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Research article

Validating costly protected area restoration after (increasing) disasters

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ABSTRACT

Protected areas such as national parks constitute an increasing land mass globally, but these areas are under increasing threat from climate change events such as drought, flooding, and bushfires. The recent Yosemite National Park fires in California provide an example of this issue. After any such disaster, authorities will need to restore those protected areas to their former state at significant costs within any public funding cycle. To corroborate that request, clear economic assessments of total costs and benefits will be required. However, in previous studies of these issues a complete set of government cost and/or benefit data may not be provided, skewing assessment results accordingly. Using South Australia's Kangaroo Island protected areas—which were significantly destroyed by bushfire in 2019–20—as a case study with a unique set of State government cost data we calculate a set of analyses via economic methods. Despite significant restoration costs the study found the discounted net present value of returning tourists to the Island is 3.15 over ten years for park tourism and regional economic impacts, providing an internal rate of return of 22%. The rebuild work is also expected to support around 430 full time equivalent (FTE) jobs during construction, with a return to full tourism supporting another 744 FTEs across relevant sectors (e.g. accommodation, retail) of the Kangaroo Island economy. This robust assessment makes it far easier for protected area managers to argue their funding case.

1. Introduction

Public investment in new and existing protected areas (e.g. national parks) mean that they now cover 15.1% of global landmass (UNEP et al., 2019) and require significant ongoing public funding support to maintain. Unfortunately, this protected area coverage is lower than the 2010 Convention for Biological Diversity target (i.e., the Aichi Target 11) and recent estimates that the minimum terrestrial area required to secure the planet's biodiversity is approximately 44%, including protected areas and other land-use safeguards (Allan et al., 2022). So while protected area growth has resulted in partial improvement to a range of biodiversity components such as threatened species, key biodiverse areas and ecoregions, and ecosystem services (Maxwell et al., 2020) much work remains to be done. That work will face additional challenges under increased global climate change-associated drought, flooding and bushfire disasters providing equal negative flora and fauna impacts in those new and existing protected areas.

Following any disaster public investment will be necessary to reinstate a protected area to its former status, with that investment constituting a substantial sum in the relevant funding cycle. In the private sector, assessments of investment benefits are set against costs to weigh the value of projects and determine whether to proceed, and similar approaches may be adopted by the public sector. The Australian government has stressed the importance of comprehensive (or in their terms systematic) cost-benefit analysis (CBA) using direct and indirect values for individual projects (Office of Impact Analysis, 2023). However, Carson (2012) notes many cost-benefit analysts implicitly assign either limitless values under constraints or zero-values for non-market goods to avoid complex analysis. The aggregation of direct use and indirect non-use values is often referred to as total economic value (TEV), which may be applied at both whole of system and sub-system levels (Riera et al., 2012). It is argued that the inclusion of total use/non-use costs and benefits thus provides a more comprehensive or systematic assessment of all factors/variables involved.

A critical challenge for jurisdictions faced with a need to estimate and assess the total economic values of the costs and benefits of restoring protected areas following a disaster include a lack of data-driven methodologies for fully valuing ecosystem service returns from

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protected areas (Balmford et al., 2015) and a lack of accurate public agency costs associated with national park capital infrastructure, operation, or restoration costs (Hughes et al., 2009; Hughes et al., 2016; Office of Impact Analysis, 2023). Some past studies have looked at the direct costs of tourism on governments (e.g. Pontin, 1993; Thomson and Thomson, 1994). Other studies have adopted partial cost accounting as a basis for evaluation (Gutman, 2002; Kniivilä et al., 2002; Van Beukering et al., 2003), in some instances publishing as consultant reports (Baaske et al., 1998; Schonback et al., 1997; Syneca Consulting, 2008). But very few studies combine a wide array of tourism benefits from protected areas with *actual* public cost data to undertake a TEV analysis of public investment (Mayer, 2014). This lack of accurate costs may explain why funding for protected areas has not kept pace with growing demand for access to and use of conservation sites (Eagles, 2003; Watson et al., 2014) and why restoration funds after any disaster may be challenging to acquire.

Robust assessments inclusive of actual cost data will provide arguments for allocating public funding (e.g. restoration works) to reconstruction of key assets and facilities in protected areas at various spatial scales (Balmford et al., 2015), while non-robust assessments will potentially result in the misallocation of limited public financial resources (Bharali and Mazumder, 2012). Hence, accurately estimating the economic benefits and costs relevant to the restoration of protected areas following a loss will assist in evaluating between management and funding alternatives (Loomis, 2002) via a tacit cost-benefit analysis employing total economic values (Brenner et al., 2016).

To achieve a comprehensive TEV analysis of the costs and benefits from the restoration of protected area after a disaster we adopt Mayer's (2014) framework to identify relevant factors to include in our assessment, in this case including actual public costs from state government budget data. Protected area benefits include consumptive (e.g. clean air consumed by all), on-site non-consumptive (e.g. recreation and tourism activity), and off-site non-consumptive (e.g. deriving value from knowing protected areas exist) values. By contrast, protected area costs include direct (e.g. park establishment and maintenance), indirect (e.g. road access) and opportunity cost (e.g. alternative land use such as agriculture) values. All values must be taken into account to achieve a comprehensive estimation of TEV (TTF, 2013). However, Mayer makes it clear that some costs and benefits will have good measurability, while other measures will be quite poor and/or challenging (Fig. 1). That said, the advantage of the framework is twofold: firstly, it provides a comprehensive and structured approach to protected area TEV assessments for other researchers to follow and secondly, it is not prescriptive about achieving a full set of values where some measures may be challenging or impossible in the protected area space.

While the advance of comprehensive CBA studies is occurring the utilization of a comprehensive TEV that includes public investment and data for government programs to robustly estimate and compare the net costs/benefits of protected area restoration and inform public policy choices is less apparent (Dwyer and Forsyth, 2009), largely due to restrictions on external access to program or project budgets. Further, since some analysts have argued for a better understanding of the potential for protected area ecosystem improvement/replacement driven by prudent related economic analysis (Hundloe, 2021), the TEV analysis reported herein explores public restoration budget effects under scenarios representing *with* and *without* protected area restoration construction/reinstated tourism impacts. The construction scenario represents the key sensitivity test for the study given the focus on replacement after disasters, providing additional robustness checks in our assessment of whether actual restoration costs are outweighed by the full set of benefits. Our approach utilising a combination of CBA, travel-cost approaches (TCM), and input-output modelling (I-O) also allows us to estimate the broader economic impacts to estimate changes in tourism economic activity in conjunction with net benefits to better inform public policy choices as a secondary sensitivity test. Finally, the opportunity costs of expanded agricultural and fishing benefits requires sensitivity testing to assess the validity of replacement in this case.

The TEV analysis developed by Mayer (2014) is viewed by some researchers as useful (Maria Raya et al., 2018) but to date remains absent from subsequent research studies due to: i) complexities in calculating social costs for protected or tourist areas (Qiu et al., 2020), ii) a lack of benefit-cost equity in surrounding communities (Kariyawasam et al., 2020), and iii) conflicting tourism and conservation values that complicate and ultimately denude public financing for protected areas (Aseres and Sira, 2021). These issues drive a need for TEV analysis via greater understanding of relevant factors and how they impact choices for protected area restoration choices (Peng et al., 2023). As a basis for our study which has clear global relevance, we use a case study from

