A GOVERNANCE TYPOLOGY OF INDIGENOUS ENGAGEMENT IN ENVIRONMENTAL MANAGEMENT

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ABSTRACT

Indigenous peoples now engage with many decentralised approaches to environmental management that offer important opportunities for Indigenous knowledge to inform sustainability objectives, management solutions and scale-dependent science questions. Indigenous engagement has particular significance because of their claims to sovereign rights and interests, the worth of traditional ecological knowledge and their highly disadvantaged socio-economic status. None of the current typologies of stakeholder engagement in environmental management deal specifically with Indigenous peoples. We present a typology derived through comparative analysis of twenty one Australian case studies, using governance theory to differentiate the intercultural spaces created by these interactions between Indigenous peoples and the Australian settler society. We consider four categories: Indigenous governed collaborations; Indigenous-driven co-governance; agency-driven co-governance; and agency governance. The typology identifies criteria and indicators that define each governance type in relation to institutional arrangements, purposes, structures, participatory processes, capacities and knowledge integration. The Indigenous-governed collaborations and Indigenous-driven co-governance case studies pay more attention to integration of Indigenous knowledge and science. However, their focus is not on integration of western science with Indigenous knowledge, but of both into environmental decision-making and management. We recommend further investigation of the influence of theory and practice in Indigenous governance on engagement in environmental management, and integration of science and Indigenous knowledge.

Key words: Indigenous knowledge, integration, governance, intercultural, environmental planning

INTRODUCTION

Indigenous peoples' engagement in environmental management is increasing globally as a result of recognition of their rights, interests, and the worth of their traditional ecological and management knowledge (Hill et al. 1999, Houde 2007, Nakanura 2008). In Australia, Indigenous peoples engage in environmental management with multiple stakeholders (governments, scientists, producer groups, conservationists and others) through a range of programs and mechanisms: natural resource management (Roughley and Williams 2007); native title agreements (Hill 2006a, Agius et al. 2007); Indigenous and co-managed areas protected under local, state, territory or national legislation (Muller 2003, Nursey-Bray and Rist 2009, Ross et al. 2009); endangered species initiatives (Nursey-Bray 2009); and water planning processes (Jackson 2009a, Jackson and Altman 2009). Environmental management is also undertaken in the pursuit of cultural objectives such as religious ceremonies, conventionally in the absence of non-Indigenous actors (Talbot 2005, La Fontaine 2006). Indigenous peoples and Australian governments recognise the positive contribution of such environmental management engagement to Indigenous well-being, reinforcement of cultural values and spiritual beliefs, and to environmental sustainability (Australian Government 2009, Burgess et al. 2009, Hill and Williams 2009, Lane and Williams 2009). Nevertheless, Indigenous engagement processes and outcomes are diverse and affected by numerous factors including governance systems, geographical and political scale, legal and rights-recognition arrangements, relationships within and between the multi-stakeholder parties, approaches to

knowledge integration, the intrinsic qualities of the natural resource (Davies 2003, Porter 2004, Natcher et al. 2005, Hill 2006a, Telfer and Garde 2006, Hunt et al. 2008, Wohling 2009). Using governance as a theoretical framework, we present a typology of Indigenous engagement in environmental management, based on Australian case studies, to assist in interrogating this diversity of experience and in building theory and practice in the field.

Australian Indigenous peoples assert sovereign rights and interests as the First Australians to collective self-determination and control over their customary estates, despite profound impacts from the colonial processes of territorial acquisition and state formation (Howitt et al. 1996). The legal, agreement-making, and policy mechanisms established by Australian governments to respond to Indigenous rights' claims are enacted within a highly charged and contested environment in which the Australian polity holds pre-eminent power (Hibbard and Lane 2004, Hunt et al. 2008). Indigenous peoples face socio-economic disadvantage on numerous measures, highlighted by an inequitable life expectancy gap with non-Indigenous people of 17 years which has remained static for decades (ATSISJC 2009a). Fewer than half the original 200 Indigenous languages survive and only 20 are in common use (Turnbull 2009). Projects that seek to engage Indigenous peoples in environmental management encounter the politics of Indigenous rights, and the context of Indigenous socio-economic disadvantage as key factors and determinants of success (Palmer 2006, Davidson and O'Flaherty 2007). Given this context, a typology of Indigenous engagement in environmental management is likely to differ significantly from a general typology of 'public' engagement or collaboration in environmental management.

Typologies are useful building blocks for theory, and can help practitioners by providing a conceptual framework for analysing and critiquing their work (Margerum 2008). The proliferation of public engagement in environmental management, and the more recent interest in collaboration and deliberative democracy, has spawned numerous typologies with different theoretical and analytical frameworks. Reed (2008) classifies these typologies into four. The first category includes several typologies based on a power-sharing continuum of participation, generally from passive information dissemination to citizen empowerment (Arnstein 1969, Davidson 1998, Head 2007, Reed 2008). This category reflects Margerum's (2008) application of a typology of collaboration based on the level at which consensus building and decision-making efforts are undertaken. The second category distinguishes on the basis of direction of information flow as either communication/consultation as one-way agency-to-public/public-to-agency; versus participation, two-way (Rowe and Frewer 2005). The third category distinguishes between pragmatic participation as a means to an end, and normative participation focusing on the democratic rights of people. The fourth category includes several typologies that distinguish on the basis of the objectives, for example between diagnostic and co-learning (Lynam et al. 2007), or between planning-centred and people-centred (Michener 1998). An Australian NRM typology based on who initiated the collaboration, its focus and inclusiveness, aligns with this category (Oliver and Whelan 2003). None of these typologies deal specifically with Indigenous engagement in environmental management, or address the issues of rights and social inequities discussed above (Reed et al. 2007, Reed 2008). Given the emphasis Indigenous people place on these

issues, we argue these typologies are not useful in guiding the theory and practice of Indigenous engagement in environmental management.

