

What do State of Conservation reports tell us about the state of conservation: an Australian case study.

Introduction

Being inscribed to United Nations Educational, Scientific and Cultural Organisation's (UNESCO) World Heritage List is the one of the most enduring and prestigious accolades afforded by the most powerful global standard in heritage conservation (Meskell, 2013). UNESCO's World Heritage Convention (WHC) and its Outstanding Universal Value (OUV) continues to dominate the conservation landscape. Sought after by nation states seeking the unique benefits associated with the label, ranging from economic imperatives such as increased tourism revenue and investment opportunities, through to political gains via international partnerships and national identity building (Koch, 2015; Meskell, 2013). However, as the system and its processes have evolved, it has drawn some critique. Rodwell (2012), reviewing the organisation's progress at its 40th anniversary, observed that as the number of sites has proliferated, there has evolved a "tendency for protection to become a secondary consideration once listing is achieved [not helped by] inadequate monitoring based on simplified statistics rather than scientific criteria" (p.73).

Since those observations, UNESCO has developed its State of Conservation (SOC) reporting process and published the SOC Online Information system. The SOC process is means by which state parties of stakeholders make UNESCO aware of any events that may negatively impact a WHS. In doing so, it seeks to optimise the information and insight it holds on World Heritage Sites (WHS) (Veillon, 2014). The online system makes available a significant body of global scale data to heritage and conservation practitioners, NGOs, and other interested stakeholders around the world. Given the urgency of the current environmental crises, information that contributes usefully to conservation action is urgently required. Further, the information is freely accessible (albeit with a minimum level of internet access, hardware, and technology) to users without requirement of financial or institutional resources. This means it has significant potential as a data source. Therefore, it is pertinent to assess the usefulness of the SOC Online Information system as a resource for users such as heritage and conservation practitioners.

Australia provides a useful conservation context with regard to its natural heritage. Its unique geology and ecology results in a large proportion of habitats and native species of flora and fauna not found anywhere else. Therefore, that its extinction rate is amongst the highest in the world (Gayle et al, 2018) and its well-publicised challenges with the Climate Crisis (New Scientist, 2021), it can be reasonably assumed to have participated in the SOC reporting process regarding its natural heritage. Further, Australia's active engagement with the UNESCO World Heritage system is evident from its early and ongoing involvement in the listing process (its most recent site was listed in 2019) and the prominent position World Heritage holds in its Heritage Strategy. The national government's 2015

strategy document frames Australia's World Heritage in terms of its "economic impacts [which are] in the order of \$15.4 billion in annual turnover and just over 79,000 direct and indirect jobs" (Australian Government, 2015). Therefore, Australia's engagement in the SOC reporting is a productive exemplar to examine how the SOC reports reflect the state of conservation.

The aim of this study then, is to examine UNESCO's SOC Online Information system to identify a) how useful the system itself is as a source of information for practitioners and, b) how useful is UNESCO's State of Conservation reporting process in assessing the state of conservation of World Heritage Sites? To address these questions the study will provide a brief overview of pertinent UNESCO World Heritage structures and detail the key reporting mechanisms used in monitoring sites. It will then describe the methodology used to explore Australia's SOC data. The study will finally present the results from the analysis and conclude with a discussion on the implications of the findings for the usefulness of SOC reporting and conservation.

UNESCO World Heritage Overview

The 1972 World Heritage Convention (WHC) is the key UNESCO instrument concerned with protecting the world's heritage. It is largely operationalised through the creation and monitoring of a global inventory of heritage sites: The World Heritage List (WHL). A site is nominated by a State Party and reviewed for inscription by the World Heritage Committee (Committee), the representative body comprised elected State Party leaders. A site is added to the WHL if it is of Outstanding Universal Value. (OUV). OUV is determined by satisfying one or more of UNESCO's ten criteria which classify cultural heritage: human-made or built items: monuments; sites and groups of buildings, and natural heritage: natural features, geologic formations or natural sites or delineated areas (UNESCO, 1972). And, following the 1992 introduction of cultural landscapes, 'mixed' sites can now be inscribed that meet both natural and cultural criteria (UNESCO, 2019).

Once added to the WHL, the responsibilities for the protection of the site sit with the State Party who "must identify and delineate the property (Article 3), and must ensure the identification, protection, conservation, presentation, and transmission to future generations (Article 4)" (Frey and Steiner, 2011 p.561). In doing so the State Parties must ensure appropriate funds, processes and resources are made available for the site's safeguarding.

In defining its safeguarding mechanisms, the State Party may benefit from collaboration with the World Heritage Centre on the production of the site's management plan and reports. It may also receive technical support via UNESCO's Advisory bodies such as the International Union for

Conservation of Nature (IUCN). The IUCN advises the Committee on issues regarding natural heritage with its focus being ensuring the safeguarding of nature through international cooperation and provision of knowledge and tools.

Reporting

In protecting a site, the State Party is required to implement active management and research frameworks. These frameworks comprise two key reporting components: Periodic Reporting and Reactive Monitoring via State of Conservation reporting. The latter is the focus of the present study. The primary objective of the SOC reporting processes is to declare any events or decisions that may affect the status of a site's OUV (UNESCO, State of Conservation, 2021).

Reactive Monitoring: State of Conservation Reports

Reactive Monitoring (RM) has evolved as the WHC has evolved, originating as an *ad hoc* process motivated by “the idea of being regularly informed about the State of Conservation of World Heritage Sites” (Cameron and Rossler, 2013, in Sheppard and Wijesuriya, 2019, p.12). Today, the Committee operates a standardised reporting process driven partly by the sheer proliferation of sites and partly due to a declared “increasing priority placed on the conservation status of World Heritage properties by States Parties” (Sheppard and Wijesuriya, 2019, p.7).