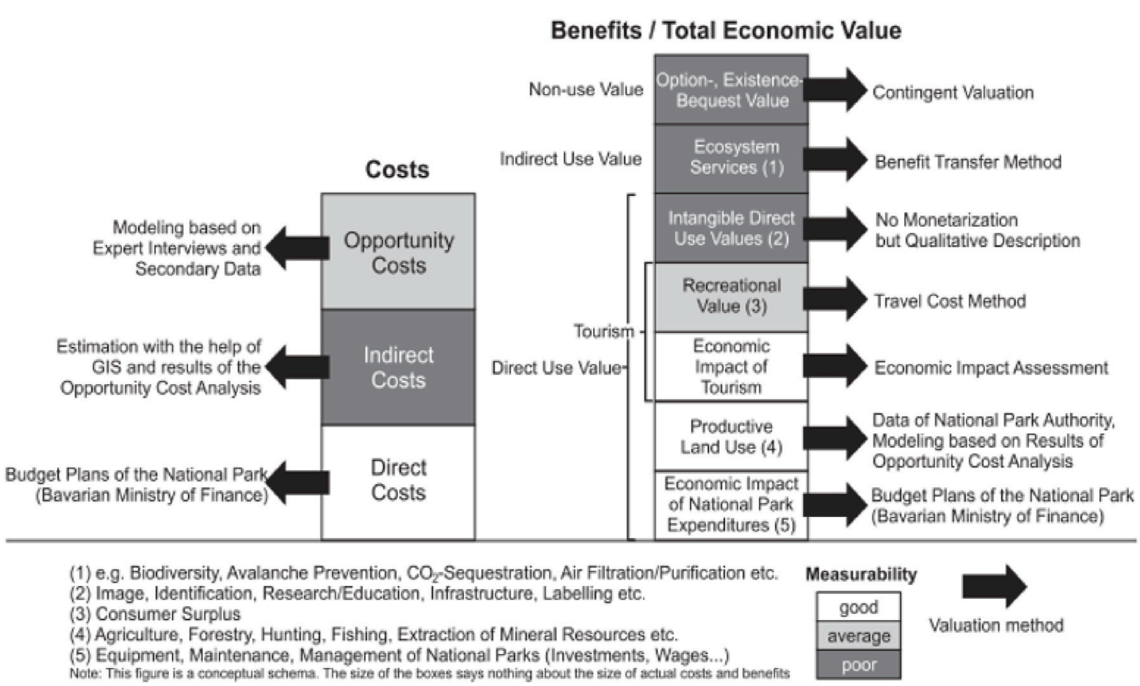


Fig. 1. Protected area cost and benefit realisation framework (Mayer, 2014).

South Australia focused on a major tourism and ecosystem protected area. The study context and methodological approaches are detailed in the following sections.

2. The study context

The protected area network of South Australia, which includes more than 300 conservation sites, has a landmass footprint that exceeds some European counties. The public authority responsible for administering those conservation sites is the South Australian *Department for Environment and Water* (DEW), while the *National Parks and Wildlife Service* (NPWS) is responsible for managing national parks and their recreational use by tourists. Within the DEW conservation network one of the most popular nature-based tourist regions for both domestic and international visitors to South Australia is Kangaroo Island (KI), just off the state's southern coastline. The total land area of KI is just over 440,000 ha with more than one-third of that area protected as nature reserves (Higgins-Desbiolles, 2011). By attracting domestic and international visitors to KI, protected area tourism contributes to state economic growth via foreign exchange earnings, employment opportunities, and improved infrastructure. Consistent with 69% of studies in the sustainable tourism literature that attribute substantial economic benefits to nature-based tourism (Li et al., 2018), approximately 93% of total employment across KI is supported by the dominant industries of agriculture, forestry, fisheries and those sectors that are related to or support protected area tourism. Overall, roughly equal numbers of KI residents are employed within agricultural and tourism jobs (RDA, 2022) which comprise the top-two industries. Further, in the 2019–20 financial period KI enjoyed approximately 120,000 international and 457,000 domestic visitor nights as tourists came to holiday (81.1%) and visit three popular KI sites: Flinders Chase National Park (53%), Seal Bay Conservation Park (38%) and the Kelly Hill caves complex (4%) (RDA, 2022). The Kangaroo Island Wilderness Trail (see Box 1) was also a popular destination for domestic visitors.

But, as predicted in many contexts globally (Cunningham et al., 2024), in early 2020 KI experienced a significant bushfire disaster which destroyed around 167,000 ha of the island with 87% of that area burnt at a high to very high severity (Fig. 2). In the fires approximately 23 unique animal and 31 plant species were adversely impacted (Filkov et al., 2020). In addition, tourism and hospitality sales fell by around 19% (down to AUD$47.1 million) when compared to the previous reporting year 2014–15 of AUD$58 million in sales in real terms (ABS, 2021). Finally, large parts of the protected area infrastructure were lost at key tourism sites (e.g. the Flinders Chase Visitor Centre).

In response, NPWS invested around AUD$8.79 million into emergency and resilience programs to support species recovery (DAWE, 2021) and a further AUD$52.28 million over four years (2019–20 to 2022–23) to rebuild critical park infrastructure on KI associated with tourism (DEW, 2021). Without this investment, it was expected that a roughly 60% decline in KI national park tourism following the bushfires—along with COVID-19 impacts—would continue to negatively impact visits to national parks, with reduced flow-on benefits to the KI economy. These outcomes define the *without* restoration scenario for the CBA as a baseline ahead of gradual expected returns to prior visitor levels, with subsequent (assumed) annual growth rates of island tourism following the completion of the NPWS replacement program. The full

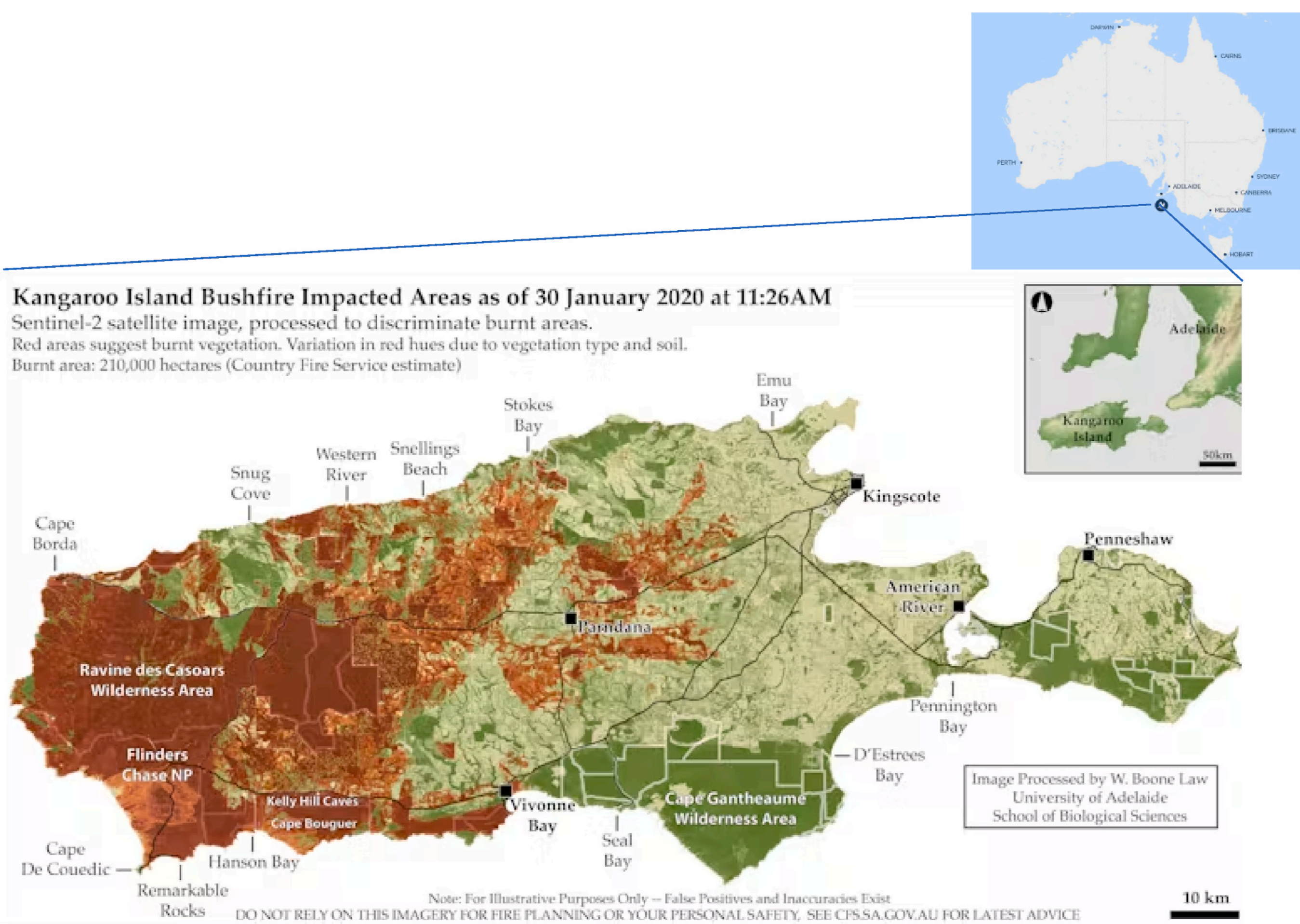


Fig. 2. Location of Kangaroo Island and bushfire damage extent (brown areas). Source (Boone Law and Lewis, 2020). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

study data set and analytical approaches are detailed below.

