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Indigenous land and sea management programs: Can they promote regional development and help "close the (income) gap"?

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Abstract

Throughout the world, there is growing recognition of the important role Indigenous people play in natural resource management and conservation. Indigenous Land and Sea Management Programs (ILSMPs; which provide funds to Indigenous people to support Indigenous land management activities) are also known to generate social and economic benefits, although relative few of these *co-benefits* have been quantified. Using northern Australia as a case study, we analysed data on ILSMP expenditure within three regional input–output tables, learning more about the size and distribution of their associated regional economic benefits. We found ILSMPs make a significant contribution to regional economies—with multipliers commonly exceeding that of other key regional industries such as agriculture and mining. We also found ILSMP expenditures make a larger contribution to Indigenous household incomes than they do to non-Indigenous incomes—thus helping to close the (income) gap. They will continue to do so, provided the proportion of ILSMP money spent on Indigenous (compared to non-Indigenous) incomes does not fall below a threshold amount. Rather than finding evidence of a trade-off between socio-ecological and financial/economic goals, our results suggest ILSMPs, known for their ecological importance, can also make a vitally important contribution to economic development in rural areas.

KEYWORDS
closing the gap, indigenous advancement, indigenous land and sea management programs, input–output analysis, northern Australia development

1 | INTRODUCTION

For tens of thousands of years, Indigenous people have been undertaking a variety of different land management activities (frequently termed caring for country in Australia) using biocultural knowledge to maintain and manage ecosystems (Ens et al. 2015; Pert et al. 2015). Governments around the world now acknowledge the critical role that Indigenous people play in natural resource management and conservation (Brondizio & Tourneau 2016). Much research highlights the significant, positive, contribution that Indigenous Land and Sea Management Programs (ILSMPs) make to Indigenous income and employment outcomes and well-being (Social Ventures Australia 2014, 2016; Barber & Jackson 2017; Larson et al. 2018). Here, we seek to contribute to the small but growing literature focused on assessing the multiple outcomes from ILSMPs, learning more about the regional economic impact of (mostly government) ILSMP expenditure and the distribution of the resulting economic gains between Indigenous and non-Indigenous people. We note that if financial gains to Indigenous people exceed those of non-Indigenous people, then ILSMPs have the potential to overcome ongoing Indigenous income disadvantage and poverty compared to other Australians.

Indigenous people view their caring for country as much more than just the physical management of a geographical location—it includes caring for all values, places, resources, stories and cultural obligations associated with an area, the associated processes of spiritual renewal, connecting with ancestors, food provision and maintaining kin relations (Altman et al. 2007). Indigenous land management activities are thus highly diverse and can be undertaken as an informal part of daily life (e.g., a bush-trip to traditional lands with the family) and/or during specifically organised occasions and rituals. The activities are generally guided by the laws, customs and ways of life inherited from ancestors and ancestral beings (Weir et al. 2011). Specific activities undertaken whilst caring for country may include the following: the collection, sharing and maintenance of customary or cultural resources (e.g., hunting, burning, knowledge sharing); actions that are undertaken to improve conditions in communities (e.g., firewood collection, management of water supplies); commercial economic activities (e.g., pastoral, art, bush harvest for sale); and threat abatement (e.g., weed and feral animal control, fire management, revegetation; Hill et al. 2013).

In Australia, Indigenous land management was first acknowledged as an important area for investment by the federal government in 1985 (Australia Committee of Review of Aboriginal Employment and Training Programs, 1985). Since then, millions of dollars have been invested in programmes that support and facilitate Indigenous land and sea management activities and investment in ILSMPs has increased markedly over time. In 2002–2003, for example, governments, philanthropic foundations, Indigenous and non-Indigenous organisations spent $2.3 million on ILSMPs. By 2011–2012, that amount had risen to almost $116 million (Hill et al. 2013) —a large per cent contributed by federal government to fund working on country programmes (which, amongst other things, by 2015 funded more than 800 Indigenous Rangers to undertake various land management activities; Commonwealth of Australia, 2015). Much funding has also gone toward establishing Indigenous Protected Areas (IPAs) currently encompassing more than

67 million hectares, comprising 44.6 per cent of Australia's National Reserve System (Commonwealth of Australia, 2017). However, a significant amount of ILSMP expenditure also occurs outside of the IPA framework (actual spend varies by region and year, however, for our study regions for 2014/15, around 10 per cent of total ILSMP expenditure related to establishing IPAs).

Although environmental considerations have been an important part of ILSMP design, social and economic objectives have also been considered (Hill et al. 2013). Indeed, numerous social, cultural and economic benefits of ILSMPs (hereafter *co-benefits*) have been identified, in addition to ecological and environmental benefits. In particular, ILSMPs are widely recognised as making important social and economic contributions to remote Indigenous communities and to Indigenous well-being (Burgess et al. 2005; Garnett et al. 2009; Social Ventures Australia, 2016; Yap 2017; Larson et al. 2018)—with many crucially important knowledge spillovers.

A wide range of co-benefits have been qualitatively described [e.g., Barber (2015)]; but comparatively few have been quantified—in Australia or elsewhere in the world (Farr et al. 2016). The Allen Consulting Group (2011) used input–output analysis to assess what they term the "economic and employment" outcomes of the working on country programme. "Flow-on" benefits of programme expenditures were clearly identified as the money earned by those funded to undertake various land management activities (e.g., salaries earned by Indigenous rangers) respent within the local economy (e.g., purchasing food at a local store), thus generating additional regional economic benefits. However, their research did not distinguish between indirect (or flow-on) benefits accruing to Indigenous and non-Indigenous people.

At least some of the substantial and observable economic "gaps" between Indigenous and non-Indigenous people have been attributed to differences in the structure of their economies. In rural and regional areas, non-Indigenous economies operate much like the broader Australian economy with markets facilitating transactions; in exchange for money, businesses provide goods and services to households and households provide labour to businesses. But the Indigenous economy, termed a "hybrid economy" by Altman (2001), has a different structure: it has market (business), customary and state (i.e., government) components, with complex linkages and interdependencies between them. Indigenous people make a relatively small contribution to the production side of the market sector. Few Indigenous people work within non-Indigenous businesses (Hunter 2014) and very few Indigenous people own businesses that supply goods and services to non-Indigenous people (Stoeckl et al. 2011).[1] So for Indigenous people, the market is there, primarily, for "consumption". Most Indigenous "production" occurs within the customary sector as when, for example, people go out on country, for a variety of inter-connected reasons and activities described above, some of which are associated with the collection or "production" of goods or services which non-Indigenous people normally only obtain through market transactions. In Indigenous economies, the state is often the dominant provider of money and services (such as health and education).

Not only do Indigenous and non-Indigenous economies differ structurally, but there is a disjuncture between the two characterised by asymmetric financial flows (Stoeckl 2010), which has potentially significant implications for policy and "trickle down" economics. Because Indigenous people are not generally involved in mainstream production, they are constrained in their ability to exchange money for labour (or business services). When policy provides a stimulus to the non-Indigenous economy, the money generated generally remains within the non-Indigenous economy (or flows out of the region in the form of taxes, savings, or imports); very little of the money "trickles down" into the Indigenous economy. In contrast, when policy provides a stimulus to the Indigenous economy, a large proportion of that money flows quickly to the

non-Indigenous economy, as many of the purchases made by Indigenous people are for essentials such as food and housing, the supply of which is generally provided by non-Indigenous people and businesses (Stoeckl et al. 2013). ILSMP expenditure may thus potentially increase Indigenous incomes, whilst simultaneously *widening the (income) gap*. This would occur if the total benefits of ILSMP expenditure accruing to Indigenous people are less than those accruing to non-Indigenous people (who are likely to be recipients of the largest share of flow-on expenditures).