As the name suggests, this is a reactive process instigated by the World Heritage Centre in response to the receipt of information concerning impacts to the OUV of a Site. This information can be identified by the Committee itself from previous reports or following a disaster or obtained directly from a state party or third parties (site managers, media, NGOs etc). Depending on the information received, the Committee will decide on the appropriate action. In the main this will initiate the State of Conservation reporting process led by the World Heritage Committee and the Advisory Bodies, with the information communicated and verified by the State Parties (Sheppard and Wijesuriya, 2019).

State of Conservation Reports

The SOC reports themselves are created using a standard format that captures the information required in a narrative form to preserve the unique and specific details put forward in each case (UNESCO, State of Conservation, 2021). To enable further analysis however some data is extracted from the narrative reports and standardised. This standardisation focusses mainly on classifying the factors effecting a site into the corresponding Primary and Secondary Threat categories (UNESCO, State of Conservation, 2021). For example, a report relating to issues around urban sprawl will be classified with a primary threat of ‘Buildings and Development’ and a secondary threat of ‘Housing’

(see Appendix 1 for the full list of primary and secondary threats). Additionally, key data regarding the report is also extracted e.g., type of site, State Party, Year of Report.

State of Conservation Information System

A recent development of the reporting process was the launch of the online State of Conservation Information System in 2013 (Veillon, 2014). The system enables multi-search functionality and the ability to extract a selection of raw data (as per the above) for onward analysis. The intention of is to make this data “publicly accessible to all stakeholders of the World Heritage Convention and any interested parties” (Veillon, 2104). The data is based on narrative SOC reports and is provides links to supporting documentation such as relevant correspondence and decisions adopted by the World Heritage Committee. By making it widely available, the two key objectives are (Veillon, 2014):

- 1) Its use in monitoring the state of conservation of properties and analyse threats to identify potential trends over time.
- 2) As a contribution to the institutional memory of the World Heritage Convention and facilitation of decision-making.

How well the data meets these objectives will be used to determines the effective of the SOC process’.

IUCN World Heritage Outlook

Supplementary to the SOC reporting process, the IUCN has developed the IUCN World Heritage Outlook. The Outlook reports evaluate the natural heritage status of each WHS so that the sites future trajectory can be assessed. These reports do not form part of the SOC reports or the advisory processes to the WHC, but instead provide an assessment of the conservation prospects of natural heritage at the time of reporting. The Outlook uses information from the SOC processes and other sources of data and evidence which factor into the final assessments on the trajectory of the site (IUCN, 2021).

The primary data source for the current study is the SOC data provided through the Information System. The research focuses on the threats (primary and secondary) as the key indicators of status of conservation. It will also use the WHL site information which can be downloaded as an Excel extract, supporting documentation provided by the Online System and the IUCN World Heritage Outlook to validate or compare with the SOC data. Given the IUCN reports are produced by UNESCO’s own advisory body with consideration to the SOC processes and data, the provide a useful and comparable data set with which to validate the results.

Methods

Data Preparation

To analyse the conservation status of Australia's natural heritage, a master data set was compiled from three sources: the data from the SOC online system; UNESCO World Heritage List for site level data; and the World Heritage Outlook data provided by IUCN (see Appendix 2 for the details on data preparations).

Microsoft Excel was used for the data cleansing and preparation activities which involved the following steps:

UNESCO Data:

1. To identify the relevant data for analysis, the two original SOC and WHL UNESCO datasets were filtered to ensure only data relevant to Australia Natural Heritage sites was included.
2. The two datasets were merged to create a single master data file.
3. The master data file was reviewed to remove data points not required for analysis e.g., names of UNESCO files; state party details, empty or null variables; and any variables provided in French.
4. The 'Threat' classification contained in the original SOC data set is provided as a concatenated data point in a single field which limits the ability to analyse the information at the level of individual threat. As such, this data was separated so that each threat was represented as a data point to allow further analysis.

IUCN Data:

5. IUCN Heritage Outlook reports are published as website text or PDF documents for each WHS. As such, the most recent online report was reviewed for each site and the key outlook data points were manually extracted and added to the master data file.

Data Visualisation

Tableau Public was used for the data analysis and visualisation stages of the study. Tableau Public is a free-to-access application that uses AJAX-based JavaScript. As a tool specialising in data visualisation (vizzes), Tableau Public positions itself as suitable "for anyone interested in understanding data and sharing those findings as data visualizations with the world. Journalists, writers, bloggers, state and local governments, non-profits, companies, and more [...]" (Tableau Public FAQ, 2021). The tool is premised on a 'self-serve' model in which users access video tutorials for basic 'how to' tutorials and a community for any advanced queries/support. Thus, this tool is widely available on the condition that any vizs are published publicly, thus any data used must be appropriate for open access

publication. The data sources used in this study are explicitly made available common use as stated in UNESCO's and IUCN's guidelines (UNESCO, State of Conservation, 2021 and IUCN, 2021).

The master data file was loaded to Tableau Public in its Microsoft Excel format. No further transformation or conversion was required other than some formatting to optimise data as displayed in the vizs e.g., any lengthy data points were shortened or naming conventions made clearer; descriptions added to metadata and viz commentary.

One of the key benefits of Tableau Public is its intuitive interface and guided 'Show Me' function which suggests the most appropriate vizs for the specific data types being analysed. Thus, by selecting the data points, Tableau highlights the suitable vizs from which users can select the best fit for their data and research question.

As such the data was analysed to explore the following questions:

1. How many threats have been reported across the Australia portfolio over time (trend reports)?
2. What are the key threats to have impacted sites?
3. What sites are most impacted by threats?
4. How does SOC threat level compare with IUCN outlook?

The visualisations produced were extracted and the primary highlights from each viz was considered for further investigation to enable further understanding of the results.

To note: Tableau Public is optimised for online viewing and as such enables display of metadata and user filtering. For the purposes of this written report, a sample metadata is highlighted with each viz.

Results

Data Preparation

Figure 1 SOC Online Information System Search Functionality.

Figure 1 shows the search functionality available through the SOC Online Information System. It enables responsive searches of the global repository of SOC reports and relating documentation. The results are displayed in several pre-defined, summary-level graphical outputs alongside a summary of

each SOC report. From here users can drill into a specific report to access the original PDF report details, correspondence and Committee decisions and documents (See Figure 2).