Our research goal was to develop a typology that would be useful in interrogating the diversity that is encapsulated within Indigenous engagement in Australian environmental management. We present the study in the following sequence. First we further discuss the significance and policy context of Indigenous engagement in environmental management to elucidate the rationale for a special Indigenous typology. We then present the methods of selection and comparative analysis of our case studies, and discuss governance as the theoretical foundation of our typology. A description of the typology, the four governance categories, and the criteria and indicators used to categorise the case studies follows. Our discussion focuses on the contribution of the typology to the issue of integration of Indigenous knowledge and science. Our conclusion considers implications of the typology and its application for current and future practice and research into Indigenous engagement in environmental management and cross-cultural knowledge production.

Indigenous engagement in environmental management: significance and policy context

Indigenous peoples' engagement in environmental management has particular significance because of: (1) their claims to distinctive status as nations with sovereign rights and interests; (2) the value of their often considerable traditional and local ecological knowledge to sustainability; and (3) their highly disadvantaged socio-economic status. While the concept of Indigeneity is contested, Indigenous peoples

through the United Nations have maintained that no formal universal definition is necessary (Stephens et al. 2006). This paper is guided by Martinez-Cobo's (1986) working definition, essentially recognising Indigenous peoples as those who, having a historical continuity with pre-invasion and pre- colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on parts or all of those territories. The Australian Government has recently endorsed the UN Declaration on the Rights of Indigenous Peoples which recognises Indigenous peoples' distinctiveness, and establishes a set of principles for respecting Indigenous rights (United Nations 2008). Three broad principles from the Declaration are relevant: (i) the right to political, economic, and cultural self-determination and sovereignty; (ii) the right to self representation and autonomy; and (iii) the right to control, develop and protect their own traditional knowledge and intellectual property (Brechin *et al.* 2002).

Current policy innovation with respect to Indigenous peoples' engagement in environmental management reflects this recognition of distinct status. Substantial funding investment has been made available for Indigenous protected areas (IPAs), Indigenous partnerships, rangers, and initiatives such as the Indigenous Water Policy Group (Australian Government 2008, Hill and Williams 2009, Jackson and Altman 2009). Innovative approaches to Indigenous economic development in remote Australia are encouraged through research on natural resource management models (Altman et al. 2007), particularly payment for environmental services such as carbon abatement on Indigenous estates (Heckbert et al. 2008). Recording of traditional ecological knowledge is attracting substantial investment and catalysing innovative

approaches that utilise digital multi-media, remote sensing and interactive software platforms (Roughley and Williams 2007, Roder 2008, Standley et al. 2009).

Recent Australian governments have also undertaken policy innovation to redress the socio-economic disadvantage of Indigenous peoples. The whole-of-government coordination trials auspiced by the Council of Australian Governments (COAG), aimed at developing "shared responsibility" agendas between Indigenous people and governments to uplift Indigenous socio-economic status. The trials confirmed the government "silo" approach as a significant barrier, and whole-of-government coordination has since been adopted as a key feature in Indigenous policy arenas, reflecting the importance Indigenous peoples place on a holistic treatment across many domains, including health and environmental management (Morgan Disney & Associates Pty. Ltd. 2006, Smith 2007). In 2007, the Australian government introduced significant policy shifts into Indigenous affairs in the Northern Territory, including an income management regime and changes to the rules of labour market services in remote communities which had been important source of funding for environmental management activities. Welfare reforms have now been extended to Cape York Peninsula (Altman and Johns 2008). The above policy context highlights the different treatment of Indigenous peoples by Australian governments in diverse arenas, thus underpinning our rationale for a distinct Indigenous typology.

METHODS

Case study selection and analysis

The typology is based on a comparative analysis of twenty one Australian case studies in environmental management (Table 1). The information sources for these case studies included formal published plans, reports, journal articles, web pages, newspaper articles and a range of informal internal reports, memoranda and meeting minutes. In addition, at least one member of the research team had direct interaction with each of the environmental management case studies either as a scholar or practitioner, and contributed participant-observation data and empirical insight relevant to these case studies. The research team included the Chair and Deputy-Chair of the Indigenous Advisory Committee to the Australian Minister for Environment, Heritage, Water and the Arts. The Terms of Reference of this Committee require extensive interaction with Indigenous groups involved in environmental management, and these researchers had direct experience with most of the case studies.

The case studies were selected to encapsulate the major types of engagement, provide geographical spread, and a diversity of settings for Indigenous engagement in environmental management, including within protected areas, natural resource management projects, terrestrial and marine settings and both government and non-government initiatives (Figure 1). The availability of data also affected choice of case studies.

All twenty one case studies were interrogated according to factors distilled from the literature and experience of the research team: institutional arrangements, purposes, decision-making and coordination mechanisms, resource rights, communication and relationships mechanisms, capacity focus and approach to Indigenous and science knowledge integration. The typology recognises five criteria that distinguish approaches to Indigenous engagement : 1) institutional arrangements, incorporating the nature of the institutions and the organisations; 2) purposes, including of the environmental management project/program, of Indigenous engagement and development, and the approach to coordination of purposes; 3) structure, incorporating decision making level/control and resource/property rights recognition; 4) participatory processes; and 5) capacities and knowledge integration. Four broad intercultural governance arrangements form the basis of our typology. Cases studies with similar governance generally showed consistent responses to the criteria, and we developed a generic form of these responses as "indicators". Table 2 presents the governance types, together with the relevant criteria and indicators.

