
  - Habitat structure – woody debris, plant surfaces, soils - providing for different life cycles/Colonization – biota, succession complexity, fire

Biotic to Biotic Processes

- Energy
  - Primary Production. Autotrophy (photosynthesis, biomass change, NEP=GPP-ER, nutrient uptake). P/R ratios.
  - Secondary production. Input autotrophic and heterotrophic. Biomass. Calorific values. Primary, secondary, tertiary consumers, trophic structure, food webs.
  - Decomposition. Heterotrophy. Breakdown and Release of C compounds and nutrients.
  - Biogeochemical Pathways
    - Abiotic → autotrophs → heterotrophs → decomposers → Abiotic
- Population Attributes:
  - Species Growth (and decline) (biomass, numbers), reproduction, recruitment, dispersal, age structure.
- Biotic Interactions
  - Competition, Herbivory, Predation, parasitism, pathogeny, commensalism, amensalism.
- Community Attributes
  - Species composition (with time and space), species richness, functional feeding group composition, natives vs invaders.

Conceptual Models

- Eco state models (conceptual models)
- Conceptual models of different EVC's etc

Cultural overlay

- Historical fire regimes, understanding historical land use
- Soil – history, fertiliser, grazing, biology

Other research needs:

- Macroinvertebrates – aquatic and terrestrial – seasonal and long term
- Waterbird movements
- Dingoes at WW, do they have a role?
- Fox control impacts on cat populations/native fauna

2.4. Wetland water regime research needs

2.4.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What information do we need to know about wetland water regimes?
- What sort of research is needed to support management?

2.4.2. Workshop Notes

Information is required on the following areas:

- Baseline data
  - Local weather recording/scale of local climate/interactions
  - Nutrient balances (in response to season and water regime)
  - Vegetation communities
  - Connectivity between systems – geomorphology
  - Groundwater interactions sub surface (hydrogeology – depth, direction etc)
- Information provided by automated systems
  - Remote sensing
  - Inputs
  - Control
  - Data loggers
- The information is required for inputs to:
  - Understand water regime (relate water level to rainfall – SWET Model)
    - Model past scenario's
    - Modelling future scenarios
    - Capacity to manipulate

- Outcomes will assist restoration program to:
  - Communicate with community
  - Track recovery trajectory
  - Indicate interventions
  - Assist with planning, timings and areas to be restored
  - Estimating and predicting nutrient loads and their effects

Research needs to support management

- DEM / Lidar data for the site
- Aerial photography
- Vegetation mapping (update IWC and EVC maps)
- Identification of different hydrological processes within each system
- Importance of scale to hydrological process
- Water inputs (spring, surface, sub surface, rivers and creeks). Using isotopes
- Water loss (groundwater and evaporation)
- Transition of chemical content between surface and ground water
- Potential for enhancing extra connectivity eg borrow pits
- Correlation between vegetation and hydrology
- Local climate modelling
- Remote sensing

2.5. Catchment and Land Processes research needs

2.5.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What are the catchment and land processes important to restoration and management of the Wetlands?
- What sort of research is needed to support management of these processes?

2.5.2. Workshop Notes

Information is required on the following processes and functions:

Restoration and change management

- Hydrology – surface and ground water
- Connectivity - habitat linkages, Warby block, Mt Meg, Reef Hills <-> Broken River/Creek
- Eutrophication/include salinity
- Biology – aquatic species, habitat for colonial roosting birds
- Land use – disturbances, fire regime
- Weed invasion – new and emerging risks, aquatic needs eg arrow head, cabomba
- Predator/prey – bigger landscape
  - Density of predators/prey
  - Pest animals i.e. noisy miners
- Social engagement – community involvement, participation, attitudinal surveys

- Common wildlife – brower/grazers, palatability of grasses, numbers and movement, carrying capacity
- Re-colonise of pioneer species. Social impacts, perceptions.
- Climate change – data on temperature, rainfall, time change, social impacts and perceptions

What data is needed for restoration efforts?

- Catchment yield<-> budget, history
  - Data suitable for analysis extent eg D.E.M., Lidar
  - Groundwater wells- depth and salinity
- Spatial/site level extent and condition of habitat
- Sediment nutrient measurement
  - Catchment waterways +Inflow points + Existing wetland levels -> nutrient budget
  - Soil chemistry – ask biochemist

Develop models of catchment and surrounding landuse

- Baseline data
- GIS, Veg map, flora & fauna survey
- GIS mapping of landscape and how various landscape uses impact the wetland
- Conceptual model of the landscape
- Land use
- Habitat redevelopment time lines
- Hydrological modelling (test model) - management plans,
- Model link between land use and nutrient sediment

Test and validate catchment model

- Habitat connectivity outside of site
- Understanding catchment yield -> water balance
- Validate land use and nutrient sediment
- Dispersal of organisms through corridors
- Literature search on habitat. Develop timeline.

Catchment land process issues to investigate to support wetland restoration efforts:

- Measure changes to local fauna as response to rehabilitation works
- Monitor stream inputs
- Restore creeks and riparian zones
- Revegetation – how to stimulate and monitor?
- Vegetation monitoring and modelling. Growth? Mortality/success?

2.6. Facilities and support for research at Winton Wetlands / Future Forums and Information Exchange

2.6.1. Questions

Two questions were posed to workshop participants to assist their deliberations. These were:

- What are the types of facilities, data and support are needed to support researcher needs?
- What sort of research forums (and elements) are useful for researchers in Wetland restoration science?

