

# Using Traditional Knowledge to Inform Adaptive Water Management: Indigenous Rights to Water in the Kimberley Region of Western Australia.

Sonia Leonard, Kimberley Land Council (KLC)

*“Law and Culture, Land and Water are all in one”*

*(David Newry, Miriwoong Traditional Owner, 2009)*

## **Abstract**

Traditional law and culture form the agency in which Indigenous people claim ownership of water and are imbedded within traditional concepts of identity. It is within this theology that Indigenous people of the Kimberley argue connection to land and thus Indigenous rights to water. Indigenous traditional knowledge provides for a social connectivity to the environment that is currently lacking from contemporary governance and water management structures within Western Australia. This paper explores the importance of integrating Indigenous values to adaptive water management through a socio-ecological systems approach based on traditional knowledge of the Miriwoong people. This case study offers a unique opportunity to explore Indigenous identity and ownership of water in two river catchments (Ord and Keep Rivers) with vastly different land tenures and how traditional knowledge could inform adaptive water management thus providing a platform for Indigenous rights to water for both economic and cultural use.

## **Introduction**

In the Kimberley of North Western Australia, water is a significant defining feature of the landscape, from the deep aquifers of the Canning Basin to the surface flowing waters of the Fitzroy River, to the vast expanse of Lake Argyle and the Ord River. In a dry semi arid environment, water brings life. To the Indigenous custodians of this region the significance of water is intrinsic to traditional law and culture, forming the theological identity of dreamtime creation mythologies. Water for thousands of years has defined clan estates, provided rules to social structures and has nourished and protected ‘country’. Traditional values of water are complex and are at the centre of Indigenous identity.

In the Kimberley over recent years there has been a growing dependency on water for regional growth and economic advancement. The ever-increasing demands on water resources are evident from pressures of mining exploration, agricultural expansion and recreational activities. This is nowhere more evident than on the floodplains of the Ord River where in the last fifty years water availability has been the catalyst for development and economic expansion. The successful integration of Miriwoong people’s agency to water in the East Kimberley is going to require new ways of thinking about adaptive water management. There will be a distinct need for change to the current processes of water planning and management while recognising a need for new evolving engagement tools to discuss future water uses.

It has been widely discussed that there has been a failure by water planners and managers in Northern Australia to facilitate the development of tools that can assist in the quantification of cultural values and the integration of Traditional Knowledge (TK) to adaptive water management (Lingiari Foundation, 2002; McFarlane, 2004; Jackson, 2006; Finn and Jackson, 2011) . It is imperative that water policy makers and managers recognise the value of Indigenous land management practises and the application of TK in adaptive water management. Combining scientific and traditional monitoring methods can not only build partnership and community consensus, but also, and more importantly, allow indigenous land managers to critically evaluate scientific predictions on their own terms and test sustainability using their own forms of adaptive management (Moller et al 2004).

This paper examines how the proposed future expansion of the Ord Irrigation Area (commonly referred to as Ord Stage 3) and anticipated legislative reform in Western Australia (WA) and the Northern Territory (NT) provide a unique opportunity for an adaptive management framework to be developed that integrates the cultural interests of Miriwoong and Gajerrong Native Title holders in water across state boundaries. The research focuses on examples of Miriwoong TK as the dominant language group in the region. It investigates the development of the Miriwoong seasonal calendar as a tool for adaptive water management and looks at opportunities for using TK to guiding legislative reform. A bottom up approach between WA and NT governments to the development of Ord Stage 3 would allow policy makers to understand not just how to protect cultural values but facilitate a move towards Indigenous water rights.