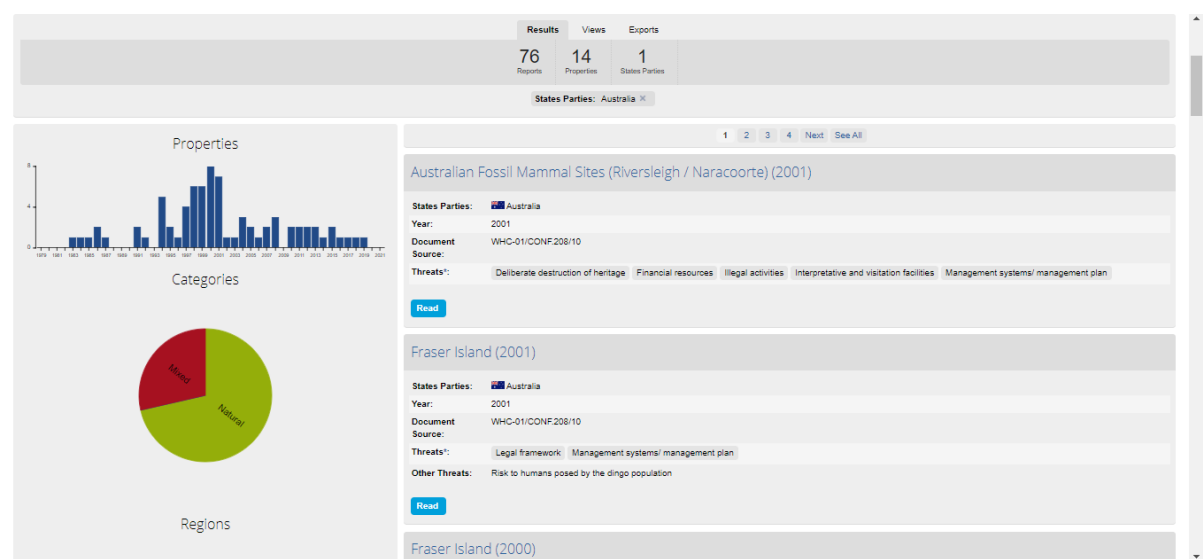


Figure 2 Summary search results for all World Heritage Sites in Australia.

The system also provides a function to export key data points from the search results into Excel format for further analysis (See Figure 3 and Figure 4). This formed the original SOC data set which was then enhanced to make it suitable for the analysis required.



Figure 3 Export function that enables Excel download of key data from search results.

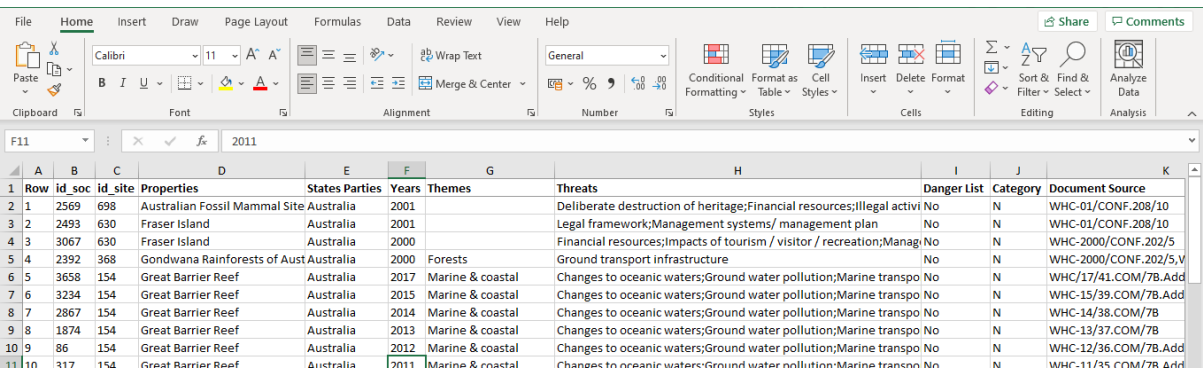


Figure 4 Export Sample showing key data from search results.

Data Visualisation

Figures 5 and 6 present the locations and relative size of each WHS. The portfolio comprises sixteen natural heritage sites, 14 of which have had at least one SOC report at some point since inscription.



Figure 5 Map of Australia's Natural World Heritage Sites (Sample metadata highlighted)



Figure 6 Relative Size of Australia's Natural World Heritage Sites (Sample metadata highlighted)

