



An integrated assessment of financial, hydrological, ecological and social impacts of ‘development’ on Indigenous and non-Indigenous people in northern Australia



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ARTICLE INFO

Article history:

Received 1 September 2012

Received in revised form 21 November 2012

Accepted 4 December 2012

Available online 21 January 2013

Keywords:

Agricultural development

Integrated modelling

Aquatic ecosystems

Indigenous

Economic impact

Australia

ABSTRACT

We use data and insights from several inter-related but independent projects conducted over 6 years (2006–11) in the Daly River catchment in Australia’s Northern Territory to explore the potential impacts of ‘development’ on Indigenous and non-Indigenous residents. We do this by combining economic, hydrological, and ecological data and models into an integrated model. We then use the model to assess the effect of six different types of economic ‘development’ on water resources, the habitat of aquatic resources and the incomes of Indigenous and non-Indigenous people. We combine this information with estimates of the value of aquatic resources consumed by local Indigenous people to generate estimates of the potential net impact of those development scenarios. We also discuss other social and cultural impacts likely to be associated with the degradation of aquatic resources.

Our analysis shows that Indigenous people not only have more to lose from ‘development’ which erodes natural capital than do non-Indigenous people, but they also have significantly less to gain. Under current institutional arrangements it thus seems that, at best, ‘development’ may have a relatively benign impact on their well-being. At worst, it may have a detrimental effect brought about by degradation of local aquatic ecosystems.

There are negative spill-over effects from development for non-Indigenous people too. Evidently some conservation land uses – which tend to align more closely with current Indigenous cultural prerogatives – may be better able to effectively promote the well-being of both Indigenous and non-Indigenous people than more conventional types of ‘development’.

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1. Introduction

Indigenous people around the world are at a significant socio-economic disadvantage: compared to non-Indigenous people they experience higher rates of poverty, disease, shorter life expectancy and social exclusion, as well as lower rates of education, employment and income (Leigh and Gong, 2008). The story is no different in Australia where the colonial processes of territorial acquisition and state formation have resulted in “a history of conflict and dispossession, loss of traditional roles, failed assimilation and passive welfare” (Banks, 2007, 8). Social exclusion from wider society is also a key characteristic of the indigenous experience reflected in some part in the life expectancy gap with non-Indigenous people

of 12 years (Australian Institute of Health and Welfare, 2010). Marked differences in life outcomes within Australian society give rise to depictions like those of Hunter (1999) who speaks of the existence of three “Nations” within Australia: the rich, the poor and the Indigenous.

From an economic point of view, the persistence of an “income gap”, in northern Australia at least, is unsurprising. It occurs in large part because of an underlying disjuncture between Indigenous and non-Indigenous economic systems (Stoeckl et al., 2011). However, this is but part of the development story. Economic systems are embedded within social systems, which themselves are embedded within the broader, ecological system (Costanza et al., 1997). Changes in the economic system thus impact upon the environment (and upon society), and these changes often feedback to the social and/or economic systems.

Such feedbacks are likely to be especially evident in rural and/or agricultural societies which are often heavily dependent upon the

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natural environment (Dasgupta, 2007). They are even more important in rural Indigenous societies. Indigenous peoples' cultures, identities, land and resources are “uniquely intertwined” (World Bank, 2001) and have a ‘hybrid’ economic system (Altman, 2001) in which customary activity is significant, and in which wild resources make substantive contributions to diet and livelihoods (Gray et al., 2005; Asafu-Adjaye, 1996).

‘Development’ assessments thus need to go beyond mere financial investigations, particularly in a region such as north Australia which is experiencing a re-evaluation of natural resource policies towards protection values (Holmes, 2010). Resource values are changing as residents, recreational fishers, tourists and conservationists place increasing emphasis on the amenity and lifestyle values associated with many tropical aquatic ecosystems (Stoeckl et al., 2012; Jackson et al., 2008) and with growing societal recognition of the benefits of customary Indigenous land management practices Altman and Kerins (2012). According to Holmes, the re-evaluation towards protection values coincides with a ‘belated recognition of the intractability of the obstacles to agricultural development and the constraints on intensification of pastoralism in Australia’s rangelands’ (Holmes, 2010, 268). Indeed in many regions of the world changing rural dynamics have produced demand for ecosystem services, amenities and aesthetics, and preservation of cultural landscapes, where previously production values such as growing food, fuel or fibre dominated the regional economy. The resulting policy challenge is therefore to fully evaluate development options.