### **Developing the last frontier**

The Ord River lies in the heart of the East Kimberley of Australia's north-west. With its headwaters originating 80km north of the township of Halls Creek on the central Kimberley tablelands it meanders 650km across the NT boarder near Mistake Creek before entering back into WA through Lake Argyle and draining into the Cambridge Gulf (figure 1). The Ord River is an ephemeral stream, dominated by a wet-dry tropical climate with an average 400mm of rain in the upper reaches increasing to up to 1000mm in the lower reaches of the vast floodplain. Rainfall occurs predominantly from December to March. The Ord River floodplains, tidal mudflats, man made lake systems of Argyle and Kununurra as well as the seasonal wetlands and permanent waterholes of Perrys Creek Lagoon are all listed as areas of significance under the Ramsar Convention (Pursche, 2004).

The Keep River catchment is a smaller more defined catchment bordering the Ord River catchment to the east of Kununurra. The head waters of the Keep River flow from the east of Mistake Creek flowing through the rocky outcrops of the Keep River National Park to Spirit Hills where extensive floodplain and tidal marsh system tare divided by the boarder between NT and WA. When in flood the waters of the Keep River floodplain expand across the Weaver Plains to join those of the Ivanhoe Plains of the Ord floodplain.

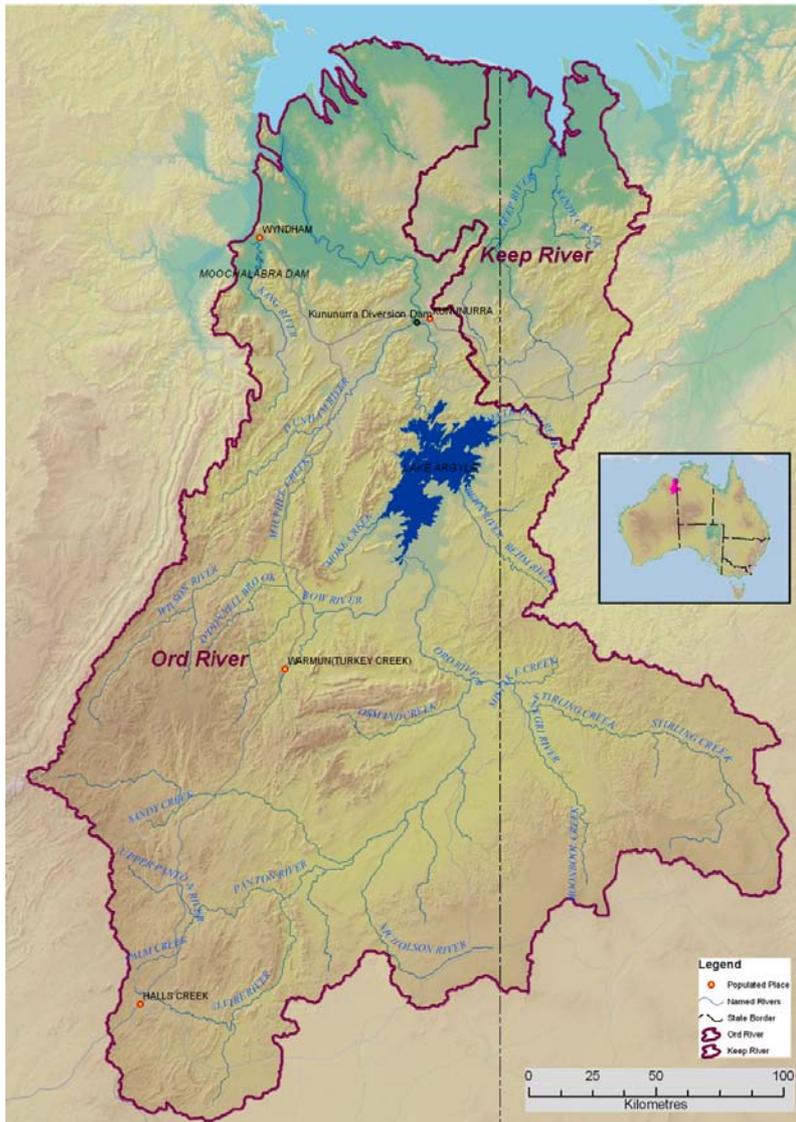


Figure 1: Map of the Ord and Keep River Catchments.

