Kakadu National Park

2025 Conservation Outlook Assessment

SITE INFORMATION

Country: Australia
Inscribed in: 1992
Criteria: (i) (vi) (vii) (ix) (x)

This unique archaeological and ethnological reserve, located in the Northern Territory, has been inhabited continuously for more than 40,000 years. The cave paintings, rock carvings and archaeological sites record the skills and way of life of the region's inhabitants, from the hunter-gatherers of prehistoric times to the Aboriginal people still living there. It is a unique example of a complex of ecosystems, including tidal flats, floodplains, lowlands and plateaux, and provides a habitat for a wide range of rare or endemic species of plants and animals. © UNESCO

SUMMARY

2025 Conservation Outlook

Finalised on 11 Oct 2025

SIGNIFICANT CONCERN

This large, spectacular and biodiversity-rich site faces many challenges. Among these are climate change and its exacerbation of threatening processes; impacts of feral animals; adverse fire regimes; salt water intrusion damaging and altering floodplain habitats; widespread declines in many mammal species and reptile species; the decline of long unburnt habitats and of plant species that mammal and bird species rely on; and the potential introduction of avian influenza to the site. Recent commitments by the Australian Government include substantial investment in Kakadu National Park's infrastructure and operations and a suite of conservation initiatives and key research projects are underway to address critical knowledge gaps aimed at improving conservation outcomes and the protection of World Heritage values in Kakadu. Although the site has dedicated and sustained management, resulting in effective control of some threats (such as the invasive Mimosa pigra), many threats remain ubiquitous and largely uncontrolled. Some threats (such as saltwater intrusion) are of increasing extent and magnitude and may be almost intractable due to global climate change. The range of threats, their geographic scale, and their severity, requires that management responses are integrated across all of the threats, and that they take into account the trajectory and consequences of climate change. Recent initiatives by the site's managers, including enhanced engagement with Traditional Owners in planning responses to and management of these threats is a significant step forward in maintaining the natural and cultural values of the site. The Australian Government's commitments are driving increases in resourcing and improvements for example in fire management programs, and advances in strategic planning and management to align management efforts to important areas of concern. Mine site rehabilitation at the Ranger site has begun and will require long-term rehabilitation works. Remediation of Jabiru township and its and transformation into a tourism and administrative hub has begun.

FULL ASSESSMENT

Description of values

Values

World Heritage values

Great natural beauty and sweeping landscapes **Criterion:(vii)**

Kakadu National Park has a wide variety of landscapes from mangrove-fringed tidal plains in the north, to vast floodplains, lowland hills and sandstone cliffs of the Arnhem Land escarpment. The escarpment consists of vertical and stepped cliff faces up to 330 metres high and extends in a jagged and unbroken line for hundreds of kilometres. The plateau areas behind the escarpment are inaccessible by vehicle and contain vast areas with no human infrastructure and limited public access. The views from the plateau are breath-taking (World Heritage Committee, 2013).

Vast congregations of waterbirds **Criterion:(vii)**

The entirety of Kakadu National Park is a listed Ramsar wetland and the large areas of internationally important wetlands in the central and northern regions provide habitat for millions of waterbirds, peaking in numbers from August to October (IUCN, 1981, 1992; State Party of Australia, 1991; World Heritage Committee, 2013). Waterbird abundance on the Kakadu National Park floodplains has been estimated at around 450-1600 birds/km2 in the dry season and 60-180 in the wet season, with magpie geese (Anseranas semipalmata) making up around 70% of the total (Pettit et al., 2011). Other abundant species in Kakadu include the green pygmy goose (Nettapus pulchellus), the Burdekin duck (Radjah radjah), and the wandering whistling duck (Dendrocygna arcuata) (Parks Australia, n.d.). Migratory shorebirds use the marine, estuarine, and freshwater habitats of Kakadu.

Large and relatively intact landscape allowing continued evolutionary processes **Criterion:(ix)**

The park has significant elements of four major river systems of tropical Australia. Kakadu’s ancient escarpment and stone country span more than two billion years of geological history, whereas the floodplains are geographically recent, dynamic environments, shaped by changing sea levels and seasonal flooding. The floodplains illustrate the ecological and geomorphological effects that have accompanied Holocene climate change and sea level rise. The Kakadu region has had relatively little impact from European settlement, by comparison to the rest of the Australian continent. With extensive and relatively unmodified natural vegetation and largely intact faunal composition, the park provides a unique opportunity to investigate large-scale evolutionary processes in a relatively undisturbed landscape (World Heritage Committee, 2013).

Conservation of significant habitats **Criterion:(x)**

The park is unique in protecting almost the entire catchment of a large tropical river, conserving one of the widest range of significant habitats in tropical northern Australia (World Heritage Committee, 2013). Several important plant communities are restricted to the park (State Party of Australia, 1991). One extensive habitat occurring in the park, sandstone heaths of the Arnhem Plateau (also known as the Arnhem Plateau Sandstone Shrubland Complex or Arnhem Shrubland Complex), is listed as an Endangered Community under national legislation, with unmanaged fire recognised as the key threatening process (CoA, 2012).