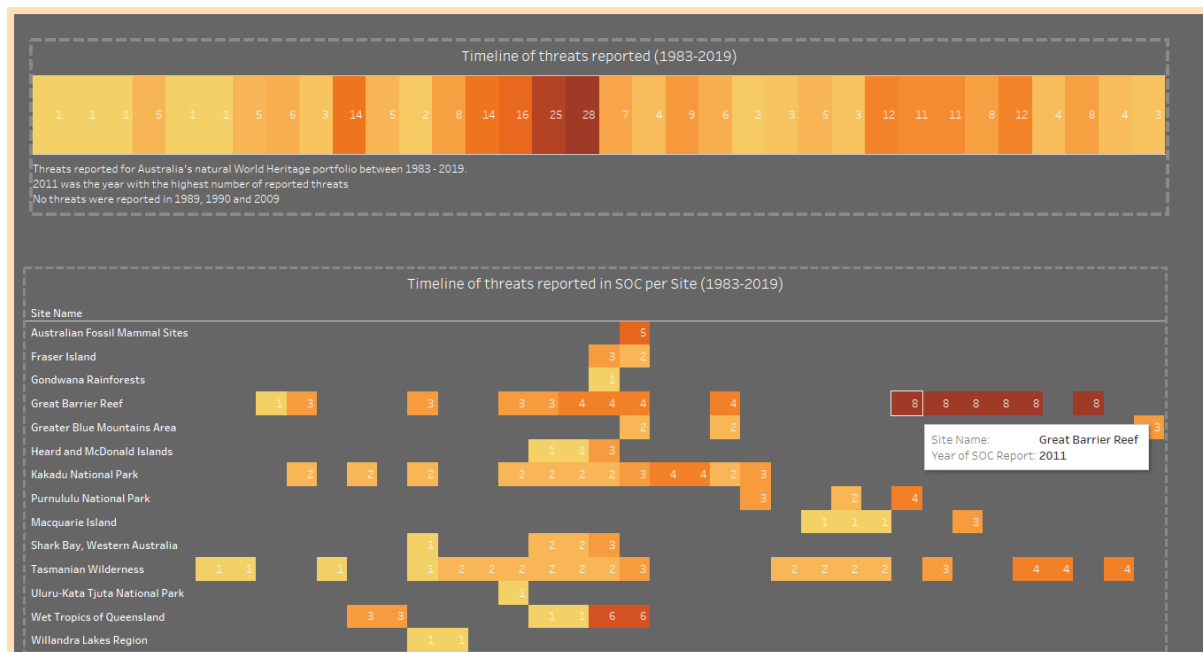


Figure 7 Timeline of all Threats Reported through SOC Reactive Monitoring 1983 – 2019 (Sample metadata highlighted)

Figure 7 quantifies the trend of all threats reported a) aggregated to show the trend over time for Australia in total. The highest number of threats (28) were reported in 2000. And b) a breakdown displays the trend of threats for each site. The last ten years show Great Barrier Reef has having the highest number of threats.

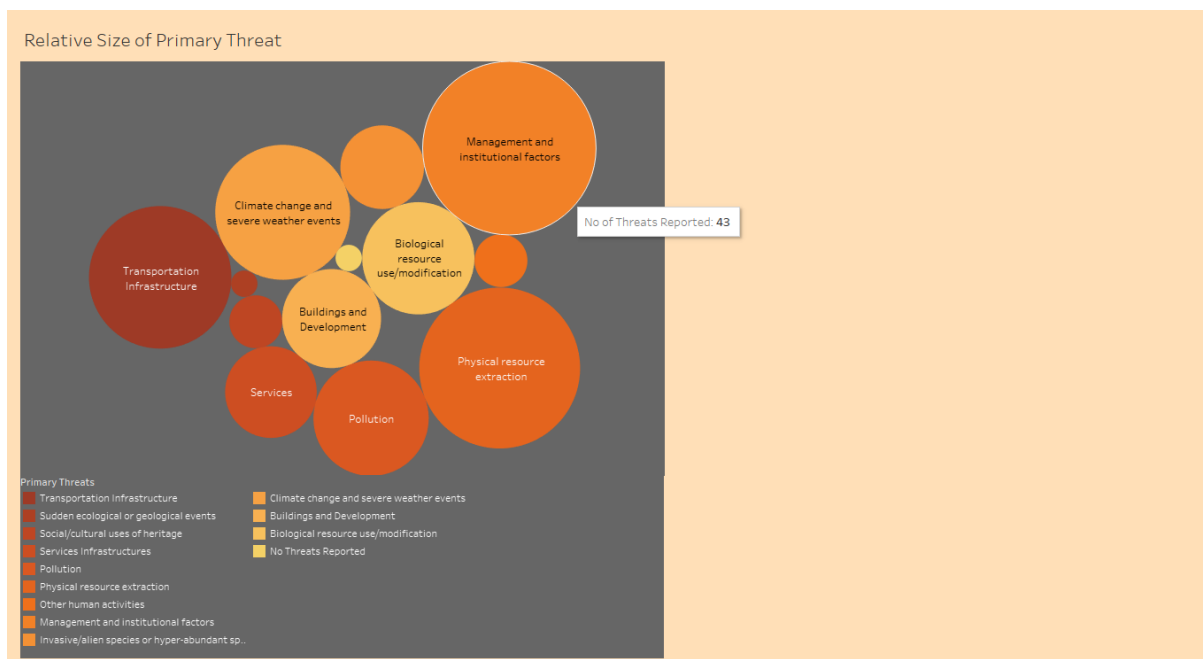


Figure 8 Relative Size of Impact of Primary Threats (Sample metadata highlighted)

Figure 8 displays the types of threat impacting Australian Natural Heritage. From this analysis the top three primary threats impacting sites are: Management and Institutional Factors, Physical Resource Extraction and Transportation infrastructure.