In 1914 the first experimental farm was established on the Ord River floodplain. Due to numerous reasons this farm was abandoned in 1945 and the Kimberley Research Station was established on Ivanhoe Plain. By 1958 the WA Government had committed to the construction of the Ord River Irrigation Area (ORIA) and construction of the diversion dam at Kununurra and the substantial storage reservoir, Lake Argyle officially opening in 1972. This has come to be known as Ord Stage 1. The Ord River Catchment has grown to provide for the township of Kununurra, hydro-electric power generation, water based tourism, boating and recreational activities. The Ord River is now at the centre of the regions economic identity and the traditional lands of the Miriwoong people.

The WA government has always been committed to a staged development of the ORIA which has been discussed extensively in published literature (Head, 1999; Pursche, 2004; KLC; 2004; DoW, 2006; KDC; 2007; Ayre, 2008) . In 2009 after many years of speculation the Commonwealth and WA governments jointly announced their commitment to the development of Ord Stage 2. Construction

began in 2010 with the expansion limited to 8000 hectares of land on WA side of the boarder, substantially less than initial proposals that spaned 16000 hectares extending into the Keep River Floodplains of the NT. It is believed that discussions are now underway between the WA and NT governments for future expansion of the ORIA (Ord Stage 3) to develop the lower Keep River floodplain with speculation that this will accrue before 2014 (unidentified informant, 2011).

In 2002 the WA Government and the Miriwoong and Gajirawoong (MG) people (or referred to as Miriwoong and Gajerrong in Native Title determinations) agreed that before entering into discussions about Ord Stage 2 that Western Australia fund an Aboriginal Social and Economic Impact Assessment (ASEIA Report) (KLC, 2004) on the impacts of Stage 1 to local Aboriginal people. The impacts of the building of the Ord Dam system and agricultural expansion on Miriwoong people has been well documented (Head, 1999; Barber and Rumley, 2003; Pursche, 2004; KLC, 2004) and will not be discussed in detail here. It was agreed that any Ord Stage 2 negotiations include reparations for the impacts identified in the ASEIA report. In 2004 agreement was reached with the MG people for Ord Stage 2 to progress leading to the signing of the Ord Final Agreement (OFA) in 2005.

The OFA provided for the establishment of the Yawoorroong Miriwoong Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation with an economic benefits package that also included the creation of freehold conservation lands to be leased back to the State as jointly managed conservation reserves and a water reserve (Reserve 31165) on the eastern shores of Lake Argyle. A detailed account of the benefits package and the implications of the OFA to the social and economic future of Miriwoong people are discussed in detail by Taylor(2008) and is not the focus of this discussion. The agreement did not recognise rights to water but it did attempt to develop adaptive management arrangements with Miriwoong people through the creation of cultural planning frame work's and joint management guidelines for conservation reserves (Hill et al, 2008; DoW, 2008 and Hill et al 2009). The success of these projects will depend on continued investment by both State and Commonwealth Governments and could provide a platform for the integration of adaptive water management frameworks based on TK that recognise Miriwoong peoples agency to water.

### **Miriwoong agency to water**

The traditional lands of the Miriwoong people extend from the northern cost of Carlton Hills Station to the Ord River south of the Carr Boyd Range and Lake Argyle and eastwards into the Keep River catchment in Australia's north west (Pursche, 2004). These lands transcend the state boarders of WA and NT and are subject to complex state government legislation and land tenures ranging from freehold, Native Title Lands', pastoral leases, jointly managed conservation areas and a National Park. Traditional laws and culture are the agency which assumes the right to access and control ancestral lands. For the Miriwoong people water is at the centre of this identity and the basis of their connection to country. Water is believed to be *Ngarranggarni*, the association of the dreamtime creation, it is the beginning of life, it's life itself, it is the 'living water' as Yu

(1999) describes for the Western Kimberley. When asked to describe the cultural significance of water in the Keep River National Park a Miriwoong traditional owner stated that;

*Water is the Ngarranggarni, that water is for this place, its land and water all together.*