Our paper focuses on this conundrum, examining how investment in ILSMPs flows through to these divided Indigenous and non-Indigenous economies in northern Australia. Specifically, we seek answers to the following questions:

1. How does the stimulus provided to regional economies by ILSMP expenditure compare to the stimulus provided by other industries (e.g., mining, agriculture) that are important to northern Australia?
2. Do the total income benefits that flow to Indigenous people from ILSMP expenditure exceed those of non-Indigenous people (after accounting for both direct initial expenditures, and also indirect flow-on expenditures)?

The paper is structured as follows. In section 2 we provide social, demographic and economic data giving an overview of our case study regions. In Section 3 we begin by justifying our modelling approach, and then describe the modifications we made to existing I-O models (required to address our core research questions). Section 4 focuses on our ILSMP expenditure data, explaining the way in which we combined information from various sources to generate estimates of total ILSMP expenditure within each region, and the distribution of that spend across the industry sectors relevant to our I-O models. Section 5 summarises our estimation methods. Results are presented and discussed in Section 6, paying particular attention to the sensitivity of results to assumptions made during the analysis, and conclusions are presented in Section 7.

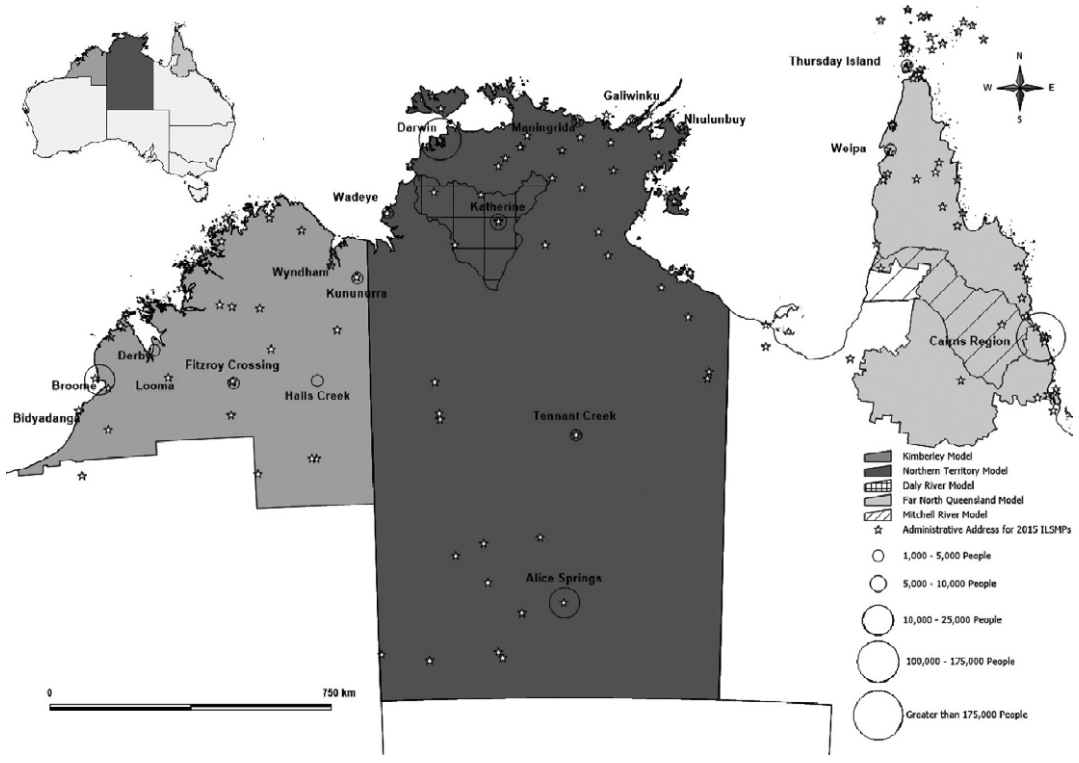
2 | CASE STUDY REGIONS

Northern Australia, including the Kimberley region of Western Australia, the Northern Territory (NT) and Far North Queensland (FNQ), was selected as our specific study area(s) (Figure 1), based on dual criteria of significant ILSMP expenditure (section 4), and the public availability of appropriate models with which to analyse that expenditure (section 3) across northern Australia. The Kimberley refers to the Kimberley SA3 region as defined by ABS 2011 Australian statistical geography standard, the NT refers to the entire Territory, and FNQ refers to two combined ABS regions, being the SA4 region of Cairns and the SA3 region of Far North Queensland. Key socioeconomic information about each region is provided (Table 1).

The Kimberley is remote and sparsely populated, without major regional cities. The largest town is Broome, other urban centres include Kununurra, Derby and Fitzroy Crossing; the closest major city, Perth, is 2,300 kms south of Broome.[2] The NT is also relatively remote and sparsely populated, and includes one major regional city, Darwin, on its northern coast.[3] FNQ comprises a mix of relatively urban and rural/remote areas, including the city of Cairns, islands of the Torres Strait and Cape York Peninsula.[4] Indigenous people are strongly represented across these regions, as shown in Table 1.

In 2011 (the most recent year for which appropriate census data are readily available), median weekly incomes in the Kimberley and NT were higher than for Australia as a whole, due to the

FIGURE 1 Study area showing geographical areas covered by our three (adapted) I-O models, the location of organisations receiving ILSMP funding during 2014/15 and the main population centres. Boundaries of Daly River (NT) and Mitchell River (QLD) catchments also shown (we later compare our I-O multipliers with those generated from models developed for these regions). Map courtesy of Wolf Stoeckl



particularly high median incomes of non-Indigenous workers; when comparing median wages of the Indigenous population alone, earnings are less in all three regions than at the national-level. Indigenous people are more likely to be employed as labourers or community and professional service workers, and less likely to be employed as managers, professionals, technicians or clerical workers than their non-Indigenous counterparts (Deloitte Access Economics, 2014). Government services (including administration, health, and education) are the largest employer in the study region, with manufacturing employing very few people across the north (Table 1). Some sectors are large employers in specific regions, for example, mining employs about 10 per cent of the Kimberley workforce, whilst tourism is an equally large employer in FNQ.

3 | MODELS AND MODELLING APPROACH

Computable general equilibrium (CGE) models are the theoretically desirable way in which to assess the regional economic impact of expenditures (Stoeckl 2007), as they explicitly account for dynamic economic interdependencies and relative price fluctuations (Gretton 2013). Unfortunately, we could find no existing CGE model equipped to address our particular research questions,[5] and thus chose to adapt three, publicly available input–output (I-O) models[6] specifically developed for our case study regions. The imperfections of our approach mean that our insights are most usefully

TABLE 1 Socioeconomic background on the study regions, compared to Australia as a whole

	Kimberley	NT	FNQ	Australia
Area (hectares'000)[a]	41,956	135,316	27,222	768,849
Population (persons)[b]	34,793	211,943	254,318	21,507,719
Indigenous population as % of total[b]	40%	27%	5%	3%
Median weekly gross personal income by usual place of residence (UPR; 2011 $)[b]	$667	$745	$552[d]	$577
Median weekly gross personal income by UPR: Indigenous persons (2011 $)[c]	$288	$269	$340	$362
Median weekly gross personal income by UPR: non-Indigenous persons (2011 $)[c]	$987	$925	$592	$582
Median weekly gross personal income by place of work (POW): Indigenous persons (2011 $)[c]	$651	$628	$650	$741
Median weekly gross personal income by POW: non-Indigenous persons (2011 $)[c]	$1,210	$1,112	$819	$914
Major industries of employment—top four sectors for each region (% of employment)[b]				
Government services (including administration, health, education, defence)	33%	40%	31%	26%
Wholesale and retail trade	9%	10%	15%	15%
Manufacturing				9%
Construction		8%		8%
Other services including personal services	10%	8%	8%	
Mining	10%			
Accommodation and food services			10%	

Sources: [a]ABS

[b]Census 2011 data from ABS

[c]Estimated from Census 2011 data accessed from ABS TableBuilder: Personal weekly income for all persons within the region by Indigenous status was extracted; those census respondents identifying as Aboriginal, Torres Strait Islander or both Aboriginal and Torres Strait Islander were combined to provide data on Indigenous persons, all other respondents were classified as non-Indigenous

[d]Weighted average of census 2011 data from ABS for the Cairns SA4 and FNQ SA3 regions.

considered in relative terms (e.g., noting that one type of industry is likely to have a larger impact than another; or that one type of household reaps larger benefits than another). We urge readers not to use results as if they are definitive, precise estimates of "impact". We welcome any, indeed all research, which provides data and/or models that helps improve upon those described here.