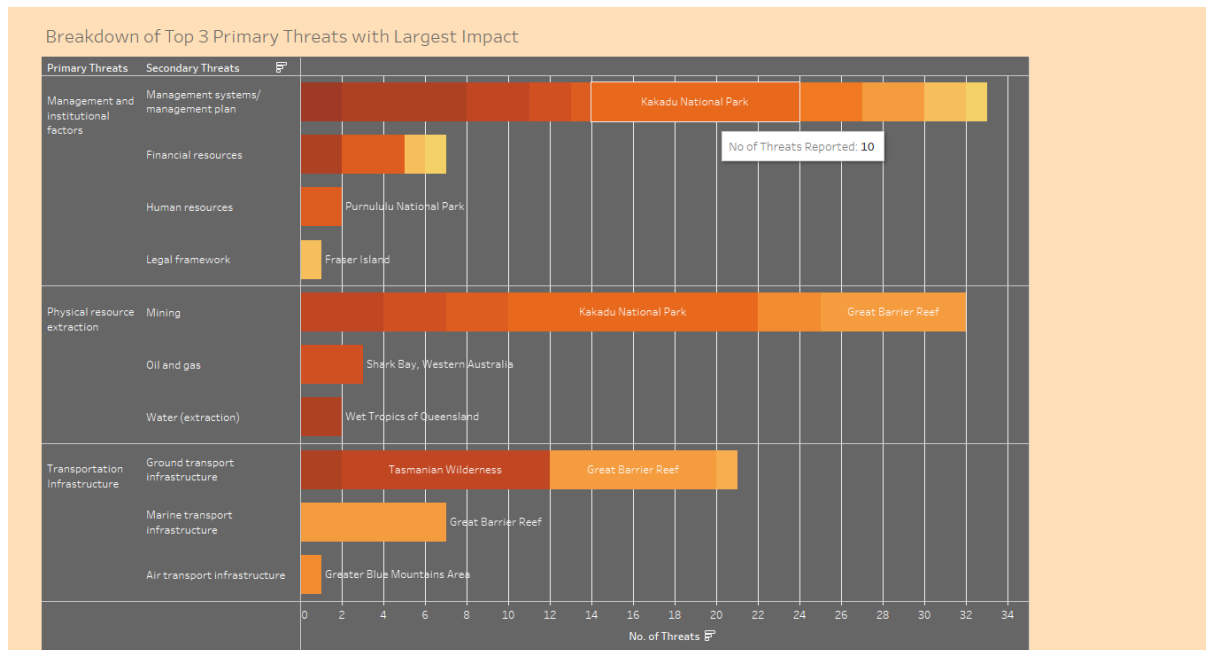


Figure 9 Breakdown of Top 3 Primary Threats (Sample metadata highlighted)

Figure 9 drills down into the top three threats impacting sites. This shows that the secondary threats having the biggest impacts on sites relate to Management systems/management plans, Mining and Ground Transportation. Further it shows that Kakadu National Park as a single site has been impacted significantly by both Management systems/management plans and Mining and the Great Barrier Reef has been impacted by Mining and Ground Transportation.

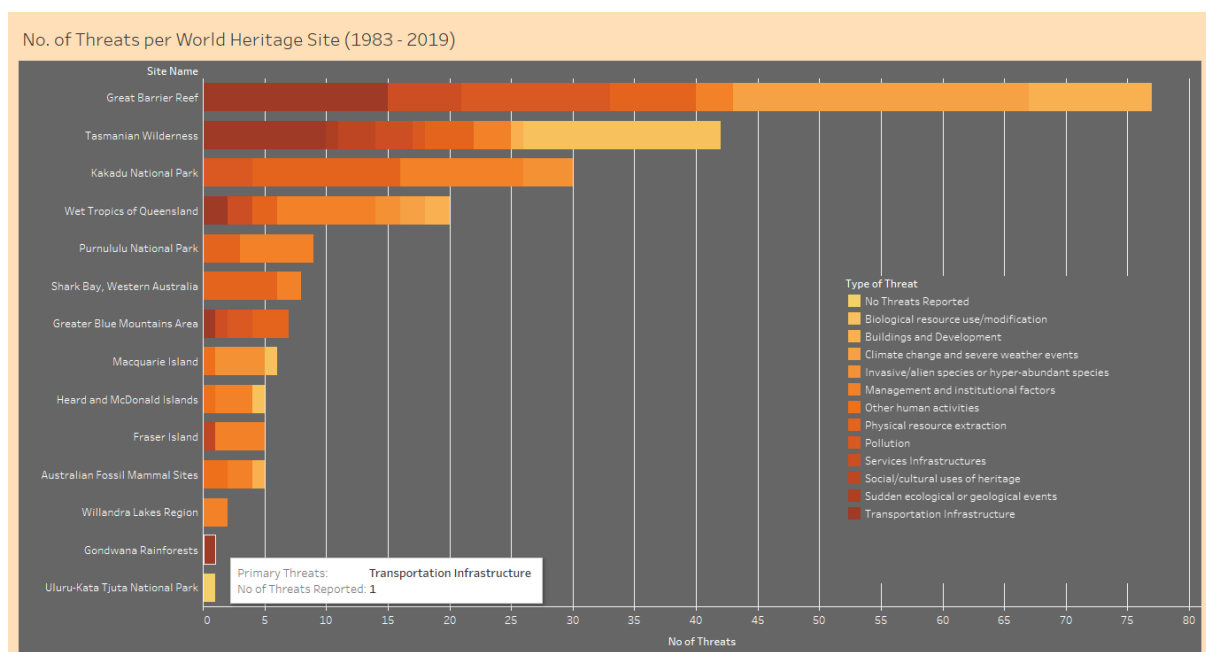


Figure 10 Breakdown of all Threats Reported per WHS (Sample metadata highlighted)

Figure 10 displays the threat profile for each site that has undergone an SOC report. The Great Barrier Reef has reported almost twice as many threats as the next most impacted site. At the other end of the scale, Uluru-Kata Tjuta has undergone an SOC report but has had no threats identified and Gondwana has reported the lowest incidence of threat with only one threat relating to Transport Infrastructure reported.

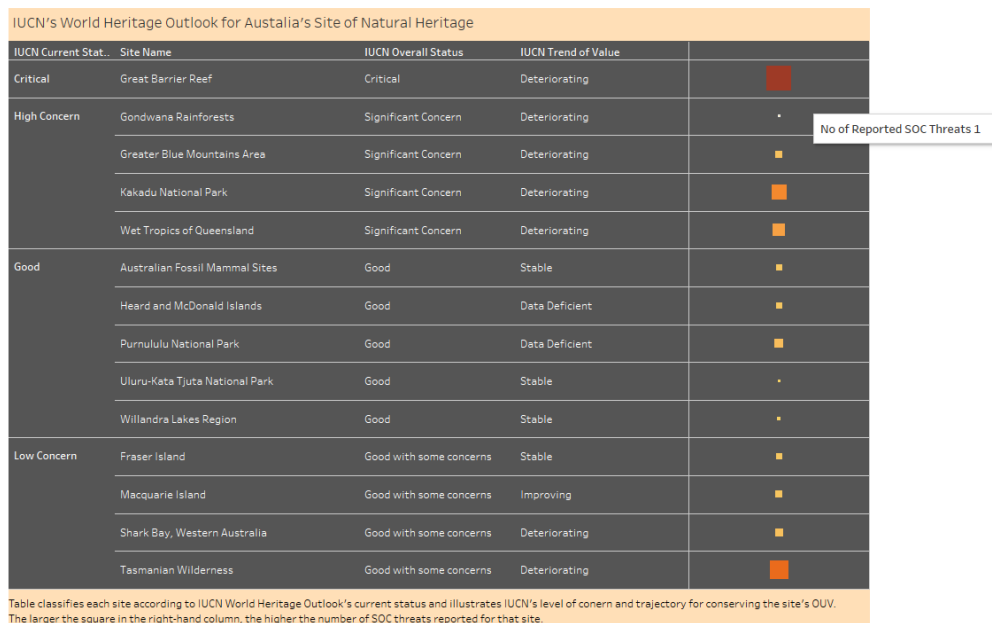


Figure 11 IUCN World Heritage Outlook per WHS (Sample metadata highlighted)