In this statement the cultural value of water is not just the place its' self or the activities related to sustainable livelihoods but the cultural story that created that place and its ability to provide life. Miriwoong peoples as many other Indigenous people across Australia believe that *Garrimalang*, the rainbow snake lives within the waters and is part of the Ngarranggarni, they are imperceptibly linked highlighting the complexities of the cultural values that are attached to water places. Over the last 10 years a substantial amount of research has focussed on identification and quantification of Indigenous values to water in Australia (Langton, 2002; Jackson and Morrison, 2005; Jackson, 2006; Goodall, 2007; Altman and Branchut, 2008; Cooper and Jackson, 2008; Weir, 2009a; Weir, 2009b; Jackson, 2011) These conversations have focused on the concept of cultural flows and the tangible values associated with sustainable livelihoods and more recently the allocation of flow regimes to protect these values (Finn and Jackson, in press). The quantification of the spiritual and ceremonial values of water is problematic, how much water is needed within a system to keep those stories alive? To Miriwoong people the protection of these values are fundamental to cultural identity.

*All year round that spring, never dry, all year round that spring, main spring down there. This place called Jarwan (the Spring), this is Ngarranggarni. The spring is very important thing. What's there? That snake, very important for the song and the land.....(if) that snake goes he take the water with him. (Button Jones, Miriwoong Traditional Owner, 2010)*

Miriwoong interactions and relationships with water are holistically linked to not just the land but also law and culture through story and song. The spiritual significance of water is further demonstrated in the Miriwoong ritual of *mantha*, which involves water being placed on ones head as a means of introducing visitors to the ancestral beings providing protection.

*That water, the culture and the land are all together. That's the reason we will not let anyone take our spring water because it's mixed with that culture and the land. You know that's why we water the new mob- new bloke, so he cant get sick because Ngarranggarni see - Ngarranggarni dreamtime. (Ronnie Carlton, Miriwoong Traditional Owner, 2009)*

This further defines the linkages that water provides to the socio-ecological relationship Miriwoong people have to their country. These types of relationships and mythological significance of water to Indigenous people have been well documented in other areas of Australia (Yu, 1999; Toussaint et al, 2005; Strang, 2005) and provides further evidence of these complexities. Water is imbedded within the identity to country and self, it provides both social and

cultural rules that define the interactions between people and the environment in which they live. This is evident in Miriwoong society, as the location of most communities is link to important water places.

*We have visited three communities so fare and each one of them communities all have water holes next to them and there is a reason why we have our communities next to them water holes, as we believe they were made by our Ngarranggari, what you white -fella would call dreamtime. We have our own name for it. This dreamtime is very special to us, it ties in with our land and our law and culture. That's all together, all in one big package. That includes the top surface water and the bottom half of the water (ground water). Sometimes we can't speak about it (bottom water) as it reflects back to the men's side of law and culture. That why I'm trying to explain that water, land and law are all together, it comes from long time ago.....These knowledge's have been passed on to these old people and the knowledge's that they understand are what we are to use to look after these spring water as they mean a lot to us. They just not a water, its just not a creek, it has a story and that story, it comes from the Ngarranggari what you call dreamtime. (Chris Griffith, Miriwoong Traditional Owner, 2009).*

The *knowledge's* that Chris Griffith talks about are based on TK (TK) paradigms that have high levels of complexity that helps define relationships between cultural theologies, social structures and the environment. This TK of the environment is a cumulative knowledge passed down through the generations that defines how to manage the environment in which Miriwoong people live. Berkes et al (2000) describes this as Traditional Ecological Knowledge, a practice and belief based on cultural transmission about the relationship of living beings with one another and with their environment. These socio-ecological relationships are by their nature a process of adaptive management, as it's a response to changing ecological processes to ensure social resilience. These stories and practises are the foundation of the Miriwoong world view and formed the connection to country that gave agency to their Native Title determination. Chambers (1995) discusses the importance of expressing agency through Indigenous TK as fundamental to protecting natural resources for sustainable livelihoods. As part of Miriwoong self determination it is important that governments provide policy platforms that allow for the integration of TK management tools to form adaptive management frameworks that reflect self governance aspirations. Importantly there needs to be water reform that recognises customary rights in water and the social implications of tradition and custom in water resource management.