Detail on the methods and data used to prepare these original tables can be found within Johnson (2001), Murti (2001), and Office of the Government Statistician Queensland Government (2004). Our adaptations, described in the subsections below, allow us to: (1) compare modelled outputs across the three regions; and (2) differentiate two household sectors (Indigenous and

non-Indigenous). Thus, we can assess the relative benefits of ILSMP expenditure accruing to each household type.

We recognise the inherent limitations of I-O analysis which are widely discussed in the literature [e.g., Isard (2017); Miller and Blair (2009); Miyazawa (2012)]. Whilst some I-O limitations (e.g., failure to account for price feedbacks) means that I-O models can overstate the financial impact of stimuli, other I-O limitations (e.g., ignoring spill-over benefits such as knowledge exchange) mean that I-O models understate impacts (Gretton 2013). The size of any over or underestimate will depend, crucially, on context [e.g., in regions with very low (high) unemployment, price feedbacks will likely be high (low)]. But we do not have the luxury of being able to access impact estimates that have been from CGE models so cannot say, a priori if our I-O models will, on balance, over or underestimate "true" impacts. We thus urge readers not to use our estimates literally (e.g., by concluding that expenditure of $\$x$ will generate an impact of $\$y$), and instead focus attention on our more robust relative messages (e.g., that multiplier A is greater than multiplier B).

3.1 | Adaptation: standardising industrial sectors

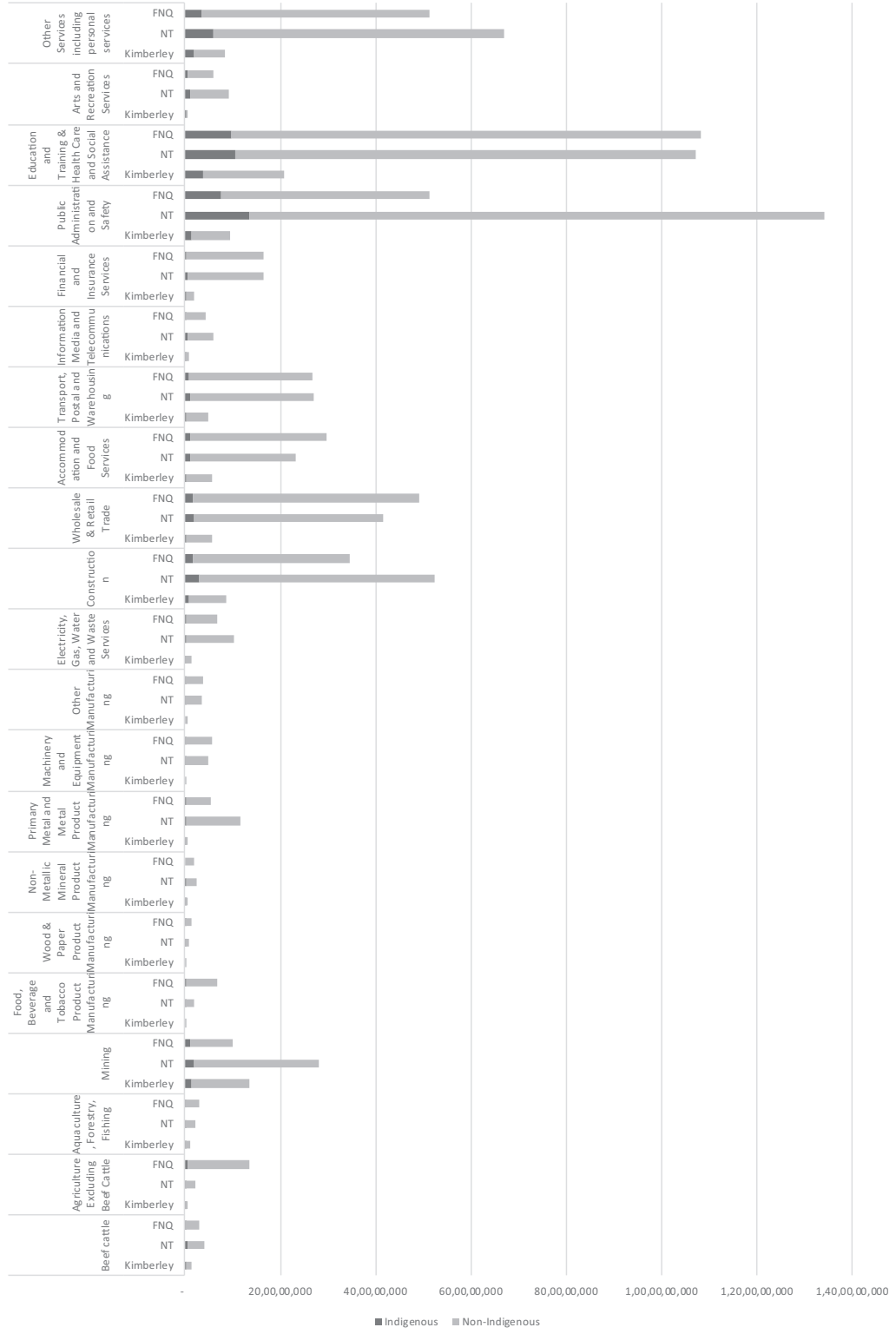
The Kimberley, NT and FNQ I-O tables focus on the inter-industrial configuration of their respective regions, representing the dominant industrial sectors within each region in greater detail. Thus, each model comprised different numbers of industry sectors with differing levels of aggregation; the Kimberley I-O table was a 38 sector model, the NT table had 50, and FNQ had 34. To enable inter-regional comparison of the estimated multipliers, a standardised list of 22 industry sectors (Figure 1) was prepared by aggregating the inputs and outputs for all sectors in each of the I-O tables.[7]

3.2 | Adaptation: reflecting differences between Indigenous and non-Indigenous households

The I-O tables were modified to facilitate comparisons between Indigenous and non-Indigenous incomes with a two-step approach used in previous research (Stoeckl et al. 2011, 2013): (step 1) disaggregate regional employment and income by household Indigenous status; (step 2) disaggregate expenditure patterns by household Indigenous status.

First, we disaggregated employment and income data by household Indigenous status.[8] Census 2011 data on income, industry of employment and Indigenous status of workforce participants (Australian Bureau of Statistics, 2011) was used to identify the number of Indigenous and non-Indigenous workers within each of our 22 standardised industrial sectors. We then estimated the proportion of total income paid to Indigenous and non-Indigenous workers for each sector (Figure 2) and estimated mean and total incomes for Indigenous and non-Indigenous workers within these regions (Table S1 within Supplementary Materials). Crucially, the ABS reports relevant census income and employment data in two ways: according to a person's *Usual Place of Residence* (UPR) or according to a person's *Place of Work* (POW). If all people live and work in the same locality, then it matters not which measures one uses—they will be identical. But if workers regularly commute, then UPR and POW data relating to income and employment will differ. Furthermore, the UPR data includes all persons (aged above 15) whether or not they were part of the labour force, whilst POW data only includes persons (aged above 15) who worked in the week prior to Census, thus excluding those who are unemployed who may have low-incomes (particularly those dependent on government support). In our focal regions, these measures

FIGURE 2 Estimated proportional allocation of gross annual income by household Indigenous status and sector, based on place of work, Census 2011 (Australian Bureau of Statistics, 2011; 2011 $)



differed—likely reflecting the fact that many people "commute" to work (as, e.g., *Fly-in-fly-out* and *Drive-in-drive out* miners) and that there are large numbers of people who are outside of the labour force.