Governance as the basis of the typology

We consider governance as the evolving processes, relationships, institutions and structures by which a group of people, community or society organises themselves (Smith and Hunt 2008). Governance theory originates from sociological institutionalism, and recognises influences of power, relationships and cultures as well as formal structures, management and corporate technicalities (Sandström 2009). In environmental management, governance approaches focus attention on functions and emergent properties, including power as a result of co-management, rather than

simply as an attribute of the formal structure of arrangements (Carlsson and Berkes 2005). Our use of the term 'intercultural' draws on recognition of the relational dimensions of social forms that develop through the interaction of Indigenous and non-Indigenous societies. The 'intercultural' concept responds to 'traditionalist' anthropological studies that reproduce idealised representations of Aboriginal peoples and hence inadequately describe the nature and extent of changes and innovations (Hinkson and Smith 2005, Merlan 2005). In Australia, all Indigenous governance systems are located within an intercultural, post-colonial frame in which the settler society nation-state has overarching sovereign power and jurisdiction, and Indigenous groups assert their rights to self-determination and self-management (Smith and Hunt 2008).

Despite this recognised universal impact of non-Indigenous forms, Smith and Hunt's (2008) investigation of contemporary Australian case-studies identified distinct and common Indigenous governance principles: networked models; locally-dispersed centres of authority; distribution of roles, powers and decision making across social groups and networks; cultural regions within the continental diversity; emphasis on internal relationships and shared connections as the means of determining group membership and representation; and nodal and gendered realms of leadership. Nodal leadership operates in a 'flexible field of authority' centred on relatively fluid networks in which leaders form the core nodes. These nodal leadership networks serve to satisfy the duality of a simultaneously egalitarian and hierarchical society (Ivory 2008). Indigenous modes of governance challenge the assumptions common to representative decision-making (Jackson et al. 2005). Our concept of Indigenous governance draws on this recognition that Indigenous peoples maintain distinct forms

of governance, separate to but influenced by, the settler societies who now inhabit some or all of their traditional territories.

RESULTS

The four governance types

Our four governance types are set out in Table 2. Indigenous governed collaborations (IG) are formulated through Indigenous initiative, and bring Indigenous peoples together to focus on common environmental issues, actions and policy agendas. The Northern Australia Indigenous Land and Sea Management Alliance (NAILSMA) and the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) are the two relevant case studies. New Indigenous governance forms are emerging through these collaborations that span very large geographical regions. Traditional owners within MLDRIN describe it as a 'confederation' of Indigenous Nations, providing an alliance of political entities, built from pre-colonisation systems of family connections, trade and exchange (Weir 2009). Delegates to MLDRIN stress that it does not substitute for the authority of traditional owners, but provides a means of establishing their distinct political status. They are not just one of a group of stakeholders within environmental management.

Indigenous-driven co-governance (ICoG) approaches are frequently formulated in response to government initiatives. Indigenous Protected Areas (IPAs), for example, arose in the context of the Australian Government's National Reserve System. However, the structures and processes developed in response have respected and

empowered Indigenous governance and enhanced, rather than undermined, traditional owner authority (Bauman and Smyth 2007). For example, Yolngu involved in Dhimurru Aboriginal Land Management Corporation in North East Arnhem Land, where there is an IPA, have applied symbolism and bonds associated with water to create a Ganma theory of knowledge sharing and dialogue to guide community and collaborative management (Robinson and Munungguritj 2001).

Agency-driven co-governance (ACoG) approaches usually arise from formal processes to recognise and define Indigenous rights, such as through native title or recognition of Aboriginal joint management of protected areas. The process of definition from an oral tradition into a written code, such as a management plan, always transforms and constrains the Indigenous forms of management. Indigenous governance principles extend beyond organisations and into wider networks of families and communities (Smith and Hunt 2008). Agency-driven models require the power to sit within the organisation, through mechanisms such as the Mutawintji Board of Management. In this type of engagement, the agency seeks to meet the expectations of a wide array of stakeholders, such as conservation groups, fishers, hunters, tourism operators and others. The complexity and competition within such an institution may crowd out the Indigenous 'minority' perspective. While Indigenous peoples use these structures to present their culturally-based world views, agencies are rarely able to legitimize the networked, nodal and gendered structures that mediate the complexities of traditional authority.

Agency-governance (AG) approaches tend to regard Indigenous people as a particular sector, similar to farmers or industry actors, rather than as group requiring a different

approach associated with their claims to a distinct political status and relationship with the nation-state. For example, the Wilderness Society's (TWS) Indigenous Conservation Program places their goals of environmental preservation to the fore in engagement with Indigenous people on the environment, and seeks to build alliances with Indigenous people who support their goals, similar to alliances built with farmers or industry actors (Pickerill 2008). Although this approach does not provide for Indigenous governance principles to shape environmental management, Indigenous people opportunistically utilise such agency-governance models to support their own Indigenous-driven agendas—reflected for example in the TWS agreement to support Chuulangan Aboriginal Corporation to advance their IPA (Claudie and Esposito 2005).

DESCRIPTION OF THE CRITERIA AND INDICATORS WITH ILLUSTRATIVE EXAMPLES

The indicators within each governance type to the criteria and sub-criteria are shown in Table 2. Not all case studies responded to all criteria in a manner that is absolutely consistent with all indicators under a particular governance type—we assigned case studies to the governance type where they demonstrated consistency with the majority of indicators. The assignments of the case studies to governance categories within the typology are best viewed as alignments, which may change over time. Our categorisation matrix of eleven sub-criteria in four governance types across 21 case studies is too complex for presentation here. Instead, we briefly describe the spectrum across the governance types of criteria and indicators presented in Table 2,

and provide illustrative examples of how each case study meets one of the indicators in Table 3.