3. Analytical methods and data

3.1. Economic analysis basis for values

Recognising complex economic/social benefits from environmental services and tourism may demonstrate to key protected area stakeholders and decision-makers the benefits provided by their existence (Mulwa et al., 2018). Yet the value of protected areas is less understood than more tangible or frequently traded land uses (e.g. agriculture). If they are known, the value of protected areas, ecosystem services, and associated economic impacts can be used to argue in favour of allocating limited public funding resources to constructive outcomes (Balmford et al., 2015). To achieve those outcomes, despite the general lack of data discussed earlier, many economists support the use of economic tools (e.g. CBA and input-output modelling) as a tool for estimating the impact and contribution from protected area tourism.

This is because, in economic terms, any social welfare from publicly managed protected area sites can be broadly measured as the difference between demand for, and the cost of, that public welfare good. Both measures are needed to place into context the trade-offs surrounding public investments to restore protected area infrastructure (Benson et al., 2013), the trade-off of which will be less funding for other public funding objectives. Trade-off information will become particularly pertinent after disaster impacts such as the devastating 2019–20 KI bushfires (Li et al., 2021) which triggered large-scale losses and a need for significant restoration funding within a short time frame. More complete assessments of protected area and nature-based tourism revenue may avoid undervaluing the benefits of conservation sites and subsequently underinvesting in their restoration (Shah and Gupta, 2000). In support of that goal, a comprehensive set of KI protected area restoration cost and benefit data was assembled to inform a TEV analysis of the public investment program. In this study we incorporate three main analytical approaches: cost-benefit analysis (CBA) with specific sensitivity tests, travel-cost methods (TCM) and input-output (I-O) models, as detailed in the sections that follow.

3.2. Analysis methods—CBA

CBA is a standard tool in economics to assess the aggregate social or public costs and benefits of a program at a given time, where results are discounted so as not to weight future costs and benefits as highly as those in the current period. Well-constructed CBA help explore trade-offs from allocating factors of production (land, labour, and capital) between alternative investment options. In this case, the quantification of future cash flows (tourism expenditure and income) over the life of the KI national park restoration construction program (2019–20 to 2022–23) and beyond out to 2028-29—discounting these back to a net present value—allows for comparisons between alternative capital investment choices under different scenarios (i.e. sensitivity of outcomes to *with* and *without* facility/infrastructure and/or tourism restoration scenarios).

Ordinarily, the net present value (NPV) of investment choices is the sum of the expected net return from the investment ($E[I]$) over the project duration in years ($t = 0 \ldots n$), divided by a discount rate r (Equation (1)). The result provides a key metric for evaluation in the form of $E[I] = (Y - K)$, where Y is the net annual return derived from the investment and K is the capital invested. Further, $Y = (v - c)$ where revenue (v) is a multiplication of the output (z) and price paid per unit of output (p) so that $v = zp$ and costs (c) account for both fixed and variable expenditures.

$$NPV = \sum_{t=0}^{t=n} \frac{E[I]_t}{(1+r)^t} \tag{1}$$

If $NPV = 0$, then the project has broken even. When $NPV > 0$ the project is profitable. Finally, when $NPV < 0$, the project is expected to make a loss. Within a CBA framework, issues such as the risk/uncertainty associated with variable tourism growth rates are typically included via sensitivity analysis to explore mean and variance of a probability distribution of variables which positively/negatively impact costs/benefits (Merrifield, 1997). This approach is adopted by our study via *with* and *without* restoration scenarios (Table 1), allowing for a series of outcome-runs to determine the likelihood of the site restoration investment covering (ideally exceeding) accumulated public debts associated with the restoration program selection.

3.3. Analysis methods—TCM

To calculate the visitor recreational benefits R^I we follow Mayer (2014) to calculate aggregate travel costs for KI visitors (Equation (2)):

$$R^I = V \bullet \sum_{s=1}^{k} e_s \tag{2}$$

where V is the total number of visits to KI parks based on the *Bookeasy* dataset, e is the actual daily travel expenditure per visitor given their origin, travel time and destination, and s denotes the different sectors of travel expenditure (e.g. accommodation, fuel, meals etc.) We can then aggregate these estimates and apply a set of growth scenarios to inform the final evaluation.

3.4. Analysis methods—I-O modelling

Regional direct income benefits from tourism expenditure I^d can also be calculated using the RISE Version 6.04 Impact Model, and following Mayer (2014) (Equation (3)):

$$I^d = \sum_{s=1}^{k} \left(R_s^I \bullet m_s^d\right) \tag{3}$$

where m_s^d is the direct multiplier for sector s, or the proportion of income generated by the first-round cash injection. The indirect regional income of tourism expenditure I^i can also be estimated (Equation (4)):

$$I^i = \sum_{s=1}^{k} \left(R_s^I - I_s^d\right) \bullet m^i \tag{4}$$

where m^i is a multiplier coefficient specific for set sectors, which estimates the second-round effects of the cash injection. These equations are also applied to the rebuild phase estimates. We sought various data for these analyses as explained below.

3.5. Direct cost data

NPWS provided a complete set of actual parks operating and capital restoration expenditure data for 2018–19. This data was broken out by

Table 1
Sensitivity tests and relevant values used.

Sensitivity Tests	Description of variable(s)			
Discount finance rates	Not applicable – IRR at 22% and highest borrowing rate 3%			
Discounted construction costs	3%	5%	7%	10%
Discounted Opportunity costs	Sheep (70%)	Cattle (5%)	Mixed (15%)	Forestry (10%)
Post-COVID visitor recovery level	40%	30%	20%	10%
Tourism benefits With/ Without Construction costs	Testing value of intervention – switched on or off in model showing costs and value of rebuilding after bush fires.			

region, projects, teams, and restoration project centre inclusive of budgeted expense, actual expense, and variations. This provided a capacity to contrast direct and indirect benefits to public costs, in both operating and capital expenditure terms, similar to other studies (see for example Driml et al., 2019). A further set of budget data related to the projects on KI were also provided spanning the 2019–20 to 2022–23 construction phase. This included program details, total budget estimates and annual spend amounts for an expected 37 separate projects. Project costs did not therefore require sensitivity assessment.

3.6. Opportunity costs

As stated above, the biggest sector of the KI economy is agriculture and fisheries which offers an opportunity cost for land currently protected on the island. The mainland-based agricultural industries include sheep and (some) cattle grazing, grain growing, and forestry. An approximate estimate of the total parks protected area is 145,000 ha which could theoretically be returned to agricultural production. Average production returns from the South-East South Australia region from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES, 2022a) were used to identify productivity drivers, while annual broadacre farm survey data (ABARES, 2022b) provided average regional returns and profits for the livestock and cropping sectors in 2018–19; that is, prior to the bushfire impacts. These figures formed a basis for the opportunity cost component of the CBA and its sensitivity to benefits from land use changes.

3.7. Indirect costs

Mayer (2014) defines indirect costs as any damage incurred outside the national parks that is caused by wildlife from within. While introduced pests (e.g. feral pigs) are an issue that needs to be controlled via an AU$2.67 million program (PIRSA, 2022), KI is a unique ecosystem comprising native flora and fauna species. As such, it is highly unlikely that damage would be caused by them as beneficial species. We therefore ignore this cost category in our analysis.