Figure 11 compares the IUCN Heritage Outlook assessment with the number of SOC threats for all sites. The Great Barrier Reef site is classified as critical with its outlook deteriorating, this corresponds the high number of SOC threats reported over time. Gondwana Rainforests are classified by IUCN as of significant concern with the status deteriorating, despite the smallest number of SOC threats reported.

Discussion

Usefulness of the SOC Online Reporting System

A report by the World Heritage Centre claimed that the SOC reporting system is “one of the most extensive systems of monitoring ever developed under an international legal instrument” (Sheppard and Wijesuriya, 2019, p.7). That users can access such an exhaustive repository of information at a global scale without a paywall or specific hardware requirements (other than internet access and the ability to use Microsoft Excel) supports this claim. Further, the ease of access, clear and responsive search functionality, the ability to export key data for additional analysis and the ability to drill down into additional documentation provides a significant breadth and depth of available information.

When the SOC Online System data is combined with the WHL site data (which includes details on the site’s location, criteria under which it was listed and its characteristics etc), a comprehensive view of World Heritage can be easily accessed. This partly supports the System’s objectives: it contributes to institutional memory.

There is scope for some improvements in the data itself. The WHL site information is obtained from a different Excel export but given these two data sets originate from the same source, it would be useful if these were combined to a single file to avoid manual data handling by user, as with any manual data entry, there is an increased risk of errors being made. Similarly for the threat data contained in the SOC reports. Currently these must be manually separated to enable analysis at the threat level, increasing the risk of error. Finally, there is no boundary information provided with the spatial data so whilst location and relative size can be analysed (Figure 5 and 6), it is not possible to examine site boundaries, which would be required in conservation planning.

More fundamental limitations are acknowledged by Sheppard and Wijesuriya’s 2019 report regarding the system and the reporting process in general. These centre around the inconsistent understanding of SOC reports by site managers and stakeholders. In their interviews with 27 WHS managers regarding the understanding and significance of the SOC process in general, only eight managers stated they were fully aware of the SOC processes (p.12). Additionally, due to the proliferation of sites and the corresponding increasing requirement to monitor them, the Committee’s capacity to effectively manage the reporting process has reduced. As a result, they have restricted the number of sites reported on and extended the timeframe in which monitoring occurs (Sheppard and Wijesuriya, 2019). This lack of understanding by key report contributors and the increasing pressure placed on the Committee challenges the quality and effectiveness of the SOC reporting system.

Usefulness of the SOC Reporting Process

The SOC reporting process identifies and documents any threats that may negatively impact a sites' OUV. In doing so and by making this information available it is hoped that the state of conservation can be assessed to identify potential threats over time and to inform decision making. Three main themes emerge from the headline analysis that suggest whilst the data is easily accessed, as discussed above, and while trends can be identified, the SOC process to inform decision making and identify potential threats is limited.

Threat Trends

Examination of the results from the data visualisation analysis illustrates the extent to which the SOC Reporting process has been used in the conservation of Australia's natural heritage. Of the sixteen natural or mixed WHS, two have had no SOC reports: Lord Howe Island Group and Ningaloo Coast and only one site had a report with no threats identified: Uluru-Kata Tjuta. The implication is then, that the remaining sites accounting for 80% of Australia's natural world heritage have been under threat at some point during their listing with UNESCO. Figure 7 shows that of the remaining sites, five appear to have had relatively 'isolated and resolved' incidents of threat and thus could, based on the SOC data, be considered sufficiently protected from a conservation perspective. However, as will be discussed below, gaps identified in the data indicate this conclusion somewhat spurious.

Future Threats

Using SOC data to inform decision making relies on the currency of the information provided. Figures 8 and 9 highlight the most frequently reported threats effecting sites. While several sites are impacts by a variety of threats (highlighting the varying array of conservation approaches required), further analysis of Figure 9 indicates Kakadu National Park to be most impacted by management issues and mining. Investigating the SOC reporting documentation relating to these specific threats for Kakadu National Park highlights a series of issues surrounding the management of the Ranger Uranium Mine located in the centre of the park. Originally excluded from the Site's boundaries, the mine is now in the process of being closed so that it can be incorporated as part of the Heritage site (Laurence and Sweeney, 2018). The majority of threats were reported between 1997 and 2005 during which time various activities such as expansion of the mine, contamination of water and ongoing tensions between the Australian Government and the traditional owners of the lands on which the park sits. There have been no further threats reported since 2005. Currently, the process for closing the mines is under scrutiny as there is concern around the mine owner's ongoing commitment in ensuring the site is closed according to the WHS standard and to achieve the desired environmental impacts by 2026 (Laurence and Sweeney, 2018). None of this information is reflected in the current SOC reports yet this is a critical step in the development of the park, both for the site itself and for people who live in area (Laurence and Sweeney, 2018). The reactive nature of the SOC reporting process means that

until sufficient concern is raised with Committee, no information is captured on the system. This limits the usefulness of the SOC reports for conservation managers as it provides them no visibility of upcoming plans that may negatively impact a site thus potentially requiring additional management or oversight from conservation perspective. Therefore, its use in decision making is restricted.