Institutional arrangements

We use the concept of institutional arrangements in this criterion to refer to the rules and rule-making context, including duties, norms and values (institutions) and the organisations that implement those rules. Table 1 lists the key institutions and organisations for all of the case studies. In all cases but one we were able to identify instruments that underpin the institutions, and codified the Indigenous approach to some extent, including an array of agreements, legislation, regulations, plans and frameworks. The Djabugay case study articulates that their rules and rule-making occurs through an Indigenous oral tradition of customary law/lore (Talbot 2005). Table 3 illustrates how the Djelk Rangers case study meets the indicator for the "institutions" criteria within the ICoG type.

Purposes

Indigenous people consistently highlight the holistic nature of their engagement in and knowledge about environmental management (Ross and Pickering 2002, Houde 2007, Berkes and Berkes 2009). Government environmental agencies, on the other hand, usually have specific responsibilities mandated by legislation such as threatened species management, without links to policy arising from other legislation, such as education or business development (Boxelaar *et al.* 2006). Environmental non-government organisations (ENGOs) similarly have specific mandates reflected in

their organisational structures and fund raising appeals. The purposes of the environmental management therefore range across the spectrum of types from narrowly defined projects to Indigenous initiatives with a broad purpose of utilising opportunities to advance their societal-wide agendas. Table 3 illustrates how the Indigenous Conservation Program and Ngarrindjeri case studies meet the indicators for the "purposes of environmental management" criteria within the AG and ICoG types respectively.

The central purposes in engaging Indigenous people in environmental management differ across the governance type spectrum from equity through rights-recognition to a broader context of reconciliation, Indigenous empowerment and utilising environmental management as the means of advancing a broad Indigenous societal agenda. Table 3 illustrates how the Urranah Station and Victorian Native Title Settlement Framework meet the indicators of Indigenous engagement purposes for ACoG and ICoG respectively.

This spectrum of purposes for engaging Indigenous peoples across the typology—from equity through rights recognition to empowerment—is associated with diversity in understanding of the purposes of development for and with Indigenous peoples (Hunt 2008). The continuum ranges from development as modernisation and technology transfer (Sillitoe and Marzano 2009), through human capability development and asset deployment (Sen 2005, Davies et al. 2008), to concepts of empowerment (Borrini-Feyerabend *et al.* 2004), community development, Indigenous hybrid economies (Altman 2007) and Indigenous "modernities" as hybrid responses owned by Indigenous peoples (Robins 2003, Walker et al. 2007). Table 3 illustrates

how the Desert Livelhooods Inland™ and Kimberley Appropriate Economies Roundtable case studies meet the indicators for the "purposes of Indigenous development" criteria within the ACoG and ICoG types respectively. The Cape York Peninsula Caring for Country employs the concept of modernisation, an indicator for the AG type, in which Indigenous people gain sufficient skills, capacities and mobility to join in the existing mainstream economy (Cape York Institute and Balkanu 2007). However, overall this case study is better aligned with Indigenous co-governance.

Approaches to coordination of purposes vary from none ("the silo") through whole-of-government attempts to link silos, to Indigenous holistic coordination. Whole-of-government methods coordinate goals by government agencies developing shared approaches to delivering their sectoral goals. The Indigenous holistic approach derives from Indigenous peoples' views of the linkages between Indigenous people, the environment and Indigenous culture. Table 3 illustrates how the Healthy Country Healthy People and Djabugay case studies meet the indicators for the "coordination of purposes" criteria within the ACoG and ICoG types respectively.

Structures

The structures of decision-making and resource rights both reflect and determine the relative power of Indigenous and agency governance. The difference between agency-driven and Indigenous-driven decision approaches lies in the extent to which theses structures enable the exercise of internal customary law in Indigenous governance arrangements. Table 3 illustrates how the Miriuwung Gajerrong Cultural Planning Framework and the Cape York Peninsula Tenure Resolution case studies meet the

indicators for the "decision-making" criteria within the ICoG and ACoG types respectively. Decision-making structures are closely tied to the arrangements for recognition of Indigenous resource rights. The spectrum ranges from situations where the Indigenous rights over the natural resource are insecure and the resource highly valuable to industrial economies, to those where Indigenous peoples have secured recognition of ownership of resources, generally of lesser value in industrial economies, through native title or land rights legislation. Table 3 illustrates how the Eastern Kuku-Yalanji and Wild Rivers case studies meet the indicators for the "resource and property rights recognition" criteria within the ICoG and ACoG types respectively. However, some ICoG types are emerging even where the resource rights are insecure, reflecting a focus on the broader reconciliation context and the opportunity to empower Indigenous peoples—the Victorian Native Title Settlement Framework is an example.

Participatory processes

Participatory mechanisms in AG types consider Indigenous people as one of many stakeholders. In these cases, the prime mover and recipient of information, with responsibility for action, is the agency. In ACoG, committees that enable a relationship between two parties in a government-to-government context are common. IG and ICoG types both emphasise the importance of developing partnerships that reflect Indigenous peoples' political status and governance systems. There is tendency to codify Indigenous expectations for example through research agreements that outline the roles and responsibilities of partners in relation to intellectual property, employment, and benefit-sharing. The IG types have built a large number of

partnerships including water management, carbon abatement, enterprise development and endangered species management, but their priorities are on traditional owner business and networks (Weir 2009). Table 3 illustrates how the Wet Tropics Regional Agreement, Mutawintji, Dhimurru and MLDRIN case studies meet the indicators for the "participatory processes" criteria within the ICoG and ACoG types respectively.