2.6.2. Workshop Notes

Forms of reference for engaging into research

- Research standards for various disciplines
- Forum outcomes and insights
- Identify key research areas
- Research prospectus
  - Who we are
  - What resources we can provide
  - What information we have
  - What we are doing
- Environmental strategy advisory panel – KPI's, research projects

Resource availability for research

- Management plans – set out for various timeframes - 6 months, 3 years, etc (to provide foreknowledge of rehabilitation works that will happen)
- Carbon vegetation data ((Deakin University project?)
- Platform to access data. Data repository (existing data) and include original documents. Access to data that sits elsewhere/other organisations. Web based data entry system.
- Recording action in a way it's useful and lasting. Describe management of dataset, for example species distribution/habitat models. Data quality requirements.

Facilities and support

- Lidar
- Oral history (formal) including indigenous and Site "induction" information - provides context. Maps/ on ground knowledge (on site induction – info on current/past research)
- Consolidated existing research - environmental, social/tourism, heritage, indigenous, european
- Mesocosm facilities (i.e. glass house, exclusion plots, etc)
- Foster relationships with existing research organisations and sharing resources => collaborations
- Utilising interactions with communities - visitors, locals (citizen science)
- Regular monitoring infrastructure/permanent photo points and transects
- Accommodation, water, power for field work, office space, high speed web, laboratory space, researchers' accommodation - weir keeper's houses?
- Nucleus / focal point of research interest
- Basic data accessible
- Drawcard/contact point – people

- ESAP to mentor staff/researchers
- Forum (mini conference) on issues and next steps
- Uni field station (establish)
- Student programs
- Long term site for monitoring
- Proposals to universities
- Funding mechanisms
- Proximity to pub/wineries/distillery
- Telemetry monitoring site
- Hard copy archive
- Using common GIS system (such as QGIS, http://www.qgis.org/en/site/?)
- Weather station
- Simplified & clear OH&S movement –total fire ban
- Research calendar (location mapping/records)/booking system
- Lockable storage of equipment
- Training for the broader community – water birds, plant ID, hydrology, how to fill a sandbag
- Science – measurements – community – provide summaries and disseminate information to different groups

Future forums

- Regular research forum (annual) to present research activities. International forum
- To have proceedings/summary paper of outcomes ->into literature
- Links to educational institutions – regular presentations, open to the community
- Regular student research forum (friendly and non-threatening)
- Cultural burning activities (regular and interpreted)
- Research framework showing research needs, opportunities and where research fits in to the total picture – enabling consistency, long term projects
- Data sharing with other institutions (bird life, museums, Parks Vic, DELWP, Universities, Environment Australia, Atlas of Living Australia)
- Online newsletter, updates of research projects. Online themes/subjects, scale, audience, newsletter updates. Progress/ updates of projects just started.
- Crowd funding

3. Conclusion

3.1. Summary from Professor Max Finlayson

- Why did we come here? Support for science on Winton Wetlands
- This the start of information to attract people – where to from here?
- There is an understand that to manage and restore the wetland trying to link to people in the region and not just at the wetlands itself. It is important for this site. It is a contested history before and after the dam.
- Other dams are going to be decommissioned in Australia so what have we done here and the knowledge and opportunities here need to be documented from a scientific point of view.
- Issues of setting goals and what does this mean and to whom and the process to get there and reinforcing the process.
- Establish preferred hydrology for the site. It needs to be evidence based.
- Institutional aspects of managing the project – beyond here – institutions, surrounds and use them.
- Restoration project examples:
  - planning, engagement of communities and knowing what is happening and the hydrology of the site
  - What is the target and purpose and can you re-establish it to the past? What is the reference condition and is this good enough for the future?
  - Involving the community is important.
- What we are doing here in terms of undoing what has happened in the past and some may not like what is going on but we need to engage with these people.
- Provide a scientific framework for what we are talking about at Winton Wetlands. Identify the needs and what was missing in past efforts.
- There is a different pressure on the environment including the human's pressure which doesn't suit the environmental change.
- Goal setting, time change, indicators
- There are opportunities here to make Winton Wetlands the centre of restoration science.

Workshops:

The future scenarios

- Look at the whole system
- Vision/goal/ triple bottom line – centre of learning
- Reference condition – what are we doing? To learn or to reset the system?
- Long term monitoring

Threat management

- Managing consequences of the threat
- Consequences of managing the threat
- Climate change issue – it is not a linear process

Ecological Processes

- Suite of processes related to the water
- Successional change will get there regardless of intervention both time wise and spatially and sometimes we won't like the change short term and long term
- Ground water and aquifer issues - how do we measure it?
- Conceptual modelling – narrative around what is going on bringing in the social as well as the biophysical side

Facilities and support

- Mesocosm and experimental facilities
- Processes to engage people

3.2. Final Outcomes

The workshop concluded that the following:

- The initial forum and research to date was an excellent base for a research plan for our wetlands restoration program (which may also be applicable elsewhere);
- The group wished to establish a Wetlands Restoration Research Hub or Network (the exact details will become clear over time) with attendees and invitees to the initial and subsequent forums;
- Regular forums should occur, with the 2nd Wetlands Restoration Research Forum at about the same time in 2016 (Thursday 18th and Friday 19th of August, 2016).