In an ideal world, one would use a multi-regional model that captures commuter's earning, and spending patterns to account for differences, as not all money will be spent at either one's UPR or one's POW (Hermannsson 2016). But we do not have access to such a model: neither do we have detailed information about the spatial earning and spending patterns of commuters. We thus developed two different sets of models: the first using POW data, the second using UPR data. We recognise that neither adequately models exactly what is going on, but together, they likely define *plausible* boundaries, and using both helps determine the extent to which final estimates of impact are sensitive to assumptions regarding the location in which most spending occurs.

The estimated share of incomes going to the Indigenous population is small (overall, 12.1, 7.7 and 6.7 per cent by POW and 13.3, 7.5 and 6.1 per cent by UPR in Kimberley, NT and FNQ respectively), despite Indigenous people comprising 15–40 per cent of the populations of these regions (Table 1). Thus, although the use of POW or UPR impacts upon the absolute values of mean, median and total incomes, the ratios of incomes flowing to households differentiated by household status remain similar whichever approach is adopted. Focusing on POW data, the public sector has the larger proportion of incomes paid to Indigenous workers. Mining, despite its larger contribution to national GDP, is not one of the largest (direct) employers. These estimates are unlikely to be precise due to the census generally undercounting Indigenous people, as well as assumptions made to calculate the figures. However, the results are consistent with other studies of northern Australia (Stoeckl et al. 2011, 2013), and with studies focusing on the differences in labour force status and income between Indigenous and non-Indigenous Australians (Hunter & Yap 2014; Kalb et al. 2014). Differences in Indigenous and non-Indigenous household incomes are due to lower labour force participation rates for the Indigenous population and their higher unemployment rates, nationally and within each state and territory (Deloitte Access Economics, 2014).

Secondly, we disaggregated household expenditure by Indigenous status. No publically available household expenditure data, differentiated by the Indigenous status of household occupants (the ABS Household Expenditure survey does not collect information regarding the Indigenous status of respondents) were located. However, Stoeckl et al. (2011) found that Indigenous households spent a larger share of their total expenditure within the retail sector than their non-Indigenous counterparts; they were also more likely to purchase goods and services locally. Each of our I-O models was thus adapted to reflect those findings. First, we divided the total household expenditures within each industry into Indigenous and non-Indigenous expenditure, based on population. Expenditure within each household sector was then adjusted to reflect differences in expenditure by household Indigenous status based upon the percentage of household expenditures spent with various different local industries in the regions reported by Stoeckl et al. (2011).[9]

We recognise that final results could be significantly influenced by these assumptions about household expenditure, but are unaware of any other data or models with which we could compare our findings (thus testing their plausibility). We thus chose to develop two different variations of our models: the first assuming that household expenditure patterns were identical for Indigenous and non-Indigenous households; the second using the inferred expenditure estimates that are described above. Using both helps determine the extent to which final estimates of impact are sensitive to assumptions regarding household expenditure.

4 | ILSMP EXPENDITURE IN THE CASE STUDY REGIONS

Table 2 summarises regionally relevant data collated using the methodology set out in Hill et al. (2013), who undertook an extensive search of online sites and documents supplemented by information provided directly by the Indigenous Land Corporation to compile information about ILSMP expenditures. The largest components relate to IPAs and Indigenous Ranger/working on country projects, with most money used to fund various (Indigenous) ranger programmes. Expenditure within the NT exceeds that of the other regions considerably; at least partly due to its size (relative to our other regions).

Our key source of information relating to the sectoral composition of ILSMP expenditure was the (anonymised) land management expenditures for projects funded by the Department of Prime Minister and Cabinet (PM&C) during 2014/15. The level of detail provided varied across projects; in some cases, we needed to estimate the allocation of expenditure between specific expenditure categories, using insights and information from: (1) other project expenditures which provided more detail; (2) the aggregated information relating to various projects compiled as described by Hill et al. (2013); and (3) literature regarding the operations of ILSMPs. Estimates of the composition of ILSMP expenditure across different categories are set out in Table 3.

The largest proportion of expenditures relates to salaries and other related employment costs; this is especially true for projects that employ local rangers within the regions to work on a variety of land management related projects. Furthermore, a large proportion of salary expenditure relates to the employment of Indigenous workers, given that a key objective of many of the ILSMPs is to ensure that Indigenous knowledge and practices are used to best effect. ILSMPs also provide training for project employees: this expenditure is over and above "normal" wages and training costs. Other ILSMP expenditures include office and administration costs, and overheads such as legal and accounting costs, and equipment, machinery and vehicles acquisition. A further category of expenditure relates to consultancy costs; many ILSMPs include feasibility or scoping studies, and may require the development of project management strategies. Whilst some of this expenditure may be spent with consultancy organisations outside the local region, this is not thought to generally be the case; local advisers are used to provide advice where possible.

We combined the Hill et al. (2013) information about total ILSMP expenditure (Table 2), with our estimates of the share of expenditure spent within each industry sector (Table 3) to estimate total ILSMP expenditure within each industry sector, for each region, during 2014/15 (Table S2 within Supplementary Materials).

Recognising the potential sensitivity of results to assumptions made about ILSMP expenditure (in addition to those relating to Indigenous/Non-Indigenous household spending and the use of income data from POW versus UPR), we also generated alternate expenditure "scenarios". In

TABLE 2 Number and value of ILSMPs (2014/15)

ILSMPs	Kimberley	NT	FNQ	Total ILSMPs in northern Australia
Number	29	64	52	145
Total value of expenditure (2014/15 $)	$10,438,656	$46,507,861	$22,642,596	$79,589,114
Average expenditure (2014/15 $)	$359,954	$971,972	$435,435	$548,890

Source: database compiled by authors of Hill et al. (2013) using methodology described in that report.

TABLE 3 Analysis of different types of ILSMP expenditure 2014/15 across different industries receiving that expenditure

		Estimated % of ILSMP expenditure spent within each industry sector		
Description of expenditure type	**Industry/sector**	**Kimberley**	**NT**	**FNQ**
Wages paid to Indigenous staff employed by ILSMPs—assumes majority of employees are Indigenous.	Indigenous—compensation of employees	38%	41%	37%
Wages paid to non-Indigenous staff employed by ILSMPs—assumes non-Indigenous employees form a small proportion of the total.	Non-Indigenous - Compensation of employees	13%	13%	12%
Costs incurred in training ILSMP staff, assuming spent with local training organisations—TAFE, private training firms etc.	Education and Training & Health Care and Social Assistance	2%	1%	2%
Equipment and machinery purchased locally—tools, tractors, etc.—for use in the programmes.	Machinery and Equipment Manufacturing	0%	2%	1%
Payments made locally for consumables used for operations of the programmes	Wholesale & Retail Trade	6%	11%	9%
Payments made locally for fuel and other costs relating to vehicles used in the programmes, plus other programme-related transport costs	Transport, Postal and Warehousing	5%	3%	9%
Payments to local property businesses in the region for office costs incurred by the programmes	Financial and Insurance Services	3%	3%	5%
Payments to local businesses for services supporting operations of ILSMPs (e.g., accounting, grant application support, Website development, secretarial help) plus consultancy services provided for programmes requiring feasibility and scoping studies etc.	Other services including personal services	17%	15%	15%
Total initial expenditure assumed to be spent within the region		84%	89%	90%
Employment-related costs such as taxes, superannuation that flows outside the region	Taxes etc.	11%	11%	7%
Payments made to organisations outside of the region	Imports	5%	0%	3%
Total initial spend on ILSMPs		100%	100%	100%

Source: Anonymised data from individual projects provided by PM&C and analysed by authors.

each case, we used an "average" total programme spend of $548,890 (from Table 2), altering the way in which the money was spent:

1. Base case – assumes that project expenditure is allocated across industry sectors consistent with our best estimate of the actual spending patterns on ILSMPs in 2014/15 in each the region (Table 3).