3.8. Impact of park expenditure

The above rebuilding program budget data detailed the full program planning for NPWS with respect to KI parks over four years. This investment will have flow-on benefits to the regional economy in terms of gross regional product and supported employment. The expected budged expenditure data thus formed a critical dataset for regional I-O modelling of the restoration construction phase benefits.

3.9. Productive land use

Productive land use benefits stem from any direct revenue generated by resources which are harvested, exploited, or sold on markets as private goods from within the parks. The budget detail provided from NPWS showed no productive land use activity for KI parks, and therefore this benefit is excluded from the analysis.

3.10. Regional impacts of tourism

Like restoration construction benefits, interstate and international visitors to KI generate economic impacts across the broader regional economy by contributing to gross regional product and supporting employment. These impacts are again captured in a regional I-O model which spans the complete assessment period (2019–20 to 2028–29) under expected gradual returns to previous tourism levels and a conservative annual growth set at 4% (SATC, 2020) as a basis for additional sensitivity testing.

3.11. Recreational value benefits

Visitors to parks often generate consumer surplus as the total amount they are willing to pay to enjoy a park site (e.g. travel costs, accommodation etc.), and which often exceeds the direct monetary costs associated with that visit (e.g. park entry fees) (Driml et al., 2019). Recreational values can be captured using TCM analysis estimates which account for these additional tourism payments (Heagney et al., 2019). As stated above, these benefits are assumed to grow at approximately 4% over the length of the evaluation and provide a basis for including recreational benefits in the CBA. The key dataset for the TCM was DEW's online visitor booking system *Bookeasy*. Visitors to parks must register their trip, anticipated destinations, dates of travel, and other information to obtain a pass to enter and/or stay at a national park site. Visitors are also required to enter their residential postcode which enables designation of a starting location for each visit.

For any national park site where postcode data was not provided/collected (e.g. some icon or high-visitation parks) partial postcode data collected via credit-card and/or point-of-sale terminals (POS) were extrapolated across all remaining icon site visitors within the same region. The Collaborative Australian Protected Area Database (CAPAD) was used to create a destination (x-y) point for each trip. CAPAD records provide useful data on all protected area sites, and in this case averaged destination points. This approach provides conservative estimates of the secondary values for the TCM approach. Activities relevant to the TCM analysis included distances travelled by car, vehicle expenses, accommodation expenses (where necessary on longer trips), and meals and incidentals per visitor. All of these values are derived from the Australian Tax Office's (ATO) 2019/11 travel determination data for 2018–19, available on the ATO website[1]. Following the collation process, the complete dataset contained records of 275,601 KI park visits from intrastate, interstate, and international origins for the 2018–19 period. More details on the TCM approach followed by this study can be found in Loch et al. (2022).

3.12. Intangible, indirect use and non-use benefits

Finally, a separate set of intangible and non-use benefits were not fully included in the CBA. Tourism itself can defined as an ecosystem service (Liu and Costanza, 2010), and therefore we partially account for indirect use values through our economic impact measures. Omitting intangible and non-use benefits in the CBA evaluation simply means that the final TEV remains conservative.

4. Results

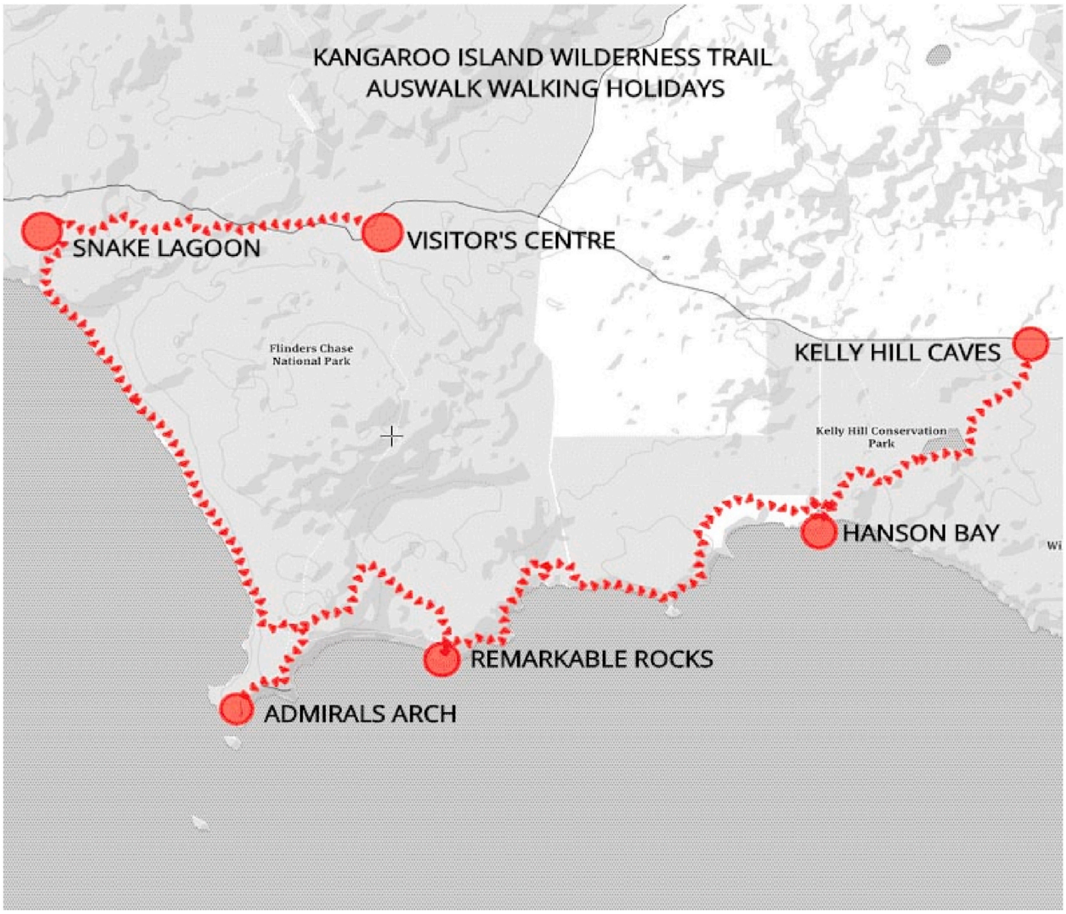
The direct budget construction costs for the KI rebuild program totalled AUD$52 million over four years: AUD$1.93 million in 2019–20, AUD$14.02 million in 2020–21, AUD$27.1 million in 2021–22, and AUD $8.95 million in 2022–23. The works include the restoration of visitor centres and NPWS works depots, reinstating educational facilities, replacing roads and fence lines, returning campsites and facilities, installing improved firefighting equipment, and reinstating the KI Wilderness Trail—an icon attraction (see Box 1 Case Study and Fig. 3). These costs formed a basis for evaluating the stimulus that would accrue to the KI regional economy because of the restoration construction works.

Next, we calculated the opportunity costs associated with protected area land. We assumed that, if national park land on KI was opened to alternative productive use, it could be distributed in line with current use rates for agricultural land across sheep grazing (70%), cattle grazing (5%), cropping (15%), and forestry (10%) commercial activities. These

[1] Australian Tax Office's (ATO) 2019/11 travel determination data for 2018–19 https://www.ato.gov.au/law/view/document?docid=TXD/TD201911/NAT/ATO/00001

Box 1: KI Wilderness Trail Case Study

The Kangaroo Island Wilderness Trail (KIWT) is a 61-km, five-day walking or hiking trek that offers visitors a unique nature-based experience (Map (Fig. 3)).



Map (Fig. 3). Map of the KIWT (Auswalk, 2020).

Located in the south-west corner of the island, the KIWT offers access to some of Kangaroo Island's most rugged and spectacular landscapes. A range of amenities along the way such as cooking sites, basic shelters, access to toilets and potable water and portage services make the trail popular and highly accessible.

In 2019–20 the KIWT was severely damaged by bushfires and, while still open to the public, all tours are now conducted by licensed operators to ensure that the recovering landscape is not further damaged. As the KIWT has considerable potential to add value to the regional and state economy the state government is motivated to rebuild the attraction and restore tourism regional economic benefits. However, does that investment make sense for the public?