Capacities

Differences between whose capacities most need improvement—the Indigenous or non-Indigenous peoples—emerged across the case studies. The spectrum ranges from a focus on improving Indigenous capacities to operate in settler societies to broader recognition of the need to improve the capacity of both Indigenous and non-Indigenous people to operate across Indigenous and settler societies. The AG types tend to focus on training for Indigenous peoples, despite recognition in the evaluation of the COAG Indigenous trials of the disproportionate and negative effect of government officers' lack of understanding about Indigenous culture and community processes (Morgan Disney & Associates Pty. Ltd. 2006, p.6). Table 3 illustrates how the Lake Condah Sustainable Development and NAILSMA case studies meet the indicators for the "capacity building focus" criteria within the ICoG and IG types respectively.

In relation to integration of Indigenous knowledge and science, the spectrum ranges from IG and ICoG types that generally make formal statements about integration approaches, to ACoG types where the focus is on collecting rather than integrating Indigenous knowledge and AG types that are often silent on Indigenous knowledge.

Table 3 illustrates how the Mornington Sanctuary, Wet Tropics and Dhimurru case studies meet the indicators for the "science and Indigenous knowledge integration" criteria within the AG, ACoG and types respectively. The Indigenous-driven models are best described as a mix of Indigenous knowledge and science simultaneously informing environmental management (Wohling 2009).

DISCUSSION

The typology does not suggest one governance approach is necessarily better than another—different contexts will require different approaches. Each governance type has strengths and weaknesses. For example, the AG types have strengths in relation to a clear government mandate and accountability but are challenged by Indigenous marginalisation through fragile, inadequate funding of the Indigenous polity (Hill and Williams 2009, Ross et al. 2009). In the ACoG types, planning and meeting processes that deliver accountability can frustrate Indigenous participation for example through Indigenous authority and expertise not being recognised in pay structures. In the ICoG types, Indigenous time frames, capacity, traditional decision-making and coordination challenges can fail government accountability tests. The IG types can find it challenging to deliver the legitimacy and accountability required for successful multi-scalar Indigenous governance. Further research is warranted to explicate the relative advantages and disadvantages of each type and to analyse the driving factors and the conditions to which they are best suited.

The typology does help illuminate the question of how western scientific and Indigenous knowledge systems can be integrated for improved environmental management—the central focus of this edition of Ecology and Society. In our case studies, the IG and ICoG types paid more attention to the question of integration of Indigenous knowledge and science for improved environmental management. However, the focus is not on integration of science with Indigenous knowledge, but of both into environmental management. MLDRIN expresses this as a specific principle 'that Indigenous science and Western science each have their own value and role in caring for country' (Weir 2009, p. 116). While Indigenous knowledge recording was occurring in other governance types, approaches to knowledge integration were cryptic. Jackson's (2009b) review of Indigenous participation in water planning found that Indigenous hydrological knowledge is rarely sought by water planners. Robinsons et al. (2009) and Wohling (2009) found that issues of fit between the contemporary environmental management categories and the dynamism of Indigenous knowledge as a living practice have limited effective integration in the Desert region and northern Australia.

Indigenous peoples themselves have consistently argued that governance of their traditional knowledge is an aspect of their inherent rights—now recognised in Article 31 of the Declaration of Indigenous Rights. An Australian conference on Indigenous Governance in 2002 noted compelling evidence that sustained and measurable improvements in the social and economic well-being of Indigenous peoples only occurs when real decision-making power is vested in their communities, when they build effective governing institutions, and when the decision-making processes of these institutions reflect the cultural values and beliefs of the people (Reconciliation

Australia, 2002). These perspectives lend support to our typology analysis that Indigenous governance has good prospects in endeavours to integrate science and Indigenous knowledge for improved environmental management.

CONCLUSION

Our typology of Indigenous engagement in environmental management uses governance theory to differentiate the intercultural spaces created by these interactions between Indigenous peoples and the Australian settler society. We consider four governance types: Indigenous governed collaborations; Indigenous-driven co-governance; agency-driven co-governance and agency governance. The typology identifies a set of criteria and indicators that define each governance type in relation to: 1) institutional arrangements, incorporating the nature of the institutions and the organisations; 2) purposes, including of the environmental management project/program, of Indigenous engagement and development, and the approach to coordination of purposes; 3) structure, incorporating decision making level/control and resource/property rights recognition; 4) participatory processes; and 5) capacities and knowledge integration.

We applied the criteria to twenty-one case studies of Indigenous engagement in environmental management in Australia, selected for their diversity, relevance to the focus and data availability. While case studies show some differences in responses to the full set criteria and indicators for each governance type, there was sufficient consistency to place the case studies as clearly aligned with one of the categories (Table 1).

The typology identifies some differences between governance types on how scientific and Indigenous systems of knowledge are being used in environmental management, the central focus of this edition of Ecology and Society. The Indigenous governed collaborations, and Indigenous-driven co-governance types paid more attention to the integration of Indigenous knowledge and science. However, the focus is not on integration of science with Indigenous knowledge, but of both into environmental management. Further investigation of the influence of governance type on knowledge integration is warranted. We used our case studies to construct this typology, but the system is yet to be validated on a fresh set of case studies. We advocate the application of the typology by policy makers and researchers, and look forward to future evaluations of its general effectiveness.