Ongoing Threats

Examination of Figure 7 highlights three sites with the highest number of reported threats while being listed as WHL: Great Barrier Reef, Kakadu National Park and Tasmanian Wilderness. These sites have had more than twenty threats reported over an almost 40-year period. This illustrates a further critique of the SOC process whereby there is no clear or determined end (Sheppard and Wijesuriya, 2019). In fact, this exemplifies the somewhat limited impact of UNESCO in carrying out actual, direct corrective action to protect Sites. In theory, the Committee can decide to add a site to the List of World Heritage in Danger with the intention of raising the profile of the case and securing additional resources to remediate the issues (Art. 189, UNESCO WHC). If the issues are not remediated the Committee can then decide to delist the site. Currently, out of the global list of 1,121 WHS, only two have been delisted and 53 sites have been added to the In Danger List. The inference then, is that 95% of all WHS are not 'in danger'. Figure 9 shows that Australia's Great Barrier Reef is, by far, the most threatened site in Australia's World Heritage portfolio, and the trend analysis in Figure 7 shows continuous cycles of SOC reporting having the highest number of threats repeatedly in the last 10 years. It raises the question as to how this site has not been added to the In Danger List?

The Great Barrier Reef

The ongoing crises faced by the Great Barrier Reef (GBR) is very well publicised (see The New York Times, 2020, and BBC, 2021, as examples) yet it appears to have evaded the In Danger list. Some views consider the main impact of the In Danger list is evidenced by state parties' efforts to avoid it (Frey and Steiner, 2011). Certainly the 'threat' of adding GBR to the In Danger list is viewed by some as spurring the Australian Government 'into action' with "an announcement of a \$500 million package of support to the GBR in 2018, being a particular highlight" (Sheppard and Wijesuriya, 2019, p.147). However, this is the most recent in a series of such offers of support (Phys.org, 2013). Further, a national audit reported that significant portions of the 2018 package were awarded through a non-compliant process to private organisations incapable of delivering the required support (Morrison et al, 2020). This indicates that instead of being a 'highlight' of the WHL process, the Australian Government's responses to UNESCO are instead "rhetorical [and] symbolic commitments" (Morrison et al, 2020, p.948). Thus, by using "partially compliant policies to avoid a WH in Danger listing" the Government can use the guise of its "partially compliant policies" (Morrison et al, 2020, p.950) and with UNESCO's apparent approval can proceed with developments that will further endanger the

GBR. As such, this undermines UNESCO's overall aim of prioritising conservation of its sites as it is transpiring to be an organisation of a geopolitical nature than of heritage protection (Rodwell, 2012).

Missing Threats

Gondwana Rainforest (Figure 10) is the site with the fewest threats of all the natural heritage portfolio. The one threat that is reported on relates to Transport Infrastructure in 2000 with no further threats reported in the 20 years since. Gondwana Rainforest site refers to a matrix of several protected areas situated along Australia's east coast. This area was devastated by the megafires of 2019/2020 (CDP, 2021). Assessment is underway but IUCN reports that the fires have:

“dramatically changed the conservation outlook for the Gondwana Rainforest of Australia, and it remains to be seen whether the natural ecosystems and ecological functions are sufficiently resilient to recover from this previously unexperienced perturbation” (IUCN, 2021 – Gondwana Heritage Outlook Assessment)).

As such, IUCN have classified the outlook for Gondwana Rainforest as of high concern and deteriorating (Figure 11). The SOC reporting system has provision for the threat of wildfires (classified as ‘sudden ecological or geological events’) however there is not a single instance of this threat being reported against any site. Although the extent of 2019/2020 megafires exceeded some predictive models (Wintle et al, 2020); the existence of the threat is well documented by scientific bodies (New Scientist, 2020). This gap in the data posits a challenge in the reliability of the process to aid management and decision making, a gap with potentially hugely significant implications.

Conclusion

The above discussion illustrates a mixed outcome in assessing the usefulness of SOC reporting process. Certainly, the reporting as made available through the SOC Online System enables access to a very comprehensive source of conservation information. That key information can be exported directly, and additional information accessed manually provides a valuable research source at a global scale.

As with any reporting system the quality of the output is only as good as the quality of the input. Thus, if key actors in the reporting process are unclear as to its requirements or struggle to manage the quantity of information involved, the quality of the output is compromised. Efforts have been made to address these issues however these mostly involve reducing the amount of monitoring activity undertaken. Given Rodwell's (2012) call ten years ago to increase the conservation priority, this reduced monitoring can only be seen as a backward move. Steps could be taken to better enable the Committee to support the protection of sites such as setting a limit to the number of sites listed and

introducing a 'sunset clause' whereby sites are automatically delisted unless certain standards are met. This would move away from the current approach which lends itself to seeking being listed as the objective of the process and then once listed, a site is, in effect, listed in perpetuity (Harrison, 2013).

In terms of the SOC process as an indicator of the state of conservation, the outlook is more problematic. By its very definition, the process is reactive and from the data assessed here, it does not provide sufficient predictive insight to optimise conservation strategies or management plans. The lack of any identification of a fire threat in the SOC reports despite existing prediction models outside of SOC, in addition to the absence of any reference to the current mine closure activity in Kakadu National Park severely weakens the data's use to facilitate decision making for conservation managers. Further, the repeated cycles of SOC reporting on the GBR without the decision to add the site to the In Danger list or any other tangible consequence incurred by the State Party, despite the critical status of the site, significantly jeopardises the credibility of the process. Therefore, if the SOC process is to be optimally useful and fully meet its own objectives in supporting potential threat identification and aid decision making, it must look to a more proactive and consequential monitoring process.