An answer to this question can be derived from estimating first and second-round effects of the original KIWT construction works from 2014 to 15 to 2016–17 via I-O model estimates of regional economic impacts, together with I-O modelling of the recreational tourism impacts prior to the bushfires. The cost of the works was AUD$7.06 million which resulted in AUD$3.2 million in first-round impacts from that stimulus, and the supporting of around 31 FTEs in the region.

Once completed, the KIWT contributed a further AUD$539,859 in secondary multipliers, and a further 5.91 supported FTE jobs. The main sectors impacted by the Trail included accommodation, retail trade, transport and food and beverage services.

In summary, the KIWT was contributing positively to the KI regional economy, and broader state gross product results, during its original operating period. Within three-four years it would have eclipsed its construction costs and provided net economic tourism and recreational benefits for the state. Importantly though, the indirect impacts of the KIWT were more than five-times the direct revenue recovered from Trail bookings. This is an important fact that managers must consider when evaluating the site and whether it offers value to the public and their investment choices.

respective alternative commercial activities attract average profits of AUD$8.06/Ha, AUD$15.84/Ha, AUD$18.35/Ha and AUD$571.40/Ha (ABARES, 2022a). The opportunity cost of allowing agriculture and forestry production on the current 145,000 ha of park land would be approximately AUD$9.6 million (Table 2)—far less than tourism benefits.

These costs were then fed into the CBA evaluation model and discounted by 3%; a high rate for South Australian government projects (SA Treasury, 2021), but one which increases the conservative nature of our estimates and takes recent inflation somewhat into account. Finally, discounted tourism benefits were calculated over the full evaluation period. These were derived from: i) the RISE Version 6.04 Impact Model's I-O restoration stimulus regional economic impact estimates (2019–20 to 2022–23) and ii) aggregated TCM recreational value and flow-on I-O regional economic impacts of a gradual return to full tourism rates by 2022–23, under assumed 4% annual growth out to 2028–29. The discounted cashflows appear in Fig. 3.

As is common in CBA, an initial negative cashflow period reflective of the construction and opportunity costs is offset by the return to full tourism rates and then bolstered by the 4% growth assumption and positive economic impacts for the regional economy. The total gross regional product contribution from the construction phase is estimated at AUD$44.9 million over four years, and around 428 FTEs will be supported during the period (Table 3). As most employment on the island is local, leakages will be relatively minor for the restoration program adding further regional benefits.

As discussed, we also contrasted the *with* and *without* restoration construction scenarios in the CBA as a sensitivity test. Without construction, KI parks would have remained at reduced tourism levels (~40% of 2018–19 visitor numbers), negatively impacting the regional economy and NPWS revenue. Cumulative discounted benefits under the *without* scenario would total AUD$22.65 million; or approximately one-half of the expected rebuild investment costs. By contrast, under the *with* construction scenario tourism can gradually recover to 2018-19 levels by 2022–23, and then grow at an average rate of 4% per annum. As such, we do not evaluate the aggregate benefits; that is, the baseline pre-bushfire stimulus level together with the expected benefits of the rebuild program. We exclude the baseline stimulus and only model the recovery/growth benefits to drive conservative estimates.

The rebuild construction phase and linked tourism recovery result in total discounted economic stimulus and recreation value benefits of AUD$144.85 million to 2028–29 (Fig. 4). The NPV over the investment period is positive at AUD$194.45 million and the benefit-cost ratio (BCR) is also positive at 3.15. Finally, the internal rate of return (IRR) is 22%—well above the 3% discount rate applied, and much higher than the 1% discount rate utilised by the South Australian government to inform their investment choices at the time (SA Treasury, 2021).

As shown in Fig. 4, the net discounted benefits exceed the total discounted restoration construction and opportunity costs of the project in 2022–23 and remain positive after that over the life of the evaluation period. By contrast, the *without* construction scenario returns highly marginal benefits that will not exceed the annual base operating expenditure budget for the parks as provided by DEW.

Finally, to provide more granular findings on tourism benefits in the CBA, using 2020 as a base year we can further contrast the difference between the *with* and *without* construction scenarios via aggregate benefit impacts (Fig. 5). Without the KI parks rebuild program the cumulative expected future tourism economic benefits (i.e., TCM and I-O) would not exceed the annual operating expenditure budget as provided by NPWS (green dashed line) over the life of the evaluation. However, as a return to prior tourism levels occurs both during and following the rebuild works, the increased visitor activity—together with assumed 4% growth after 2022-23—would see cumulative benefits exceed both the NPWS operating budget and the discounted combined construction/opportunity costs (red dotted line). Positive total discounted cumulative benefits would then accrue against the investment from that year forward.

Table 2
Opportunity cost calculation for KI park land: all currencies in AUD$.

Industry	Land Allocation	Area Transformed Ha	Average Profit/Ha	Opportunity cost
Sheep grazing	70%	101,500	AUD$8.06	AUD$817,658
Cattle grazing	5%	7250	AUD$15.84	AUD$114,853
Mixed cropping	15%	21,750	AUD$18.35	AUD$399,211
Forestry	10%	14,500	AUD$571.4	AUD $8,285,233
Total	**100%**	**145,000**		**AUD $9,616,955**

5. Discussion

This study represents the first TEV cost-benefit analysis of a public investment strategy into the restoration of important South Australian protected area sites following a natural disaster, providing a case study with global implications. As it is probable that such disasters will be a more frequent part of the global protected area landscape management in future, we consider the lessons from this study relevant and timely to park authorities, as well as government funding agencies (e.g., Treasury officials). Our findings highlight the fact that park restoration investments following calamitous events such as the 2019-20 bushfires can be fully evaluated to determine whether restoration projects and spending by governments constitute value for money, which is clear in this case. The analysis herein presents evidence that strategic investment into the parks network on Kangaroo Island is economically prudent for not only NPWS revenue, but for the greater KI region and the state of South Australia itself.

The protected area restoration investment strategy developed by DEW to address the KI rebuild issue was also aimed at returning tourism visitation to pre-bushfire levels (and then incorporate expected increases to visitor numbers over time), to gradually achieve previous revenue levels. However, given that the frequency/severity of natural disaster impacts on national parks may increase under climate change (Hansen et al., 2014) the framework presented herein provided a unique opportunity to make future investment decisions which are both economically and ecologically sound. From this study we would argue that the use of TEV approaches serves to provide administrative bodies who govern public green spaces (such as protected area sites) with a means to better plan and execute investment aimed at mitigating future climate-related disaster costs, in terms of potential future losses of both natural and man-made capital, and a comparison with trade-offs across other government budget options. As this issue is not only one of economic consequence (e.g., the inherent large costs involved in replacing infrastructure destroyed by natural disasters), but also one which is consequential for the very ecosystems spaces that protected areas are enacted to safeguard, the work presented provides a meaningful contribution to bridging the gap between economic activity and the ecosystem in which that activity occurs (Liu and Costanza, 2010). For example, identifying and building wildlife fire refuges, protected flora enclosures, and separate species sanctuaries from which repopulation can take place may constitute practical investment options going forward. These choices can be parameterized similarly to those demonstrated in our analyses to evaluate different strategies and inform current choices, while ensuring that expert considerations of non-economic factors are weighted equally within the decision-making process.

In line with the earlier Australian government focus on comprehensive cost-benefit value assessment the findings of this study demonstrate that appropriate investment in publicly managed protected area sites can reap benefits beyond those in terms of direct revenue alone. This is based on the primary outcome of the framework that allows for a clear link to be drawn between economic and ecosystem considerations, delivering systematic or comprehensive results. This approach may also afford governing bodies the opportunity to measure benefits which range wider than economic and ecological outcomes (e.