Acknowledgements:

The authors would like to acknowledge the fine work of numerous people over many years occurring within the case studies profiled in this study. We thank CSIRO for the generous support that enabled the conduct of this comparative analysis, and Marcus Finn and Iris Bohnet for commenting on earlier versions of this paper. The ideas expressed in this paper are those of the authors alone.

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Table 1: the case studies

Case study	Key organisations	Key instruments underpinning the institutional arrangements
Agency governance (opportunistic Indigenous co-governance) AG		
Indigenous Conservation Program	The Wilderness Society	Native Title and Protected Areas Policy
Mornington Sanctuary	Australian Wildlife Conservancy	Voluntary conservation plans
Wild Rivers Declarations and Rangers	Department of Environment and Resource Management	Wild Rivers Act 2005 (Qld)
Agency-driven co-governance ACoG		
Cape York Peninsula Tenure Resolution	CYP Tenure Resolution Implementation Group	Cape York Land Use Heads of Agreement; Cape York Peninsula Heritage Act 2007 (Qld)
Desert Livelihoods Inland™	Desert Knowledge Cooperative Research Centre	Sustainable Livelihoods Framework, research agreements between partners
Eastern Kuku-Yalanji ILUA	Jabalbina Aboriginal Corporation	Native Title Acts
Healthy Country, Healthy People	Joint Australian and NT Government Steering Committee	Schedule 2.5 to the Overarching Agreement on Indigenous Affairs
Mutawintji National Park	Mutawintji Board of Management	Mutawintji National Park Lease (agreement)
Urannah Station	Indigenous Land Corporation; Urannah Property Association	Aboriginal and Torres Strait Islander Act 2005
Wet Tropics Regional Agreement	Rainforest Aboriginal Consultative Committee	Wet Tropics Regional Agreement, Wet Tropics World Heritage Protection and Management Act 1993 (Qld)
Indigenous-driven co-governance ICoG		
Cape York Caring for Country	Balkanu Cape York Development Corporation	Cape York Agenda of the Cape York Institute and partners
Dhimurru IPA, Sea Country Plan	Dhimurru Land Management Aboriginal Corporation	Indigenous Protected Areas within the National Reserve System
Djabugay Indigenous Land Management	Djabugay Tribal Aboriginal	Indigenous customary law/lore

Techniques	Corporation	
Djelk Rangers	Bawinga Aboriginal Corporation	Northern Land Council Rangers Program; also now an IPA
Kimberley Appropriate Economies Roundtable	KLC, ACF, EK Steering Committee	Kimberley Land Council, Australian Conservation Foundation and Environs Kimberley Letter of Agreement 2004
Lake Condah Sustainable Development Project	Winda Mara Aboriginal Corporation	Aboriginal Land (Lake Condah and Framlingham Forest) Act 1987 (Cth)
Miriuwung-Gajerrong Cultural Planning	MG Corporation	Ord Final Agreement; MG native title determinations
Ngarrindjeri Nation Sea Country Plan	Ngarrindjeri Regional Authority	South-east Regional Marine Plan; Regional Partnership Agreement
Victorian Native Title Settlement Framework	Victorian Traditional Owner Land Justice Group	Indigenous Management Agreements under the Framework
Indigenous governed collaborations IG		
MLDRIN	Indigenous Nations of the Murray and Lower Darling	Constitution of the Murray Lower Darling Indigenous Nations
NAILSMA	NAILSMA Board	Heads of Agreement between Kimberley Land Council, Northern Land Council and Balkanu

Table 2: Governance Typology of Indigenous engagement in environmental management

Criteria ↓ / Governance type →	Indigenous governed collaborations indicators	Indigenous-driven co-governance indicators	Agency-driven co-governance indicators	Agency governance, some opportunistic Indigenous co-governance indicators
Institutional arrangements				
Nature of key institutions	Indigenous organisations working together on specific policy and action goals shaped and constrained by Indigenous rules and rights-recognition regimes	Engagement with Indigenous peoples shaped and constrained by Indigenous rules, but modified by the rules government and non-government agencies, and by rights-recognition regimes	Engagement with Indigenous peoples shaped and constrained by the rules of government and non-government agencies, but modified to recognise Indigenous rules within legislated rights	Engagement with Indigenous peoples shaped and constrained by the rules of government agencies, or the the NGOs
Nature of key organisations	Diverse Indigenous organisations at multiple scales	Diverse Indigenous and non-Indigenous organisations across non-government, private and government sectors	Government agencies and NGOs, Land Councils, National Native Title Tribunal	Government agencies in environment and natural resource management, non-government organisations (NGOs)
Purposes				
Of environmental management project or program	An overall purpose of strengthening Indigenous society through environmental management	Multiple purposes, reflecting Indigenous-centred holistic community planning and empowerment	Multiple purposes, reflecting outcomes of negotiated agreements through ILUAs or joint managed protected areas	Usually single or dual purpose, managing specific threats, species or areas, undertaking community education projects, fostering policy change
Of Indigenous engagement	Inherent rights and responsibilities	Reconciliation, long term lasting resolution of issues	Equity plus recognition of specifically defined rights	Equity with other stakeholders in environmental management
Of Indigenous development	Indigenous modernities, people resist, accommodate and reshape interventions	Indigenous empowerment, Indigenous hybrid economies, community development	Human capability development, sustainable livelihoods through deployment of assets	Development as modernisation; transfer of technology to Indigenous people within mainstream economies
Approach to coordination of purposes	Cross-regional and cross-jurisdictional empowerment	Indigenous holistic community empowerment	Whole-of-government	Not essential, agency accountability for specific mandate