### **Water reform and legislative change in Northern Australian**

Over the last decade Australia has undergone a process of water reform and legislative change. This has been extensively driven by concern for over allocation of water resources in the Murray Darling Basin and the potential for expanded development in Northern Australia. The National Water Initiative (NWI) (2004), the blue print for this reform process aims for a cohesive and contemporary approach to water management in Australia. The NWI is the policy setting for Indigenous participation in water resource management and planning. The implications of the NWI for Indigenous rights to water have been

extensively discussed by McFarlane, 2004; Jackson, 2007; Durette, 2008 and Weir, 2009b. Uncertainty exists surrounding the interpretation of Section 52-54 of the NWI and it is largely considered to be subjective leading to an inconsistency in approaches by State and Territory governments to interpret through planning processes (Jackson, 2007; Jackson and Altman 2009; O'Donnell, 2011). This is nowhere more obvious than between WA and NT. In WA there is limited recognition of in-situ cultural values and in the NT there is a move towards allocations of Strategic Indigenous Reserves within the consumptive pool.

The WA Government signed up to the NWI in 2006 and its interpretation has been framed by the Native Title Act 1993 and the WA Aboriginal Heritage Act 1972. In WA cultural values to water are only recognised as in-situ to environmental flows (La Grange Water Allocation Plan, 2009). The water reform process in WA is progressing slowly due to the continued delay of the new Water Resource Bill that will replace the outdated Rights in Water and Irrigation (RIWI) Act 1914. As a result there is no legislative basis for statutory water planning in WA. This hampers attempts by Indigenous groups for participatory and adaptive water management that facilitates cultural interests in water. In 2008 the WA Department of Water commissioned a report (Falk, 2008) to identify its obligations to the Sections 52-54 of the NWI in regards to Indigenous rights to water. This report was generalist in its format and didn't adequately discuss issues of cultural values to water or strategies for Indigenous engagement policies.

The RIWIA has long been the focus of Indigenous Rights to water in WA since the landmark Native Title Case *Ward V's State of Western Australia* 1998. In this case rights to water were acknowledged for Miriwoong people but later overturned on appeal to the Federal court of Australia in 2000 and further upheld in 2002. O'Bryan (2007) reviews the interpretation of the RIWI Act (1914) with particular reference to Part 3 s4(1) vesting of control to watercourses, that was the pivotal discussion that determined the RIWI Act extinguished Miriwoong people's Native Title rights to water. In WA there exists an opportunity through legislative change to the current RIWIA to embrace principles of adaptive water management to work with Native Title holders. For Miriwoong people the pending development of Ord Stage 3 could provide the test case on how best to integrate Indigenous interests in water through progressive policy reform and negotiation across state jurisdictions.

The Draft Kimberley Water Plan (DoW, 2010) is the only guiding document for future water planning and management in the Kimberley. With only superficial reference to Indigenous aspirations to access water for commercial use it does not set down a firm basis to provide for cultural or economic interests in water management and planning in the future. It does however provide an interesting analogy for future negotiations in the review of the Ord River Water Management Plan (2007). In section 4.3 of the Draft Kimberley Water Plan (DKWP) under significant issues specific to the Ord catchment subregion it states;

*“Ensuring that all current agreements and plans are revised should there be any further expansion beyond Stage 2 of the Ord irrigation scheme.”*

This statement gives reference to strategic objective 3 and can be interpreted through Position Statement 5 of the objective to place a commitment to continued adaptive water resource management through Indigenous consultation. It provides the basis for Miriwoong people to insist that their customary rights to water are recognised. The Kimberley Land Council (2011) wrote in its submission to the DKWP, that adaptive water management in WA needed to expand beyond consultation and engagement to facilitate integration of TK into decision-making frameworks. Only once this had been achieved could policy and legislative reform adequately address issues of customary rights to water. The DKWP also states that Indigenous aspirations for commercial access to water are successfully dealt with through water licensing procedures and the Ord Final Agreement in the Ord catchment. This is very confusing and misleading as it is only referred to mean that Indigenous people could apply for a water licence to undertake economic activity like any other individual. This is not recognition of customary rights to water and does not allocate a Strategic Indigenous Reserve enabling Indigenous people to enter the water market.