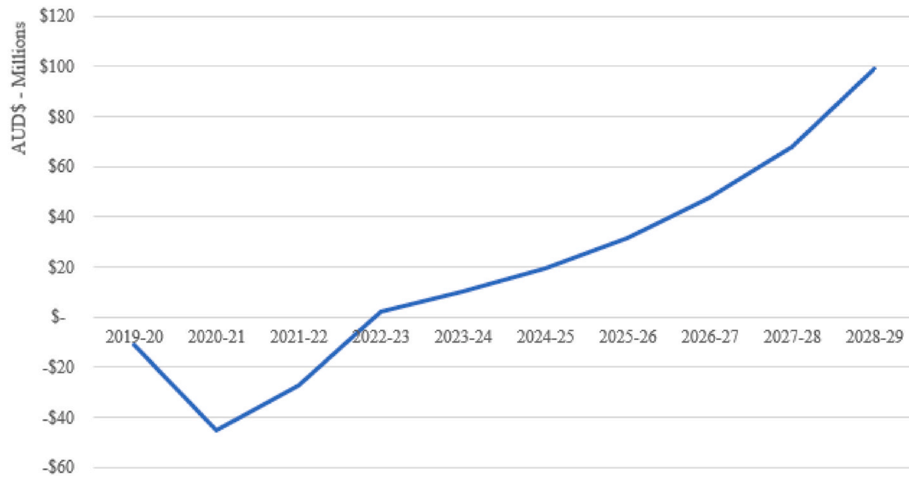


Fig. 3. Cashflow analysis – KI National Parks rebuilding investment, 2019 to 2029.

g., bequest benefits for those that may never visit the sites in question). While it is known that the connection between economic outcomes and the ecosystems within protected area sites is absent in many economic analyses, the inclusion of social health gains/reduced healthcare costs (or economic benefits derived) is typically not addressed (FIT, 2018). Yet, following our example here, any TEV estimated via the ecosystem services approach allows for such societal benefits to be estimated. For example, using this method may assist management authorities to make sound decisions regarding investment scope and magnitude—while considering environmental, social and wellbeing benefits *in addition* to considerations of revenue—as the ecosystem services model allows for each of these factors to be readily parametrized while undertaking the CBA. Examining broader social factors was found to be particularly relevant to the KI Wilderness Trail case study investigated in the present study. Walkers who use the track would also likely benefit both in terms of health and wellbeing, in addition to being educated about the ecosystem they are enjoying. Such benefits should not be underestimated as they have been shown to have a profound effect on Gross Product (regional, state etc.) where they have been examined (see for example Loch et al., 2021). The combined approach is also recommended for specialised tourism studies by Dwyer et al. (2016).

Further work investigating social benefits derived from investment into SA protected areas and their costs/benefits is therefore recommended for better planning and decision-making in future. This is because, without a picture of the accurate restoration costs, the benefits of the works could have been unambiguously inflated. The scenarios provided here illustrate this in the contrast between operating and restoration total costs (Fig. 5 green and red line differentials). Given the reported common lack of accurate cost data in previous protected area CBA studies, even if reasonable cost estimates are factored in (e.g., scenarios to approximate restoration costs), it is likely that the assessment conclusions would be of lower total value to researchers and decision-makers. But given the public nature of the information, and the obvious NPV differentials from restoring public assets such as protected areas, there can be less argument or justification for government authorities to persist with keeping cost information in the background in future assessments.

Finally, in this case where accurate cost and operations budget data was made available, we were also able to broadly compare both the primary economic contributions of total SA protected area network revenue (e.g., campsite fees) to total secondary economic contributions (i.e., the sum of travel cost and multiplier impacts) to derive a $1:$23 ratio between the two categories at a whole-of-regional-area level. This offers additional high-level arguments against claims that currently protected area land could provide greater welfare benefits to regional communities if they were employed in alternative production (e.g., grazing pasture) or land uses which alienate public access and use. Further, applying the data provided by NPWS for their operating expenditure and capital expenditure items in the 2018–19 period enabled us to determine the ratio between those expenditure levels and total secondary economic benefits to the regions: a $1: $10.40 difference—another useful measure of economic benefits, which are sorely required as stated above. This further refutes simple claims that protected area sites are expensive to maintain and operate, and that public resources would be better deployed toward commonly argued for alternative services (e.g., transport or elite sports). In scale, this ratio is also consistent with values reported in earlier studies of Queensland national parks (Driml et al., 2019) and the United States' national park System (Haefele et al., 2016)—although not representative of post-disaster benefits and costs which would increase public costs, but where protected area restoration after such disasters would also increase public benefits. A deeper consideration of such ratios can serve to inform resource allocation decisions following disasters (Richardson et al., 2018), where trade-offs associated with competing park investments or benefit-cost assessment outcomes can be enhanced by the net economic

Table 3
KI Parks restoration construction stimulus impact results, $AUD.

	2019–20	2020–21	2021–22	2022–23	Total
Additional expenditure	$2.0 m	$14.08 m	$27.2 m	$9.0 m	$52.2 m
Impact on GRP[2]					
Initial [3]	$604,000	$4.2 m	$8.2 m	$16.4 m	$29.4 m
Flow-on	$318,000	$2.2 m	$4.3 m	$8.6 m	$15.5 m
Total	**$922,000**	**$6.4 m**	**$12.5 m**	**$25.0 m**	**$44.9 m**
Impact on Employment (FTE)[4]					
Initial	5.36	37.68	72.67	145.50	261.20
Flow-on	3.43	24.14	46.56	93.22	167.36
Total	**8.79**	**61.82**	**119.23**	**238.72**	**428.56**

[2] Gross Regional Product or Gross State Product is a measure of the net contribution of an activity to the economy, it is the measure of the value of output less the cost of goods and services used in producing the output. It is the preferred indicator for measuring economic impact (BDO Australia, 2020).

[3] '*Initial impacts* are those that impact the level of economic activity as a result of the stimulus. *Flow-on* effects are estimates of the purchases required from other sectors as a result of the initial economic activity, plus the estimates of the output from second, third and subsequent spending rounds by firms (BDO Australia, 2020).

[4] See South Australian Department of Treasury and Finance, Guidelines for the evaluation of public sector initiatives, Part B: investment Evaluation Process, 2014, page 68.

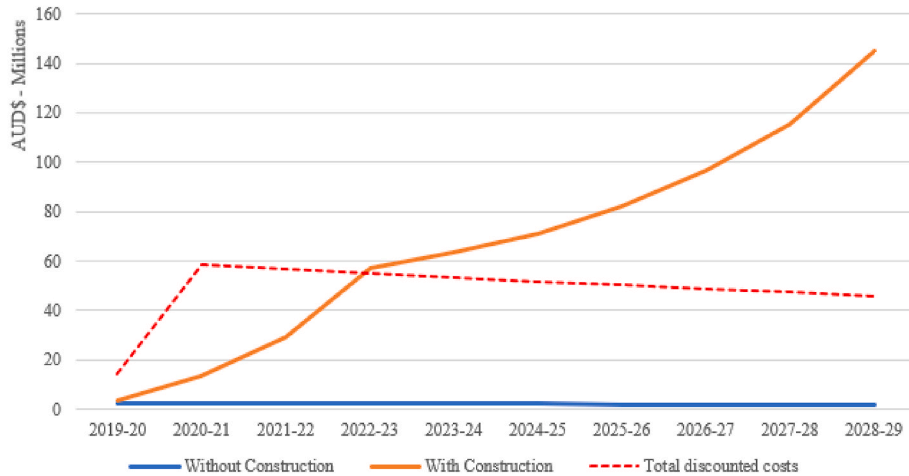


Fig. 4. Discounted economic benefits and costs of KI NPWS rebuild program.