2. Human capital bias – here we assume that 60 per cent of programme money is spent on Indigenous incomes with the balance spent on training (in economic parlance; "human capital").
3. Physical capital bias – here we assume that 60 per cent of programme money is spent on Indigenous incomes with the balance spent on purchasing machinery and equipment (i.e., "physical capital").

5 | ESTIMATION METHODS

In the first case, we used our (adjusted) I-O models to estimate economic "multipliers" for each of our 22 key industries—for each industry, assuming that there is a one-dollar increase in demand for its final product, and then determining the resultant (summed) demand for all industry products, allowing for both that initial one-dollar increase, and also indirect expenditures with other industry.

Next, we used each of our (adjusted) I-O models to estimate the regional economic impact of the ILSMP expenditures. For the purposes of the I-O analysis, ILSMPs expenditure was treated as an exogenous injection into the local economy. We estimated three different ILSMP multipliers—the first using our (best estimate) of current expenditure patterns, the second using expenditure patterns with a human capital bias, and the third assuming ILSMP expenditure programmes have a physical capital bias. In each case, modelled estimates of the total regional impact of ILSMP expenditure was divided by estimates of initial expenditure, to estimate ILSMP multipliers that could be compared with the preceding industry multipliers.

As many (most) ILSMPs also create employment for non-Indigenous people (hiring, for example, non-Indigenous programme coordinators), we also ran a series of simulations (sensitivity analyses) to determine how far first-round (direct) expenditures on Indigenous salaries could fall, before the total (direct and indirect) increase in non-Indigenous salaries exceeded that of Indigenous salaries.

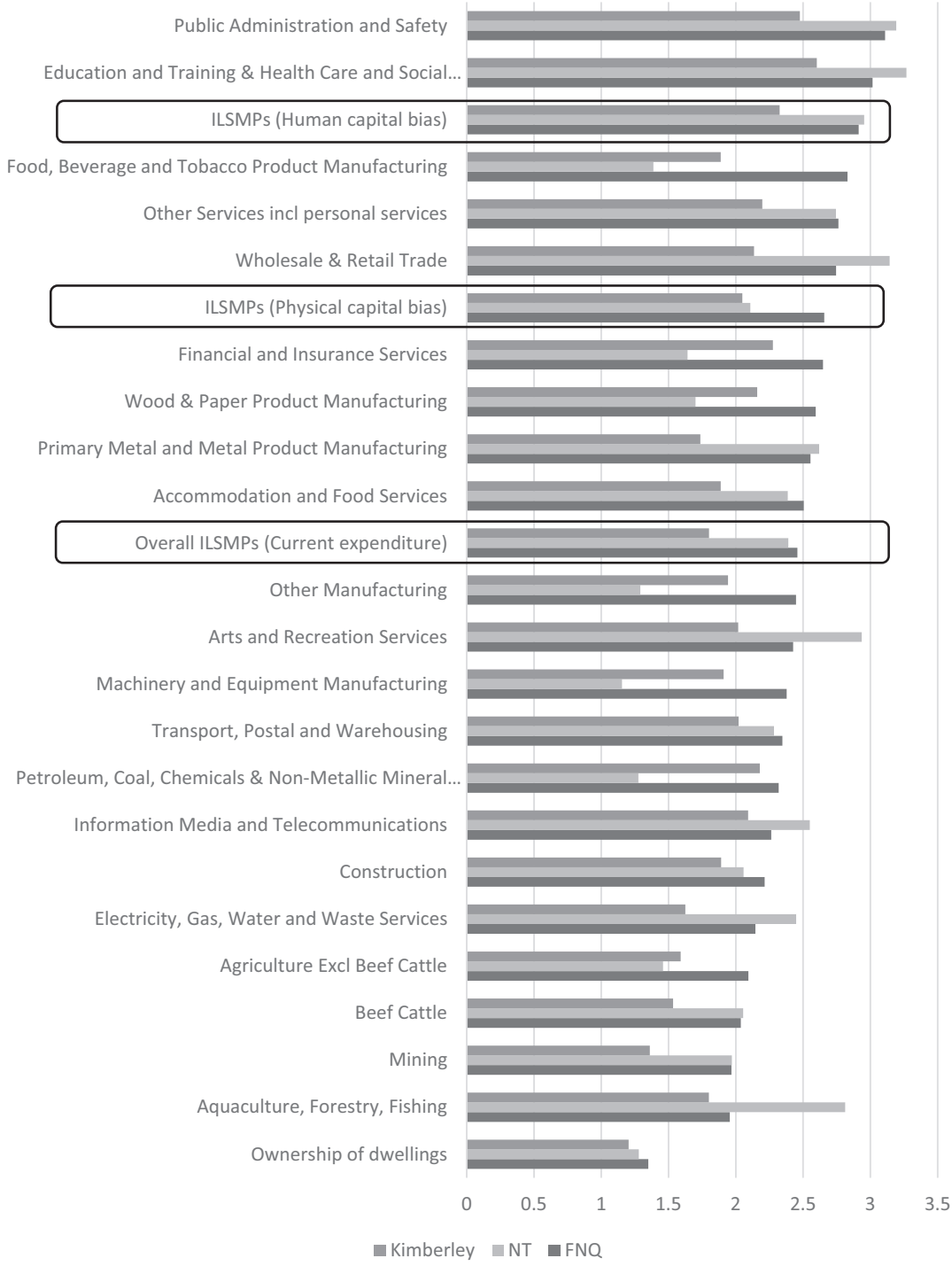
6 | RESULTS AND DISCUSSION

6.1 | ILSMP multipliers compared to other industry multipliers

Figure 3 shows our estimates of the *Type II* multipliers associated with each of our models' industry sectors, for each of the three regions, using (1) the POW employment and income data, and (2) household expenditure estimates that differentiate between Indigenous and non-Indigenous households. Multiplier estimates generated from the models using UPR employment and income data are available on request but were only different from the POW estimates, if looking beyond three decimal places, so we have not presented them here. Similarly, multiplier estimates that were generated from models that assumed household expenditure was identical between Indigenous and non-Indigenous households did not differ unless looking beyond three decimal places, so we do not present them either. These results are available on request.

In addition to showing multiplier estimates for each of the 22 industry sectors, we also show our estimated ILSMP multipliers, which are associated with (1) base expenditure; (2) expenditure focused on human capital; and (3) expenditure focused on physical capital (machinery and equipment).

FIGURE 3 Estimated multipliers by industry sector (based on models using incomes by place of work and household expenditures that differentiate between Indigenous and non-Indigenous households



First, we note that the size of multipliers varies systematically across regions. Much of this is due to scale: geographical (NT is significantly larger than the other regions); demographic (the Kimberley is far less populous than the other regions); and economic (two regions include major regional cities, Darwin in the NT and Cairns in FNQ, whereas the Kimberley includes no major city). Differences in scale impact the number and composition of businesses in each region, which impact the multipliers: if there are few businesses within a region, then there will be relatively little local "re-spend", and thus smaller multipliers (Stoeckl 2007). For our models, multipliers in the Kimberley are almost always smaller than in the other regions, whilst most (but not all) of the NT's multipliers are smaller than those of FNQ, which are in turn, smaller than multipliers associated with Australia as a whole [estimated to range from just over 2 for petroleum and coal products to 3.3 for wholesale trade (Australian Bureau of Statistics, 2004)]. We compared our multiplier estimates with those generated from other I-O models across northern Australia—supporting the hypothesis that (all else constant) the smaller the region, the smaller will be associated multipliers. This comparison is set out within Table S3 within Supplementary Materials. Multipliers generated from a catchment scale model of the Daly River Model (shown in Figure 1) are generally smaller than those for the whole of the NT, and the multipliers associated with the Mitchell River catchment (also shown in Figure 1) are generally smaller than those for FNQ.