Structures				
Decision-making level and control	Decision-making defined by arrangements between Indigenous agencies; high Indigenous control	Decision-making defined by Indigenous law and culture and partner requirements; substantial Indigenous control	Agency and Indigenous people according to agreed structures, typically committees; substantial agency control	Depends on specific project, usually agency controlled but local scale provides Indigenous co-governance in some cases
Nature of the resource and property rights recognition	Highly valued by Indigenous societies; rights may be defined/constrained but viewed as open to transformation	Lesser value in industrial economy (hinterlands of first world economies); Indigenous rights strong and recognition growing	Contested value between industrial and Indigenous economies; Indigenous property rights defined and contained	Highly valued by industrial economy e.g. water in heavily used systems; Indigenous property rights not recognised
Participatory Processes				
Participatory processes	Inclusivity that engages Indigenous people in new Indigenous institution-building; emphasis on Indigenous networks, and partnerships driven from Indigenous political identity	Inclusivity that engages Indigenous people in new environmental institution-building; emphasis on networks and partnerships driven from Indigenous political identity	Indigenous rights-based negotiation e.g. for Native Title Acts, cultural heritage clearances; emphasis on committees and brokers	Participation through stakeholder mechanisms e.g. committees, competitive project funding, involvement in tree planting; emphasis on agency roles and relationships that support this role
Capacities and knowledge integration				
Focus of capacity-building	Focus on: • Building trust and relationships between Indigenous groups with diverse histories, cultures and mandates	Focus on: • Indigenous functionality in their own Indigenous society and settler society • Diverse effective Indigenous NGOs • Non-Indigenous peoples' functionality in Indigenous society	Focus on: • Indigenous functionality in settler society • Ways to recognise Indigenous knowledge • Effective organisations to represent Indigenous rights and interests • Cultural awareness training for non-Indigenous people	Focus on Indigenous peoples' capacity: • Training • Ensuring Indigenous people's functionality in settler-society mode • Indigenous knowledge brought to the table, validated
Interaction between science and Indigenous knowledge	Indigenous governance of knowledge integration, science to support Indigenous questions and aspirations	Wariness of science role in colonialism, Indigenous knowledge systems central and incorporate/verify science where appropriate	Science as one knowledge relative to others (strategic rationality), Indigenous knowledge useful alongside local, farmers knowledge	Science as the source of objectivity (instrumental rationality), Indigenous knowledge ignored or verified by science

Table 3 Illustrative examples of the case studies meeting the criteria and indicators

Case study	Governance type/indicator	Illustrative example
Institutional arrangements		
Djelk Rangers	Engagement with Indigenous peoples shaped and constrained by Indigenous norms and traditional rights, but modified by statutory duties and policies of the agency or the norms and values of NGOs, and by rights-recognition regimes	**D**ecisions within Bawinanga Aboriginal Corporation, who host the Djelk Rangers, are mediated within the informal institution of the 'smoko' room. Local Aboriginal elites with power based on seniority, Indigenous knowledge and customary authority negotiate with Aboriginal neo-elites whose power derives from modernising projects, including the duties of the Djelk Rangers to protect biodiversity within parameters set by their government funding agencies (Altman 2008).
Purposes		
Indigenous Conservation Program (TWS)	AG: Project/program usually single or dual purpose, managing specific threats, species or areas, undertaking community education projects, fostering policy change	TWS describes their purpose in working with Indigenous traditional owners as "to achieve protection and management of Cape York Peninsula and the return of homelands to the control and management of its traditional owners" (TWS 2007).
Ngarrindjeri Nation Sea Country Plan	ICoG: Project/program multiple purposes, reflecting Indigenous-centred holistic community planning and empowerment	The Ngarrindjeri Nation Sea Country Plan has multiple goals, ranging across healthy people, healthy country, equitable benefit-sharing, health and spiritual well-being of Ngartjis (special animals), ongoing occupation of country and respect for law (The Ngarrindjeri Nation 2007)
Urannah Station	ACoG: Indigenous engagement for equity with other stakeholders plus recognition of specifically defined rights	Indigenous engagement at Urannah Station, part of the Indigenous Land Corporation's (ILC) program of works, is aimed at achieving equity for Indigenous Australians through halving the employment gap within a decade (O'Connor 2008, Sullivan 2009).
Victorian Native Title Settlement Framework	ICoG: Indigenous engagement for reconciliation, long term lasting resolution of issues	The Victorian Native Title Settlement Framework explicitly recognises reconciliation within its objects, which encompass social and economic upliftment, grievance-resolution and rights recognition.
Desert Livelihoods Inland™	ACoG: Human capability development, sustainable livelihoods through deployment of assets	The Desert Livelihoods Inland™ focuses explicitly on human capability and asset deployment theory. The approach develops a shared understanding between researchers and desert Aboriginal people about vulnerabilities, assets and strategies that impact on livelihood outcomes (Davies et al. 2008, Desert Knowledge CRC 2009).
Kimberley Appropriate Economies Roundtable	ICoG: Indigenous empowerment and community development	The Kimberley Appropriate Economies Roundtable promoted theories of ecological economics and Indigenous governance, aimed at empowering Indigenous peoples and other citizens to build their own planning, decision-making and governance capacity (Robins 2003, Hill 2006b).
Healthy Country, Healthy People	ACoG: Whole-of-government approach to coordination of purposes	In Healthy Country Healthy People, multiple departments coordinate delivery across environmental, socio-cultural and economic goals through a Steering Committee of government officers, with Indigenous organisations in an advisory role (Office of Indigenous Policy 2006).