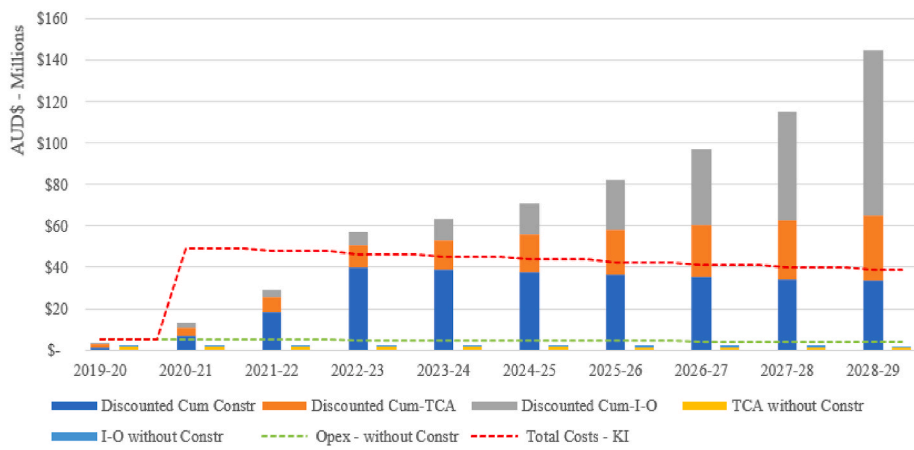


Fig. 5. Annual discounted cashflow returns – KI rebuild program.

values reported in this study. Government allocations from general budgets toward park operating/capital investments may have greater economic benefit than targeted fee increases (Haefele et al., 2016).

5.1. Study limits

While access to and applications of real government budget data in this study are in line with Australia federal government (and arguably global) objectives, some limits do apply. For example, multiplier impacts may not be the most appropriate means by which economic impacts are established and alternative approaches may offer closer estimates of the variables included. Other jurisdictions that lack similar access may struggle to replicate or follow the insights offered herein. Further, budget trade-offs or the total opportunity costs of allocating public funds on this basis remain limited and could feature more highly in future analysis. Dependent on where this study goes next, the study parameters may offer pathways for incorporating and exploring such costs via expert interviews as suggested by the Mayer framework.

It is also important to note that this analysis assumes there are no on-going adverse events (e.g. bushfires) that could reduce the payoff period of the restoration costs. Under a changing climate, where bushfires and other adverse events occur more frequently, this assumption may not hold. If we transition to a climate where remedial restoration expenditure is required frequently society may re-evaluate both the allocation of expenditure and the benefits they obtain from travel (i.e. travel to bushfire prone areas may decline). If society is not willing to pay for restoration, then 15 % of the necessary global 44% target is at significant risk.

6. Conclusions

Protected area sites represent a significant proportion of total global land mass, but still at lower than optimal rates for biodiversity and ecosystem service provision needs. This coverage is at increased future risk from negative impacts related to climate change events such as drought, flooding, and bushfires. The 2022 Yosemite National Park fires in the United States is a prime recent example of the damage that can occur from such events. If future impacts are as expected this will also increase the need for protected are managers to seek significant public funding in relatively short cycles to restore ecosystem services to their previous levels. To support those requests protected area authorities—and Treasury officials alike—need to be better informed about the full set of trade-offs and the supporting statistics. To produce the best set of statistics government officials should provide a clear and complete set of projects, operating, and capital expenditure data.

In this paper we access and utilize a comprehensive set of projects, operating, and capital cost data around the restoration of a key protected area in South Australia's national park network, which in total comprises a land mass that eclipses some European counties. As an example of the advantages of combining accurate cost data with a full set of relevant benefits we can provide a more precise evaluation of the value of those restoration works to the South Australian economy, and the case study regional economy on Kangaroo Island. We identify a roughly 3:1 ratio of benefits to costs, providing strong evidence of the logic behind the restoration decision. Restoring the protected area sites ensures both gradual returns to pre-bushfire tourism levels with regional economic advantages; but also continued strategic profits in terms of ecological rehabilitation and assured future biodiversity ecosystem services associated with the parks. As people value their protected areas in a wide variety of ways, additional studies along these lines can only serve to inform government funding decisions in future and help to advance cognisant protected area valuation studies in future.

CRediT authorship contribution statement

Adam Loch: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Glen Scholz:** Writing – original draft, Project administration, Funding acquisition, Data curation, Conceptualization. **David Adamson:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Stuart Sexton:** Writing – original draft, Methodology, Formal analysis, Data curation. **Alexandra Peralta:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Adam Loch reports financial support was provided by South Australian Department for Environment and Water. Thanks is also extended to Associate Professor Patrick O'Connor for his support and guidance on this project.

Data availability

Data will be made available on request.