Methodological differences in the preparation of the source I-O tables are likely also at least partially responsible for systematic differences in estimated multipliers across regions, although research suggests that differences in the economic structure of rural communities and in the production and purchasing patterns of rural businesses are potentially more significant drivers of differences in multipliers (Stoeckl 2012). Underlying methodological differences in the construction of the I-O tables used in our analysis are therefore unlikely to account for all of the differences identified within this study.

We note also that there are significant differences in multipliers for different industries—and for some (other than mining and agriculture), these differences play out differently at large and small scales. Businesses in different industries tend to spend money differently: capital intensive industries such as mining, which require little labour and employ few people, have smaller multipliers (Johnson 2001; Murti 2001), compared to labour-intensive industries (such as those in the services sector), and thus generate comparatively small knock-on effects. It is not, therefore, surprising to find that for our models, "Public Administration and Safety" and "Education and training & Healthcare and social assistance" generate the largest multipliers, as these labour-intensive sectors are by far the largest employers in each of the regions (Figure 2).

This point is underscored when considering the three different multiplier estimates we have generated for ILSMPs. For each region, the largest estimated ILSMP multiplier is that which is related to an assumed expenditure pattern that uses 60 per cent of all monies for wages for Indigenous people, and the rest on Human Capital (e.g., training). Indeed for this assumed expenditure pattern, multipliers are amongst the highest of all industries (alongside "Public Admin and Safety"; "Education and training". Other ILSMP multipliers vary by region—in the NT the multiplier associated with current expenditure is larger than that which is associated with an expenditure pattern that would use 60 per cent of all money for the wages of Indigenous people, with the rest on machinery and equipment. In both the Kimberley and FNQ, multipliers associated with current expenditures are lower than those associated with our other (contrived) expenditures.

As discussed above, some of these differences are associated with scale (if one were interested in regional impacts for smaller regions within the NT or FNQ—e.g., the catchments depicted in Figure 1), then one would expect multipliers to be smaller—reflecting the fact that one cannot

purchase many goods and services "locally" (a likely problem in very remote areas). Some of the differences will also reflect differences in existing expenditure patterns. To better gauge the extent to which differences were attributable to (1) scale/model, and to (2) expenditure patterns, we generated different multiplier estimates for ILSMP. We used different I-O models (Kimberley, NT and FNQ) and assumed different ILSMP expenditure patterns (Table 4). Most evident, is the fact that multiplier estimates vary more by model, than by expenditure patterns, highlighting the importance of scale—the regional economic impact of ILSMPs are larger for a state/territory, than for a small region within it. There is some evidence to suggest that the expenditure patterns associated with ILSMP programmes undertaken in FNQ generate more "impact" than those of other regions, but differences across regions are core: the bigger the region's population/economy, the bigger the estimated impact.

Those points aside, at 1.8, 2.4 and 2.5 respectively (Table 4), the multipliers associated with (current) ILSMP expenditures in the Kimberley, NT and FNQ are generally higher than many of the other key industries flagged for special attention in the Northern Development Agenda—specifically, Beef, Other (Non-Beef) Agriculture, Mining (Figure 3). This assumes that expansion of the other industries occurs "exogenously" (e.g., through an increase in demand for their output, not because of the construction of, for example, a dam, the construction of which, would provide regional economic stimulus). The multipliers associated with ILSMPs are also generally higher than multipliers associated with different types of manufacturing (although there are regional differences); so too for construction, transport and finance. This has significant policy implications, highlighting that ILSMPs are not only good for the environment (Commonwealth of Australia, 2015, 2016), and Indigenous communities (generating social and economic outcomes; Barber 2015; Burgess et al. 2005; Garnett et al. 2009), but they are also a good way in which to promote more general regional economic development.

6.2 | Comparison of increases in Indigenous and non-Indigenous household incomes

Table 5 provides estimates of the total impact of ILSMPs on the economies of the Kimberley, NT and FNQ in 2014/15: $18.8 m, $111.1 m and $55.6 m, respectively ($185.6 m in total). With initial expenditure of $79.6 m (total expenditure from federal, state and territory governments plus funding from philanthropic sources), our modelling suggests that ILSMPs generate an additional regional economic benefit of $106.0 m, over and above direct ILSMP expenditures.

For Indigenous people, the total increase in wages from direct and indirect expenditures associated with current ILSMP expenditures was $4.4 m in the Kimberley, $20.1 m in NT and $8.8 m in FNQ[10] (for estimated Indigenous populations of: 13,924; 56,778 and 38,672 respectively). The associated increases in wages for non-Indigenous people were: $3.9 m in the Kimberley, $19.7 m in the NT and $12.1 m in FNQ (for estimated non-Indigenous populations of 20,869; 155,165 and 215,646 respectively). For two of our three regions, the total stimulus

TABLE 4 Comparison of multipliers estimated within each study region based upon the patterns of ILSMP expenditure from each region

	Kimberley Model	NT Model	FNQ Model
Kimberley expenditure patterns	1.80	2.26	2.31
NT expenditure patterns	1.90	2.39	2.45
FNQ expenditure patterns	1.92	2.38	2.46

TABLE 5 Estimated financial benefits from ILSMP expenditure by region (for 2014/15, shown in 2014/15 $)

	Kimberley	NT	FNQ
Initial (direct) expenditure on ILSMPs in 2014/15 $	10,438,656	46,507,861	22,642,596
Estimated initial incomes paid to Indigenous households within direct expenditure $	3,966,689	19,068,223	8,377,761
Estimated initial incomes paid to non-Indigenous households within direct expenditure $	1,357,025	6,046,022	2,717,112
Total regional impact on the economy $	18,798,764	111,138,830	55,638,421
Indirect ("knock-on") impact $	8,360,108	64,630,969	32,995,825
Overall multiplier effect	1.8	2.4	2.5
Direct and indirect increase in Indigenous incomes $	4,356,068	20,056,046	8,835,883
Direct and indirect increase in non-Indigenous incomes $	3,950,073	19,753,159	12,110,735
Indirect increase in Indigenous incomes (resulting from multiplier effects) $	389,379	987,823	458,123
Indirect increase in non-Indigenous incomes (resulting from multiplier effects) $	2,593,047	13,707,137	9,393,623

accruing to Indigenous people, as wages, is larger than that accruing to non-Indigenous people. In these regions, ILSMPs are, unambiguously, helping to close the (income) gap. In FNQ, the wage-based income increase in non-Indigenous households is larger than that of Indigenous households; but one needs to be careful not to interpret that as suggesting the ILSMP expenditure is widening the gap—one should, instead, compare increases per household. The increase in Indigenous household incomes (per household) exceeds the increase in non-Indigenous incomes per household, across all of the regions, including FNQ. A similar conclusion holds if dividing total increases in Indigenous and non-Indigenous incomes by respective populations (rather than households). So too, does this hold, if considering impact estimates generated using the I-O models that have been modified using (1) the UPR data (rather than the POW), (2) assumed similar expenditure for Indigenous and non-Indigenous households; and (3) the different ILSMP expenditure scenarios described above (where we assumed a human capital or physical capital expenditure bias)—see Tables S4 and S5 within Supplementary Materials for detailed results.

Our sensitivity analysis suggests that first-round (direct) expenditures on Indigenous salaries could fall to as low as 46.1 per cent in Kimberley, 31.6 per cent in NT, and 18.7 per cent in FNQ, before the ILSMPs started to *widen the gap* (making a larger contribution to non-Indigenous than to Indigenous incomes).