The NT Department of Natural Resources, Environment, The Arts and Sport (NRETAS) has given specific recognition of the NWI through the staged move to develop water allocation and management plans across the Territory. Under the *NT Water Act 1992* water control districts are declared to manage water extraction and allows for water allocation to various declared beneficial uses including ‘cultural’ requirements. This has resulted in the NT Government interpreting the NWI through the NT Water Act to recognize Native Title holders as declared beneficial users and is considering provisions for the allocation of Indigenous Reserves within the consumptive pool. This has been interpreted in the Tindall Limestone Aquifer (Katherine) Water Allocation Plan to allow provisions for commercial allocations to Native Title holders. The plan states;

*“At the 5 year review, or sooner if practicable, aim to have sufficient water available from the consumptive pool to satisfy identified requirements on Indigenous owned land. (Part 8)*

*Reclaim water from licences that have not developed as proposed at the 5 & 10 year review of this Plan, and reallocate to purposes including Indigenous economic development. (Part 8)*

*Allow up to 680ML to be made available for Indigenous Commercial Development upon successful Native Title claim (Part 8).” (NRETAS, 2009)*

Further more, the NT Strategic Water Information and Monitoring Plan (NRETAS 2010) states that consideration needs to be given to strategic reserves to support Indigenous economic development opportunities referred to as Strategic Indigenous Reserves (SIR) in all future water allocation plans. The plan also recognises that additional to SIR these plans will aim to protect sites of Indigenous cultural importance through determination of cultural flow requirements that may extend beyond environmental flow allocations. This has the potential to benefit Miriwoong Native Title holders in the NT with a need to develop a water allocation plan for the Keep River Catchment in the event of Ord Stage 3. Water allocation and planning in the NT is in its infancy. At present there

is no specific reference to Indigenous reserves in the Act and current discussions about Indigenous allocations are subjected to interpretation. It is anticipated that the NT Government will amend the Water Act within coming years and it is hoped that this will include more solid grounding for Indigenous water allocations. The conceptual challenge remains to understand traditional water use and develop strategies that allows for the development of management tools that effectively integrate Indigenous Knowledge of the complex interactions of climatic seasons, weather and hydrological cycles.

### **Miriwoong Seasonal Calendar Management tool**

Indigenous seasonal calendars have been produced to document traditional understandings of seasonal indicators and environmental change in Northern Australia (O'Connor and Prober, 2010; Green et al, 2010; Woodward, 2010; Prober et al, 2011). Despite this, there has been little attempt to use these calendars to develop TK management tools that can inform western principles of adaptive water management. They provide detailed understandings of how TK defines the interaction between the cycles of annual weather patterns, water availability and the subsequent response of flora and fauna in the landscape, providing an Indigenous understanding of a whole of an environmental system. Tran (2010) discusses how the use of TK of seasonal changes reflects a cyclical relationship with water and is intrinsically linked to management of country. Miriwoong people have a detailed understanding of the relationship between seasonal weather patterns and the availability of water within an environmental system and have aspirations to use this knowledge to manage their country.

Researchers from the Mirima Language and Cultural Centre in conjunction with the Kimberley Land Council have been working with Miriwoong traditional owners to investigate the application of this knowledge into a seasonal calendar management tool. In discussions with Mirwoong people about the cultural values of water it was evident that the availability of water within the system was fundamental to the understanding of bio-temporal indicators and changing weather patterns. This knowledge has been worked into a interactive information systems web interface (for more information visit [www.mirima.org.au/calendar](http://www.mirima.org.au/calendar)) that allows traditional owners to collate TK about their environment into a form that allows for articulation of knowledge to form management decisions.