References

ABARES, 2022a. About My Region - South-East Australia, Regional Profiles. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, ACT.
ABARES, 2022b. Farm survey data, Farm survey and Analysis. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, ACT.
ABS, 2021. Australian National Accounts: Tourism Satellite Account. Australian Bureau of Statistics, Canberra, ACT.
Allan, J.R., Possingham, H.P., Atkinson, S.C., Waldron, A., Di Marco, M., Butchart, S.H., Adams, V.M., Kissling, W.D., Worsdell, T., Sandbrook, C., 2022. The minimum land area requiring conservation attention to safeguard biodiversity. Science 376, 1094–1101.
Aseres, S.A., Sira, R.K., 2021. Ecotourism development in Ethiopia: costs and benefits for protected area conservation. J. Ecotourism 20, 224–249.
Auswalk, 2020. Kangaroo Island Wilderness Trail - 5 Day, SA. Auswalk Guided Tours, Adelaide.
Baaske, W., Reiterer, F., Sulzbacher, R., 1998. Cost–benefit-analysis of the national park Oberosterreichische Kalkalpen. Schlierbach: Studienzentrum fur Internationale Analysen. Vienna, Austria.
Balmford, A., Green, J.M., Anderson, M., Beresford, J., Huang, C., Naidoo, R., Walpole, M., Manica, A., 2015. Walk on the wild side: estimating the global magnitude of visits to protected areas. PLoS Biol. 13, e1002074.
BDO Australia, 2020. User Notes for the RISE Version 6.04 Impact Model. BDO Consulting, Adelaide, SA.
Benson, C., Watson, P., Taylor, G., Cook, P., Hollenhorst, S., 2013. Who visits a national park and what do they get out of it?: a joint visitor cluster analysis and travel cost model for Yellowstone National Park. Environ. Manag. 52, 917–928.
Bharali, A., Mazumder, R., 2012. Application of travel cost method to assess the pricing policy of public parks: the case of Kaziranga National Park. Journal of Regional Development and Planning 1, 44–52.
Boone Law, W., Lewis, M., 2020. I made bushfire maps from satellite data, and found a glaring gap in Australia's preparedness. The Conversation, Canberra, ACT. Available at: https://theconversation.com/i-made-bushfire-maps-from-satellite-data-and-found-a-glaring-gap-in-australias-preparedness-132087.
Brenner, L., Mayer, M., Stadler, C., 2016. The economic benefits of whale watching in El Vizcaíno Biosphere Reserve, Mexico. Econ. Soc. Territ. 16, 429–457.
Carson, R.T., 2012. Contingent valuation: a practical alternative when prices aren't available. J. Econ. Perspect. 26, 27–42.
Cunningham, C.X., Williamson, G.J., Bowman, D.M.J.S., 2024. Increasing frequency and intensity of the most extreme wildfires on Earth. Nature Ecology & Evolution 8, 1420–1425.
DAWE, 2021. Kangaroo Island: Impacts of the 2019-20 Bushfires. Australian Government Department of Agriculture, Water and the Environment, Canberra, ACT.
DEW, 2021. In: Parks 2025 and Kangaroo Island Bush Fire Recovery Budget Dataset, South Australian Department for Environment and Water,. Adelaide, South Australia.
Driml, S., Brown, R., Silva, C.M., Li, L., 2019. Estimating the Value of National Parks to the Queensland Economy: Methodology Report. The University of Queensland, Brisbane, Qld.
Dwyer, L., Forsyth, P., 2009. Public sector support for special events. E. Econ. J. 35, 481–499.
Dwyer, L., Jago, L., Forsyth, P., 2016. Economic evaluation of special events: reconciling economic impact and cost–benefit analysis. Scand. J. Hospit. Tourism 16, 115–129.
Eagles, P.F., 2003. International trends in park tourism: the emerging role of finance. The George Wright Forum. JSTOR, pp. 25–57.
Filkov, A.I., Ngo, T., Matthews, S., Telfer, S., Penman, T.D., 2020. Impact of Australia's catastrophic 2019/20 bushfire season on communities and environment. Retrospective analysis and current trends. Journal of Safety Science and Resilience 1, 44–56.
FIT, 2018. Revaluing parks and green spaces: measuring their economic and wellbeing value to individuals, Green Spaces for Good. Fields in Trust, London, UK.
Gutman, P., 2002. Putting a price tag on conservation: cost benefit analysis of Venezuela's national parks. J. Lat. Am. Stud. 34, 43–70.
Haefele, M., Loomis, J., Bilmes, L., 2016. Total economic value of US National Park Service estimated to be $92 billion: implications for policy. George Wright Forum 33, 335–345.
Hansen, A.J., Piekielek, N., Davis, C., Haas, J., Theobald, D.M., Gross, J.E., Monahan, W. B., Olliff, T., Running, S.W., 2014. Exposure of US National Parks to land use and climate change 1900–2100. Ecol. Appl. 24, 484–502.
Heagney, E., Rose, J.M., Ardeshiri, A., Kovac, M., 2019. The economic value of tourism and recreation across a large protected area network. Land Use Pol. 88, 104084.
Higgins-Desbiolles, F., 2011. Death by a thousand cuts: governance and environmental trade-offs in ecotourism development at Kangaroo Island, South Australia. J. Sustain. Tourism 19, 553–570.
Hughes, M., Jones, T., Deery, M., Wood, D., Fredline, L., Whitely, Z., Lockwood, M., 2009. Estimating the economic, social and environmental value of tourism to protected areas. Technical report, pp. 80.
Hughes, M., Smith, A., Tuffin, M., 2016. Bibbulmun Track User Survey Report: 2014-15, Prepared for the Trails Grant Program, Department of Sport and Recreation. Murdoch University, WA, Perth, WA, p. 43.
Hundloe, T., 2021. The A to Z of Environmental Qualifications, Environmental Impact Assessment. Springer, pp. 289–301.
Kariyawasam, S., Wilson, C., Rathnayaka, L.I.M., Sooriyagoda, K.G., Managi, S., 2020. Conservation versus socio-economic sustainability: a case study of the Udawalawe National Park, Sri Lanka. Environmental Development 35, 100517.
Kniivilä, M., Ovaskainen, V., Saastamoinen, O., 2002. Costs and benefits of forest conservation: regional and local comparisons in Eastern Finland. J. For. Econ. 8, 131–150.
Li, K.X., Jin, M., Shi, W., 2018. Tourism as an important impetus to promoting economic growth: a critical review. Tourism Manag. Perspect. 26, 135–142.
Li, S., Wang, Y., Zhao, Y., 2021. Assessment of the ecological destruction of wildfire based on remote sensing image. The 4th International Conference on Image and Graphics Processing. ACM Digital Library, New York, NY, pp. 97–101.
Liu, S., Costanza, R., 2010. Ecosystem services valuation in China. Ecol. Econ. 69, 1387–1388.
Loch, A., Auricht, C., O'Connor, P., 2021. Value of South Australia's national parks and reserves: Part 2 - secondary economic value. In: Study 1: Economic Value of Nature-Based Tourism, SA. South Australian Department for Environment and Water, Adelaide, p. 48.
Loch, A., Scholz, G., Auricht, C., Sexton, S., O'Connor, P., Imgraben, S., 2022. Valuing national park benefits using combined methods. GFAR Working Paper Series. The Centre for Global Food & Resources. University of Adelaide, Adelaide, SA, p. 38.
Loomis, J., 2002. Integrated Public Lands Management. Columbia University Press, New York.
Maria Raya, J., Martínez-Garcia, E., Celma, D., 2018. Economic and social yield of investing in hiking tourism: the case of Berguedà, Spain. J. Trav. Tourism Market. 35, 148–161.
Maxwell, S.L., Cazalis, V., Dudley, N., Hoffmann, M., Rodrigues, A.S.L., Stolton, S., Visconti, P., Woodley, S., Kingston, N., Lewis, E., Maron, M., Strassburg, B.B.N., Wenger, A., Jonas, H.D., Venter, O., Watson, J.E.M., 2020. Area-based conservation in the twenty-first century. Nature 586, 217–227.
Mayer, M., 2014. Can nature-based tourism benefits compensate for the costs of national parks? A study of the Bavarian Forest National Park, Germany. J. Sustain. Tourism 22, 561–583.
Merrifield, J., 1997. Sensitivity analysis in benefit cost analysis: a key to increased use and acceptance. Contemp. Econ. Pol. 15, 82–92.
Mulwa, R., Kabubo-Mariara, J., Nyangena, W., 2018. Recreational value and optimal pricing of national parks: lessons from Maasai Mara in Kenya. Journal of Environmental Economics and Policy 7, 204–222.
Office of Impact Analysis, 2023. Guidance note - cost benefit analysis. In: Cabinet, D.o.P. M.a. (Ed.), DPMC, Canberra, ACT, p. 19.
Peng, L., He, L., Shen, M., Zhao, M., Armatas, C.A., 2023. Understanding stakeholder perceptions of environmental justice: a study of tourism in the Erhai Lake basin, Yunnan province, China. Ecol. Soc. 28.
PIRSA. Feral pig eradication program on Kangaroo island. Department of Primary Industries and Regions, South Australia, Adelaide. Available at: https://pir.sa.gov.au/biosecurity/introduced-pest-feral-animals/find_a_pest_animal/pigs/feral_pig_er

adication_program_on_kangaroo_island#:~:text=Feral%20pigs%20are%20a%20major,the%20pest%20from%20the%20island.
Pontin, D., 1993. Local government and facility investment. Datasport 3, 2–5.
Qiu, R.T.R., Park, J., Li, S., Song, H., 2020. Social costs of tourism during the COVID-19 pandemic. Ann. Tourism Res. 84, 102994.
RDA, 2022. RDA Adelaide Hills, Fleurieu and Kangaroo Island Economic Profile. Id, VIC. Consulting Pty Ltd., Collingwood.
Richardson, L., Koontz, L., Peacock, B., 2018. For the benefit and enjoyment of the people: an exploration of the economic benefits of National Parks. George Wright Forum 35, 42–52.
Riera, P., Signorello, G., Thiene, M., Mahieu, P.-A., Navrud, S., Kaval, P., Rulleau, B., Mavsar, R., Madureira, L., Meyerhoff, J., Elsasser, P., Notaro, S., De Salvo, M., Giergiczny, M., Dragoi, S., 2012. Non-market valuation of forest goods and services: good practice guidelines. J. For. Econ. 18, 259–270.
SA Treasury, 2021. In: Treasury, D.o. (Ed.), State Budget 2021-22: Budget Statement Paper No. 3. South Australian Government, Adelaide, p. SA.
SATC, 2020. South Australian Tourism Commission 2019-20 Annual Report, SA. South Australian Tourism Commission, Adelaide.
Schonback, W., Kosz, M., Madreiter, T., 1997. Donauauen National Park: Cost-Benefit-Analysis. Springer, Wien, Austria.
Shah, K., Gupta, V., 2000. Tourism, the Poor and Other Stakeholders: Experience in Asia. Overseas Development Institute, London.
Syneca Consulting, 2008. Economic Impact Analysis for Three Capes Track, Tasman National Park: Revisited Assessment, Report Prepared for Tasmanian Parks and Wildlife Service. Syneca Consulting Pty Ltd., Sydney, NSW.
Thomson, F.L., Thomson, N.J., 1994. Tourism, tax receipts and local government: the case of Kangaroo Island. J. Tourism Stud. 5, 57–66.
TTF, 2013. Conceptualizing the value of protected areas: a literature review of the value, financing and tourism potential of Australia's protected areas. Tourism and Transport Forum Australia, Melbourne, Victoria, pp. 32.
Unep, I.U.C.N., Iucn, W.C.P.A., 2019. The World Database on Protected Areas. United Nations, Cambridge, UK. https://www.protectedplanet.net/.
Van Beukering, P.J., Cesar, H.S., Janssen, M.A., 2003. Economic valuation of the Leuser national park on Sumatra, Indonesia. Ecol. Econ. 44, 43–62.
Watson, J.E., Dudley, N., Segan, D.B., Hockings, M., 2014. The performance and potential of protected areas. Nature 515, 67–73.