7 | CONCLUSIONS

The ILSMP multipliers which we estimated (using a range of different modelling and expenditure assumptions) were generally larger than the multipliers associated with other key regional

industries (specifically those associated with agriculture and mining). Thus, independent of outcomes specifically benefitting the Indigenous communities or the environment, it is clear that ILSMPs have an important role to play in the economic development of northern Australia.

Our analysis also highlights the contribution that ILSMPs can make to Australia's *Indigenous Advancement Strategy*, and to the government's stated goal of *closing the gap*. Non-Indigenous people benefitted significantly from these programmes (particularly through indirect, "knock-on" expenditures), but in general the total benefits of ILSMP expenditures flowing to Indigenous people exceeded those flowing to non-Indigenous, thus helping to close the (income) gap. This would not be the case if initial expenditures on Indigenous salaries were to fall below (about) 46.1 per cent in Kimberley, 31.6 per cent in NT, and 18.7 per cent in FNQ.

The size of the total regional impact of ILSMPs, and the distribution of benefits (to business, Indigenous and non-Indigenous households) depends upon: (1) total spend; (2) the distribution of initial spend (e.g., mostly on labour, or a split between labour and capital); (3) regional expenditure patterns; and (4) the size of the region considered. This has several related policy implications:

1. If wishing to maximise the economic impact of expenditure in rural/remote regions, then one must focus ILSMP expenditure on the goods and services that are available within those regions—otherwise benefits will be incurred outside the key area of interest;
2. Assuming goods and services are available locally, if seeking to maximise the regional economic impact of ILSMPs, then one should encourage programme managers to purchase required goods and services (business supplies) from "local" (regional) businesses (rather than importing goods and services from outside the region);
3. If goods and services are not available locally, consideration could be given to the idea of using policy to help start or develop new businesses that could supply those goods and services (this will not always be feasible); and
4. If seeking to maximise benefits accruing to Indigenous people, then one should encourage managers of ILSMPs to hire Indigenous people at all levels, to purchase business supplies from business that are owned by (or at minimum, employ many) Indigenous people, and wherever possible, support the training of Indigenous people, and the development of Indigenous enterprises (which may in future, be able to become part of a "supply chain").

Our research highlights that ILSMPs also make a significant contribution to the incomes of non-Indigenous households and businesses. This is in addition to other crucially important contributions ILSMPs make to Indigenous well-being (Larson et al. 2018) and to the longer-term impacts that associated knowledge transfers generate (another important topic for future research). ILSMPs also support ecosystem functions and are known to have significant positive impacts on a range of other social and cultural values (Social Ventures Australia, 2014, 2016). These broader positive impacts of ILSMPs (not always apparent in mining or agriculture) may allow Indigenous communities to leverage opportunities to develop other privately funded enterprises, thus leading to longer-term gains for all (including reduced demands on government budgets to deal with the consequence of poverty (Taylor & Stanley 2005). Far from there being a trade-off between socio-ecological and financial/economic goals, our results strongly suggest that ILSMPs, known for their ecological importance, also have a vitally important contribution to make to the economic development of rural/regional areas.

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ENDNOTES

[1] Although Indigenous owned business are far more likely to employ Indigenous workers than non-Indigenous owned businesses (Forrest 2014; Hunter 2014), such enterprises comprise a small proportion of all businesses across Northern Australia.

[2] Based on 2016 Census data, Broome Significant Urban Area (SUA) has a population of 13,984, of whom 21 per cent Indigenous; Kununurra Urban Centre and Locality (UCL) has a population of 4,341, 26 per cent Indigenous; Derby UCL population is 3,325, 47 per cent Indigenous; and Fitzroy Crossing UCL population is 1,141, 58 per cent Indigenous. The population of Perth SUA is 1.9 m.

[3] Based on 2016 Census, the population of Darwin SUA is 123,574, of which 9 per cent Indigenous.

[4] Based on 2016 Census, the population of Cairns SUA is 144,787, of which 9 per cent Indigenous.

[5] The Enormous Regional Model (Victoria University 2016), for example, provides information on our geographic regions of interest, but does not differentiate between Indigenous and non-Indigenous households.

[6] National I-O models cannot be used to estimate regional impacts as business expenditure patterns are likely to differ regionally: simplistically, the smaller and more remote a regional economy is, the smaller will be the regional economic impact of development in that area (Stoeckl 2007; The Allen Consulting Group, 2011). This is because total impact depends not only on how much is spent initially (the first-round effects), but how these monies are subsequently re-spent. Smaller economies have fewer businesses, providing fewer opportunities for businesses and households to re-spend locally (Stoeckl & Stanley 2009); knock-on impacts of expenditure are therefore typically small (sometimes even zero) as the supply chain of industries extends to other regions.

[7] Within the base I-O tables, before developing models or estimating multipliers, we summed the values in the columns and rows for each of the industry segments that we wished to combine, thus presenting the same level of economic activity within the region but shared across a smaller number of segments.

[8] Specifically, the ABS Tablebuilder was used to extract a report on Total Personal Income (INCP) by place of work, by Industry of employment and by Indigenous status for each region. The number of Indigenous and non-Indigenous people employed within each industry who fell within each of the income bands used in the census was multiplied by the mid-point of each band, enabling an estimate to be made of the total incomes for all. Dividing this by the number of people enabled us to estimate the mean. For those within the negative, nil and not stated income bands, income was assumed to be $0, and those within the top band of $2,000 per week ($104,000 per annum), it was assumed that all within that band were earning $104,000 per annum.

[9] Specifically, retail expenditure by Indigenous households was increased and that of non-Indigenous households decreased such that the ratio of the two expenditures matched that found in the earlier study (Stoeckl et al. 2011). Household expenditures on imports were adjusted by equal and opposite amounts, ensuring total estimated expenditure of the combined households matched the source I-O models.

[10] This represents 4.1, 4.7 and 3.0 per cent, respectively, of total estimated income paid to Indigenous workers in each region (Table 2), and 4.0 per cent across all three regions.

REFERENCES

Altman, J.C. (2001) *Sustainable Development Options on Aboriginal Land: The Hybrid Economy in the Twenty-first Century*, Canberra, Centre for Aboriginal Economic Policy Research, Australian National University.

Altman, J.C., Buchanan, G.J. and Larsen, L. (2007) *The environmental significance of the indigenous estate: natural resource management as economic development in remote Australia CAEPR Discussion Paper No 286/2007*, Canberra, Centre for Aboriginal Economic Policy Research, Australian National University.

Australia Committee of Review of Aboriginal Employment and Training Programs (1985) *Aboriginal employment and training programs: report of the Committee of Review, August 1985*, Canberra, Australian Government Publishing Service.

Australian Bureau of Statistics (2004) *Australian national accounts: input-output tables table 22*. Output multipliers 1998-99, cat.no. 5209.0.55.001.

Australian Bureau of Statistics (2011) Census data. http://www.abs.gov.au/websitedbs/censushome.nsf/home/quickstats?opendocument&navpos=220 (accessed 27 May 2017).

Barber, M. (2015) *Rangers in place: the wider Indigenous community benefits of Yirralka Rangers in Blue Mud Bay, north-east Arnhem Land Final report*, Darwin, Charles Darwin University.

Barber, M. and Jackson, S. (2017) 'Identifying and categorizing cobenefits in state-supported Australian indigenous environmental management programs: international research implications', *Ecology and Society*, **22**, 11.

Brondizio, E.S. and Tourneau, F.-M.L. (2016) 'Environmental governance for all', *Science*, **352**, 1272–3.

Burgess, C.P., Johnston, F.H., Bowman, D.M.J.S. and Whitehead, P.J. (2005) 'Healthy country: healthy people? Exploring the health benefits of Indigenous natural resource management', *Australian and New Zealand Journal of Public Health*, **29**, 117–22.