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Appendix 1 List of Threats

Primary Factor	Secondary Factor
Buildings and Development	Commercial development
Buildings and Development	Housing
Buildings and Development	Industrial areas
Buildings and Development	Interpretative and visitation facilities
Buildings and Development	Major visitor accommodation and associated infrastructure
Transportation Infrastructure	Air transport infrastructure
Transportation Infrastructure	Effects arising from use of transportation infrastructure
Transportation Infrastructure	Ground transport infrastructure
Transportation Infrastructure	Marine transport infrastructure
Transportation Infrastructure	Underground transport infrastructure
Services Infrastructures	Localised utilities
Services Infrastructures	Major linear utilities
Services Infrastructures	Non-renewable energy facilities
Services Infrastructures	Renewable energy facilities
Services Infrastructures	Water infrastructure
Pollution	Air pollution
Pollution	Ground water pollution
Pollution	Input of excess energy
Pollution	Pollution of marine waters
Pollution	Solid waste
Pollution	Surface water pollution
Biological resource use/modification	Aquaculture
Biological resource use/modification	Commercial hunting/duktion
Biological resource use/modification	Commercial wild plant collection
Biological resource use/modification	Crop production
Biological resource use/modification	Fishing/collecting aquatic resources
Biological resource use/modification	Forestry/wood production
Biological resource use/modification	Land conversion
Biological resource use/modification	Livestock farming/ grazing of domesticated animals
Biological resource use/modification	Subsistence hunting
Biological resource use/modification	Subsistence wild plant collection
Physical resource extraction	Mining
Physical resource extraction	Oil and gas
Physical resource extraction	Quarrying
Physical resource extraction	Water (extraction)
Local conditions affecting physical fabric	Dust
Local conditions affecting physical fabric	Micro-organisms
Local conditions affecting physical fabric	Pests
Local conditions affecting physical fabric	Radiation/light
Local conditions affecting physical fabric	Relative humidity
Local conditions affecting physical fabric	Temperature
Local conditions affecting physical fabric	Water (rain/water table)
Local conditions affecting physical fabric	Wind
Social/cultural uses of heritage	Changes in traditional ways of life and knowledge
Social/cultural uses of heritage	Identity, social cohesion, changes in local population
Social/cultural uses of heritage	Impacts of tourism / visitor / recreation
Social/cultural uses of heritage	Indigenous hunting, gathering and collecting
Social/cultural uses of heritage	Ritual / spiritual / religious and associative uses
Social/cultural uses of heritage	Society's valuing of heritage
Other human activities	Civil unrest
Other human activities	Deliberate destruction of heritage
Other human activities	Illegal activities
Other human activities	Military training
Other human activities	Terrorism
Other human activities	War
Climate change and severe weather events	Changes to oceanic waters
Climate change and severe weather events	Desertification
Climate change and severe weather events	Drought
Climate change and severe weather events	Flooding
Climate change and severe weather events	Other climate change impacts
Climate change and severe weather events	Storms
Climate change and severe weather events	Temperature change
Sudden ecological or geological events	Avalanche/ landslide
Sudden ecological or geological events	Earthquake
Sudden ecological or geological events	Erosion and siltation/ deposition
Sudden ecological or geological events	Fire (wildfires)
Sudden ecological or geological events	Tsunami/tidal wave
Sudden ecological or geological events	Volcanic eruption
Invasive/alien species or hyper-abundant species	Hyper-abundant species
Invasive/alien species or hyper-abundant species	Invasive / alien freshwater species
Invasive/alien species or hyper-abundant species	Invasive / alien marine species
Invasive/alien species or hyper-abundant species	Invasive/alien terrestrial species
Invasive/alien species or hyper-abundant species	Modified genetic material
Invasive/alien species or hyper-abundant species	Translocated species
Management and institutional factors	Financial resources
Management and institutional factors	Governance
Management and institutional factors	High impact research / monitoring activities
Management and institutional factors	Human resources
Management and institutional factors	Legal framework
Management and institutional factors	Low impact research / monitoring activities
Management and institutional factors	Management activities
Management and institutional factors	Management systems/ management plan

Appendix 2 – Data Preparation Notes

	SOC Information System Data Preparation	
Data Point #	Field Name	Data Preparation notes
1	Site ID	Used as is
2	Site Name	Used as is
3	SOC Report Year	Used as is
4	Themes	removed
5	Primary Threats	manually extracted to individual data points
6	Secondary Threats	manually extracted to individual data points
7	Category	Used to filter on Natural and Mixed sites
8	Date of Inscription	Used as is
9	secondary_dates	removed
10	longitude	Used as is
11	latitude	Used as is
12	area_hectares	Used as is
13	CulturalYes	removed
14	Cultural2	removed
15	Cultural3	removed
16	Cultural4	removed
17	Cultural5	removed
18	Cultural6	removed
19	Natural7	removed
20	Natural8	removed
21	Natural9	removed
22	NaturalYesNo	removed
23	criteria_txt	removed
24	category	Used as is
25	IUCN World Heritage Status	Manual Field added from IUCN Outlook Heritage report
26	Current state of value	Manual Field added from IUCN Outlook Heritage report
27	IUCN World Heritage Trend of values	Manual Field added from IUCN Outlook Heritage report
28	Date of IUCN Assessment	Manual Field added from IUCN Outlook Heritage report
29	Overall THREATS	Manual Field added from IUCN Outlook Heritage report
30	Comments	Manual Field added for author's notes

Appendix 2 – Data Preparation Notes

	WHL Site Information Preparation	
Data Point #	Field Name	Data Preparation notes
1	unique_number	removed
2	id_no	Used as is
3	rev_bis	removed
4	name_en	Used as is
5	name_fr	removed
6	short_description_en	removed
7	short_description_fr	removed
8	justification_en	removed
9	justification_fr	removed
10	date_inscribed	Used as is
11	secondary_dates	removed
12	danger	removed
13	date_end	removed
14	danger_list	removed
15	longitude	Used as is
16	latitude	Used as is
17	area_hectares	Used as is
18	Cultural1	removed
19	Cultural2	removed
20	Cultural3	removed
21	Cultural4	removed
22	Cultural5	removed
23	Cultural6	removed
24	Natural7	removed
25	Natural8	removed
26	Natural9	removed
27	Natural10	removed
28	criteria_txt	removed
29	category	Used as is
30	category_short	removed
31	states_name_en	removed
32	states_name_fr	removed
33	region_en	removed
34	region_fr	removed
35	iso_code	removed
36	udnp_code	removed
37	transboundary	removed