*When we see the rainfall we call it Nyinggiyi-mangeny (Wet Season). Nyinggiyeng is the big wet season rain, all that proper rain, you know, not the rain that comes and goes but that big rain, you know, when that rain has set in. More rain then any other season. At this time it will rain all night, all night and all the next day till you see the rivers flood everywhere. (Button Jones, Miriwoong Traditional Owner)*

Miriwoong TK differentiates types of rain and is imbedded within Miriwoong language. These types of rain are linked to sub-seasonal weather patters. *Nyinggiyi-mangeny* is the wet season and is classified by Miriwoong people into the sub-seasons of *Barrawoondang* and *Jaloorr-mageny*. *Barrawoondang* (the build up) is the time for the strong wind with thunder and lightning along with stop start rain and is associated with *Warrayalng*; a term for the first rains and

describes the first running of water that causes the rivers to turn brown and kills fish. *Jaloorr-mageny* is the time of heavy rain and monsoonal downpours. It is classified by two different types of rain; *Melijegeb* (rain all night) and *Nyinggiyeng* (continuous rain, 'all night and all next day') that indicates the coming of *Walanbinang*, when the river brakes its banks and overflows onto the floodplain and across low lying areas.

The TK of the Miriwoong seasonal calendar gives a detailed description of the hydrological cycle and the seasonality of surface water flows of ephemeral streams. The observation of fish dying with the first flush of floodwaters indicates an oxygen-deprived environment and is well documented in freshwater ecology for ephemeral streams (Gordon et al, 2004). Here Miriwoong TK provides a detailed understanding of positive and negative feedbacks within the system and helps Indigenous people respond to and monitor environmental fluctuations. Ford and Martinez (2000) discusses how overtime these understandings of explicit feedback mechanisms can guide future management decisions. The Miriwoong TK of bio-temporal indicators also provides further evidence of hydrological condition and stream ecology.

*After the Warnka-mageny (cold season) it will be barndenyirriny (hot) time, it get warm up. At that time we get fish, it tell us that a lot of fish will be in the shade, in under the shade, like that tree leaning over the water, you know where that shade is, a lot of them (fish) will be there cooling off, you know under the shade. (David Newry, Miriwoong Traditional Owner)*

Immediately the above statement provides an understanding of how seasonal change effects water temperature and the response of stream biota. It also indicates the condition of riparian vegetation and it's importance to maintain stream ecology. Further to this bio-temporal indicators can provide information on the behavior of fauna in response to water availability.

*The goanna comes out now, the goanna get fat after the first rain. During the Nyinggiyi-mageny (Wet Season) they bury themselves in the ground. After that rain finished, it's fat now at that season, it's the sign of the fatness of goann. (David Newry, Miriwoong Traditional Owner)*

*Another indicator for the barndenyirriny (hot season) is the pelican we call them dabaroong. They make a cork screw like flight, up in the sky. They start off from here, they go round like this like a cork screw round and round and then when it find water they come down were that water is.....they look around for water now because its dried up now. That barndenyirriny comes along and when everything dries up that pelican do that. . (David Newry, Miriwoong Traditional Owner)*

Bio-temporal indicators can demonstrate a relationship between the behaviour of animals and the availability of water in the system. The Miriwoong observation of pelican flight patterns provides valuable information about the location and scarcity of surface water on Miriwoong country. The fatness of a goanna can be linked to an increase in food sources as a response to the timing of the onset of monsoonal rains. The TK serves as a point of reference in space and

time providing benchmarks for management activity. Understanding the linkages of this knowledge and being able to monitor and evaluate changes in the system in response to changing variables is fundamental to principles of adaptive management. The Miriwoong seasonal calendar model with further expansion to an interactive mapping interface for monitoring and evaluation has the potential to provide a powerful management decision-making tool based on TK. The challenge remains how to integrate traditional and science based information to develop an adaptive water management framework.