Despite the fact that recent decades have seen numerous integrated interdisciplinary models that explore social, economic and/or environmental consequences of a wide array of development options, to the best of our knowledge, none have combined insights from multiple disciplines to compare and contrast impacts on Indigenous and non-Indigenous people. As noted by Godoy et al., (2005, 132), “Rigorous quantitative studies linking market economies with the well-being of indigenous peoples or with their use of renewable natural resources have yet to take off.”

This issue defines the central role of our paper: to investigate the different impacts of ‘development’ on Indigenous and non-Indigenous people in the Daly River catchment, in northern Australia – a region experiencing relatively rapid agricultural development. We do this by combining economic, hydrological, and ecological data and models into an integrated Catchment Management Strategy Evaluation (C-MSE) model. We then use the model to assess the effects of six different types of economic ‘development’ on water resources, aquatic habitats and the incomes of Indigenous and non-Indigenous people. We combine this information with estimates of the value (replacement cost) of aquatic resources consumed by local Indigenous people to generate estimates of the potential net impact of those development scenarios. We also qualitatively assess other social and cultural impacts likely to be associated with the degradation of aquatic resources (i.e. native flora and fauna obtained from rivers, creeks, wetlands, floodplains or riparian zones for the purposes of food production, medicinal use as well as art and craft production).

The paper thus provides new empirical insights about the potential impact of different types of development on water resources, aquatic habitats and on both Indigenous and non-Indigenous people. This is timely, since government water agencies are seeking integrated approaches to assessing the impacts of increasing water consumption. The paper also demonstrates, for the first time, a method for empirically integrating data and concepts from a variety of research projects across multiple disciplines to assess the differential impact of development on Indigenous and non-Indigenous people, accounting for impacts on some of the region’s ecosystem services.

2. Materials and methods

2.1. Case study region

The Daly River catchment is situated in the Northern Territory (NT) and covers just over 53,000 km² (Fig. 1).

The catchment has a mean annual rainfall of approximately 1354 mm (CSIRO, 2009) and more than 94% of the region’s rainfall is received between November and April. The river displays distinct hydrological seasonality (Kennard et al., 2010) with most discharge occurring during that period. During the wet season, river flows are likely to be between 1000 and 8000 m³/s; during the dry season (May–October), perennial flow in the main channel of the Daly River is sustained by groundwater aquifers.

The catchment is recognised for its high ecological value, with the estuary and lower floodplains satisfying waterbird-based criteria for listing as a Ramsar Wetland of International Importance (Chatto, 2006). The Daly supports the greatest number of species of freshwater turtles found in any Australian river, and the largest Australian population of pig-nosed turtle. It also contains freshwater elasmobranchs of high conservation significance (e.g. freshwater sawfish *Pristis microdon*) as well as a diverse freshwater teleost fish fauna (Pusey et al., 2011).

Cattle grazing is the dominant land-use in the region (approximately four animals km²) alongside conservation (Townsend and Padovan, 2009), although dry-land and intensive irrigated cropping are of increasing importance in the middle reaches of the Daly River, and its confluent Katherine River. In 2009, about 5% of the catchment had been cleared for more intensive land-uses such as urbanisation, pasture and agriculture (Law and Blanch, 2009) and there is increasing risk of clearing in the future.

More than 35% of the region’s workers are employed in the Government, Education, or Health sectors (Larson and Alexandridis, 2009) and there is strong interest in diversifying that narrow base. The Daly is considered to be the most prospective region for development of the Territory’s agricultural industries, in part because of its abundant groundwater (Jackson, 2006). In the upper reaches water use has increased substantially as a result of horticultural expansion and an additional 110,400 ha has been identified as being potentially suitable for agricultural development with additional dry season water extraction from surface water systems and groundwater proposed (Chan et al., 2012). Two groundwater allocation plans have been prepared within the catchment to regulate water use and manage water within sustainable limits (for the Katherine Tindal Aquifer and the Ooloo Aquifer).

Of the 10,000 people who live in the Daly, 27.6% are Indigenous (Carson et al., 2009), and as many as eleven Indigenous language groups exist in the catchment (Jackson, 2004). Indigenous people thus comprise a significant – and rapidly growing – proportion of the population.

2.2. Models used in the integrated assessment

The analysis builds upon the work of several inter-related but independent projects conducted over 6 years (2006–11). Its contribution (beyond that which has been already been made by the projects and publications depicted in Fig. 2) is to integrate economic, hydrological, ecological and socio-cultural information. The integration component encapsulated in this paper is highlighted in Fig. 2 with the use of dotted lines.

Each of the sources of information is described briefly below.

2.2.1. The economic model

Stoeckl et al. (2011) investigated various aspects of socioeconomic activity and water use in the Daly River (NT) and in one

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