Commonwealth of Australia (2015) *Reporting back... 2013-14: working on country and indigenous protected areas programmes*, Department of Prime Minister and Cabinet. https://www.dpmc.gov.au/sites/default/files/publications/reporting-back-2013-14WOC%26IPA-programmes.pdf (accessed 2 October 2017).

Commonwealth of Australia (2016) *Reporting back... 2014-15: how indigenous ranger and indigenous protected areas programmes are working on country*, Department of Prime Minister and Cabinet Retrieved from https://www.pmc.gov.au/sites/default/files/publications/2014-15-WOC-IPA-Reporting-back.pdf (accessed 10 October 2017).

Commonwealth of Australia (2017) *Indigenous protected areas*. https://www.pmc.gov.au/indigenous-affairs/environment/indigenous-protected-areas-ipas (accessed 2 October 2017).

Deloitte Access Economics (2014) *Economic benefits of closing the gap in Indigenous employment outcomes*. http://www.deloitteaccesseconomics.com.au/uploads/File/RA%20-%20Closing%20the%20gap%20170114.pdf (accessed 2 November 2016).

Ens, E.J., Pert, P., Clarke, P.A., Budden, M., Clubb, L., Doran, B., Douras, C., Gaikwad, J., Gott, B., Leonard, S., Locke, J., Packer, J., Turpin, G. and Wason, S. (2015) 'Indigenous biocultural knowledge in ecosystem science and management: review and insight from Australia', *Biological Conservation*, **181**, 133–49.

Farr, M., Stoeckl, N., Esparon, M., Grainger, D. and Larson, S. (2016). *Economic values and indigenous protected areas across Northern Australia*. Darwin, James Cook University.

Forrest, A. (2014) *Creating parity, the forrest review*. https://www.pmc.gov.au/sites/default/files/publications/Forrest-Review.pdf (accessed 29 August 2017).

Garnett, S.T., Sithole, B., Whitehead, P.J., Burgess, C.P., Johnston, F.H. and Lea, T. (2009) 'Healthy Country, healthy people: policy implications of links between indigenous human health and environmental condition in tropical Australia', *Australian Journal of Public Administration*, **68**, 53–66.

Gretton, P. (2013) *On Input-Output Tables: Uses and Abuses. Productivity Commission Staff Research Note*, Canberra, Australian Productivity Commission.

Hermannsson, K. (2016) 'Beyond intermediates: the role of consumption and commuting in the construction of local input–output tables', *Spatial Economic Analysis*, **11**, 315–39.

Hill, R., Pert, P., Davies, J., Robinson, C., Walsh, F. and Falco-Mammone, F. (2013) *Indigenous Land Management in Australia: Extent, Scope, Diversity, Barriers and Success Factors*, Cairns, CSIRO Ecosystem Services.

Hunter, B. (2014) *Indigenous employment and businesses: whose business is it to employ Indigenous workers?* CAEPR Working Paper No. 95/2014, Canberra, Centre for Aboriginal Economic Policy Research, The Australian National University.

Hunter, B. and Yap, M. (2014) *Income, work and education: insights for closing the gap in Urban Australia*; CAEPR Working Paper No 92/2014, Canberra, Centre for Aboriginal Economic Policy Research, The Australian National University.

Isard, W. (2017) *Methods of Interregional and Regional Analysis*, London and New York, Routledge and Taylor & Francis Group.

Johnson, P.L. (2001) *An Input-Output Table for the Kimberley Region of Western Australia: Economic Research Centre*, Perth, Department of Economics, University of Western Australia.

Kalb, G., Le, T., Hunter, B. and Leung, F. (2014) 'Identifying important factors for closing the gap in labour force status between indigenous and non-indigenous Australians', *Economic Record*, **90**, 536–50.

Larson, S., Stoeckl, N., Jarvis, D., Addison, J., Prior, S. and Esparon, M. (2018) 'Using measures of wellbeing for impact evaluation: proof of concept from a case study with an Indigenous community in North Queensland Australia', *Ambio*. https://doi.org/10.1007/s13280-018-1058-3

Miller, R.E. and Blair, P.D. (2009) *Input-Output Analysis: Foundations and Extensions*, Vol **2**, Cambridge, Cambridge University Press.

Miyazawa, K. (2012) *Input-Output Analysis and the Structure of Income Distribution*, Vol **116**, Berlin, Springer Science & Business Media.

Murti, S. and Northern Territory Office of Resource Development (2001) *Input-output Multipliers for the Northern Territory 1997–1998*, Darwin, NT, Retrieved from Office of Resource Development.

Office of the Government Statistician Queensland Government (2004) *Queensland regional input-output tables 1996-97 34 industries*. http://www.qgso.qld.gov.au/products/reports/qld-reg-io-tables/index.php (accessed 4 November 2016).

Pert, P.L., Ens, E.J., Locke, J., Clarke, P.A., Packer, J.M. and Turpin, G. (2015) 'An online spatial database of Australian Indigenous Biocultural Knowledge for contemporary natural and cultural resource management', *Science of the Total Environment*, **534**, 110–21.

Social Ventures Australia (2014) *Evaluative social return on investment report social, economic and cultural impact of Kanyirninpa Jukurrpa's On-Country programs*. https://socialventures.com.au/assets/2014-KJ-SROI-Report-FINAL.pdf (accessed 22 February 2018).

Social Ventures Australia (2016) *Consolidated report on indigenous protected areas following social return on investment analysis*. https://www.dpmc.gov.au/sites/default/files/publications/SROI-Consolidated-Report-IPA_1.pdf (accessed 10 November 2016).

Stoeckl, N. (2007) 'Using surveys of business expenditure to draw inferences about the size of regional multipliers: a case-study of tourism in Northern Australia', *Regional Studies*, **41**, 917–31.

Stoeckl, N. (2010) 'Bridging the asymmetric divide: background to, and strategies for bridging the divide between Indigenous and non-Indigenous economies in northern Australia'. In R. Gerritsen (ed.) *Northern Australia Political Economy*, Darwin, NT, Charles Darwin University, pp. 106–29.

Stoeckl, N. (2012) 'Comparing multipliers from survey and non-survey based IO models: an empirical investigation from Northern Australia', *International Regional Science Review*, **35**, 367–88.

Stoeckl, N. and Stanley, O. (2009) 'Maximising the benefits of development in Australia's far north', *Australasian Journal of Regional Studies*, **15**, 255–80.

Stoeckl, N., Esparon, M., Stanley, O., Farr, M., Delisle, A. and Altai, Z. (2011) *Socio-economic activity and water use in Australia's tropical rivers: a case study in the Mitchell and Daly River catchments: final report for The Tropical Rivers and Coastal Knowledge Research Consortium*, Darwin, Charles Darwin University.

Stoeckl, N., Esparon, M., Farr, M., Delisle, A. and Stanley, O. (2013) 'The great asymmetric divide: an empirical investigation of the link between indigenous and non-indigenous economic systems in Northern Australia', *Papers in Regional Science*, **93**, 783–801.

Taylor, J. and Stanley, O. (2005) *The opportunity costs of the status quo in the Thamarrurr Region*, CAEPR Working Paper No. 28/2005, Canberra, Centre for Aboriginal Economic Policy Research, The Australian National University.

The Allen Consulting Group (2011) *Assessment of the economic and employment outcomes of the Working on Country Program*, Canberra, The Allen Consulting Group.

Victoria University (2016). Centre of Policy Studies Knowledgebase - The TERM Model. http://www.copsmodels.com/term.htm (accessed 28 September 2016).

Weir, J., Stacey, C. and Youngetob, K. (2011) *The benefits of caring for Country*. Canberra, Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS).

Yap, M. L.-M. (2017) In pursuit of culturally relevant indicators of Indigenous wellbeing Operationalising the 'recognition space'. Doctor of Philosophy, Australian National University, https://openresearch-repository.anu.edu.au/bitstream/1885/132620/1/Yap%20Thesis%202017.pdf (accessed 22 February 2018).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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