### **Integrating Traditional Knowledge and adaptive water management**

River catchments can be defined by the ecological and physical characteristics, but social processes that determine land use activities drive management and planning of these systems. The TK of Miriwoong people provides a discourse to understand the socio-ecological interface of the Ord and the Keep catchments and as Allan et al (2008) discuss its fundamental to effective adaptive management programs. Traditionally western policy makers have managed catchments through a reductionist approach to understanding natural resource management (Smith, 1997). Many have commented on the failings of this approach (Allan et al, 2008; Holling, 1995) and the need for more holistic ways of looking at environmental systems. The Miriwoong seasonal calendar tool is a platform on which to build a holistic approach to catchment management that allows Indigenous knowledge to be conceptualised in ways that help land managers understand how to incorporate TK to western principles of land management. This will be of considerable importance in Northern Australia where extensive gaps exist in baseline scientific understandings of the complex interactions of ground and surface waters. Complementing the limited scientific monitoring information in such regions with TK is potentially workable and cost-effective as discussed by Johannes (1998). The current joint management agreements that Miriwoong people have over conservation reserves with the WA Department of Conservation and a further jointly managed water reserve (Reserve 31165) with the WA Department of Water could stand as vehicles to test the integration of the seasonal calendar management tool. Additionally the Keep River National Park on the NT side of the boarder could provide for the application of standardized management decisions based on the application of TK across state boundaries.

Strauch and Almedom (2011) in their work with the Sonjo in Northern Tanzania, demonstrated that TK can be successfully used to regulate natural resources to maintain catchment water quality. This was achieved through social, political and spiritual structures that allowed for effective enforcement of rules for water management based on a holistic view of the catchment system. The Miriwoong model will create opportunities for better understanding and quantification of cultural values to water that can inform adaptive management structures for proposed expansion of the ORIA. There will need to be a political will from both the WA and NT Governments to allow these types of projects time to mature and learn from reflection of outcomes. Gregory et al (2006) in their review of the application of adaptive management approaches to water planning found that with time TK provided important understandings for management of catchment systems. This was also acknowledged in the Water Use Planning Guide-lines in

British Columbia (1998) that highlighted the benefits of using TK as a fundamental rationale of adaptive management. Flanagan and Laituri (2004) further state that the integration of TK in adaptive frameworks is essential for a successful collaborative process that recognises Indigenous property rights in water. The incorporation of TK into water management and planning in the Western United States of America has also provided opportunities for equitable roles in resource management decisions and help the quantification of reserved Indian water rights. A progressive joint approach by policy makers will be essential for appropriate management of future large-scale agricultural development and water regulation in the Kimberley of Western Australia. An opportunity now exists through water reform and the potential of future expansion of the ORI for policy makers to embrace Miriwoong TK in adaptive water management thus providing a precedent of Indigenous engagement in best practice adaptive water management that recognised customary rights to water.

### **Conclusion**

The Ord Irrigation Area has the potential to provide for recognition of Indigenous rights to water with potential expansion of Ord Stage 3 into the Keep River region of NT. It is widely predicted that the Ord Stage 3 expansion would be subject to WA water resource management legislations. This would need agreement not just from the NT Government but also Miriwoong traditional owners. In March 2011 Native Title was awarded covering the whole of the Keep River region. It will be important that rights that are recognised under NT water allocation policy are not forfeited in these negotiations. The opportunity exists for customary rights in water to be at the forefront of these negotiations through the integration of TK into adaptive management frameworks and legal discussions of Native Title rights and interests in water. Agreement making provides a powerful tool in which to negotiate economic accesses to water that has long term benefits through the establishment of water markets in the Ord River system. Through integrating TK into a seasonal calendar management tool adaptive management frameworks can be established providing greater awareness to the cultural values of water that underpin Indigenous identity and agency to customary rights to water.

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