Djabugay Indigenous Land Management Techniques	ICoG: Indigenous holistic community empowerment	Djabugay people's multiple goals for their Indigenous land management techniques arise from a perspective that places an Indigenous world view at the centre. Eleven aspects of Indigenous land management emanate from this centre: tradition and Laws/lores; elders; spiritual; land and sea country; employment; youth; health; obligation and responsibility; community rangers; education; and cultural training. (Talbot 2005).
Structures		
Miriuwung-Gajerrong Cultural Planning	ICoG: Decision-making defined by Indigenous law and culture and partner requirements; substantial Indigenous control	The Ord Final Agreement established a formal committee with a majority of Miriuwung-Gajerrong people as the decision-making body. The Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation supports the committee with processes that empower localised decision making by Dawang, through an Indigenous governance structure (Hill et al. 2008)
Cape York Peninsula Tenure Resolution	ACoG: Decision-making by agency and Indigenous people according to agreed structures, typically committees; substantial agency control	The Cape York Tenure Resolution process is headed by a decision-making committee comprising three State Government Ministers, the Australian Conservation Foundation, The Wilderness Society, Balkanu and the Cape York Land Council (Bligh 2008). Decisions on land tenure outcomes are underpinned by Indigenous Land Use Agreements, and require negotiation and Indigenous consent, thereby empowering Indigenous law and custom.
Eastern Kuku-Yalanji ILUA	ACoG: Resources of contested value between industrial and Indigenous economies; Indigenous property rights defined and contained	The Eastern Kuku-Yalanji ILUA focuses on recognition and regulation of people's native title rights as custodians and managers of traditional country, while delivering statutory Aboriginal ownership of some areas of land (DERM 2007).
Wild Rivers Declarations and Rangers	AG: Resources of high value to industrial economy e.g. water; Indigenous property rights not recognised	The marginalisation of Indigenous peoples from Wild Rivers decision-making reflects legislative regimes that have placed the control and regulation of water with the Crown and its agencies (Jackson and Altman 2009).
Participatory processes		
Wet Tropics Regional Agreement	ACoG: Participation through Indigenous rights-based negotiation e.g. for Native Title Acts, cultural heritage clearances; brokers. Emphasis on committees and brokers	The Wet Tropics Regional Agreement Interim Negotiating Forum constituted an Aboriginal Negotiating Team and a Government Negotiating Team (Petrich 2003).
Mutawintji National Park	ACoG: Emphasis on committees and brokers	Mutawintji Board of Management
Dhimurru IPA, Sea Country Plan	ICoG: Inclusivity that engages Indigenous people in new environmental institution-building. Emphasis on networks and partnerships driven from Indigenous political identity	Dhimurru stresses their pride in their model of partnerships which is founded in Yolngu culture and the customary ways Yolngu care for country (Dhimurru 2006). This requirement of Indigenous agency to drive the participation has resulted in the new environmental institution of a formal Advisory Group of government and other stakeholders to the Dhimurru IPA (Bauman and Smyth 2007)

MLDRIN	IG: Inclusivity that engages Indigenous people in new Indigenous institution-building Emphasis on Indigenous networks, and partnerships driven from Indigenous political identity	MLDRN partnerships all contain acknowledgements of the traditional owners, their specific relationships with country, and the importance of their decision-making structures (Weir and Ross 2007)
Capacities and knowledge integration		
Lake Condah Sustainable Development Project	ICoG: Capacity focus on: • Indigenous functionality in their own Indigenous society and settler society • Diverse effective Indigenous NGOs • Non-Indigenous peoples' functionality in Indigenous society	At Lake Condah, a sophisticated approach to simultaneously build Indigenous and non-Indigenous capacity and pathways to sustainability has been developed through "Lake Condah Learning" (Bell 2009).
NAILSMA	IG: Capacity focus on building trust and relationships between Indigenous groups with diverse histories, cultures and mandates; Indigenous governance of knowledge integration, science to support Indigenous questions and aspirations.	NAILSMA regularly hosts events that bring together Indigenous peoples from across the north to build common agendas, such as the Northern Australian Indigenous Experts Water Futures Forum (NAILSMA 2009). NAILSMA has an Indigenous Knowledge Strategy and supports the Traditional Knowledge Revivals Pathway (ATSISJC 2009b).
Mornington Sanctuary	AG: Science as the source of objectivity (instrumental rationality), Indigenous knowledge ignored or verified by science	At Mornington Station, active land management is coupled with comprehensive monitoring and scientific research programs, including large-scale, long-term research on issues such as fire management and the impacts of cattle grazing on flora and fauna. (Australian Wildlife Conservancy 2003). Indigenous knowledge is not utilised, although Tirralintji Aboriginal community live on an excision within the boundaries of the Sanctuary.
Wet Tropics Regional Agreement	ACoG: Science as one knowledge relative to others (strategic rationality), Indigenous knwoeldge alongside loca, farmers knowledge	A significant and innovative Aboriginal cultural mapping project, using digital video and spatially located data on GIS systems under traditional owner control, initiated as a result of the Wet Tropics Regional Agreement, sits alongside the scientific information that underpins plans and actions within the world heritage area (Roder 2008).
Dhimurru IPA, Sea Country Plan	ICoG: Wariness of science role in colonialism, Indigenous knowledge systems central and incorporate/verify science where appropriate	Dhimurru approach knowledge integration as mutual investigation of Balanda (non-Indigenous) and Yolngu systems of knowledge to support Yolngu-controlled land and sea management (Tallegalla Consultants 2000, Robinson and Munungguritj 2001).

Figure 1 : Location of case studies in Australia