Threatened, endemic and relict plants **Criterion:(x)**

Kakadu is the one of the most diverse and floristically intact area of northern Australia with more than 1,600 plant species recorded from the park. There are at least 200 known plant species that are endemic

to the Kakadu area (including the adjacent areas of western Arnhem Land), making it one of Australia's centres of endemism for plants (Woinarski et al., 2006). Several species of plants are listed as endangered or threatened under national legislation or by IUCN (DNP, 2016a), for example, the Graveside Gorge wattle (Acacia equisetifolia) is listed in the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 as critically endangered, and exclusively grows in Kakadu National Park.

▶ Threatened, endemic and relict mammals

Criterion:(x)

The park contains about one quarter of the land mammal species found in Australia, with more than 64 recorded species (DNP, 2007). Kakadu pebble-mound mouse (Pseudomys calabyi), Kakadu dunnart (Sminthopsis bindi), Arnhem rock-rat (Zyzomys maini) and Arnhem leaf-nosed bat (Hipposideros inornatus) have most of their known population within the confines of the park. Another significant species is the ghost bat (Macroderma gigas). The marine and coastal habitats support a substantial dugong (Dugong dugon) population (State Party of Australia, 1991; IUCN, 1992). Northern brush-tailed phascogale (Phascogale pirata) (previously Phascogale tapoatafa), present at the time of inscription, has declined severely in Kakadu and may now be extirpated in the site; the nabarlek (Petrogale concinna) has also declined severely at the site over the last two decades (Northern Territory Government, 2012) and may have been extirpated. However, anecdotal records in recent years suggest Petrogale concinna may persist in some parts of the park. Recent listing of several species (e.g. Northern Brush-tailed Possum) and uplisting of several species (e.g. black-footed tree-rat, Mesembriomys gouldii gouldii) known to have extant resident populations within the park, highlights the importance of Kakadu as an important refuge for species declining more broadly across their ranges (IUCN Consultation, 2024).

▶ Threatened, endemic and relict birds

Criterion:(x)

Over one third of Australia's bird species (275) have been recorded in the park (IUCN, 1992). Birds whose survival depends in part on the protection of the park include the red goshawk, uplisted to endangered under the EPBC Act in 2023 (Einoder 2024), grey-rumped fruit-dove (Ptlinopus alligator) (BirdLife International, 2016), endemic to the Arnhem Land sandstone massif; and hooded parrot (Psephotus dissimilis). Also worthy of note are the white-throated grass-wren (Amytomis woodwardi) and the partridge pigeon (Geophaps smithii smithii) (IUCN, 1981; State Party of Australia, 1991), as well as the Alligator Rivers yellow chat (Epthianura crocea tunneyi), now almost confined to the site and listed as endangered under the EPBC (National Environmental Science Program Threatened Species Research Hub, 2019).

▶ Threatened, endemic and relict frogs

Criterion:(x)

More than 25 (DNP, 2007) species of frogs have been recorded from the park (IUCN, 1992). Most notable is the uncommon, large carpenter frog (Limnodynastes lignarius), which is restricted to sandstone escarpment areas between western Arnhem Land and the Kimberleys. Other species Copland's Rock frog (Litoria coplandi), rockhole frog (Litoria meiriana), and the rarely seen masked frog (Litoria personata) (State Party of Australia, 1991). No amphibians are listed as being threatened (Woinarski and Winderlich, 2014).

▶ Threatened and endemic reptiles

Criterion:(x)

The reptile fauna comprises a diverse range of species. At the time of nomination, two species of crocodile, seven species of freshwater turtle, three species of sea turtle, 77 lizard species (15 gecko species, four legless lizard species, 10 dragon species, 11 monitor species and 37 skink species) and 39 species of snake had been recorded in the park (State Party of Australia, 1991). The number of known reptile species in the park has increased substantially since then. There are many endemic or near endemic reptile species including the Oenpelli python (Nawaran oenpelliensis), yellow-snouted gecko (Lucasium occultum), dotted velvet gecko (Oedura gemmata), giant cave gecko (Pseudothecadactylus lindneri), Arnhem phasmid gecko (Strophurus horneri), Arnhem Land skink (Bellatorius obiri), Jabiluka ctenotus (Ctenotus arnhemensis), brown-backed ctenotus (C. coggeri), Magela ctenotus (C. gagadju), and Jabiluka dwarf skink (Menetia concinna) (Woinarski et al. 2009). Kakadu contains among the most important breeding habitat in the world for the saltwater crocodile (Crocodylus porosus) and the pig-nosed turtle (Carettochelys insculpta) (IUCN, 1981; 1992). Field Island, at the mouth of the South Alligator River, has a small beach which regularly supports small numbers of nesting Flatback Turtle

(Groom et al., 2017). Recent listing of several species (e.g. Northern blue-tongue Lizard) and uplisting of several species (e.g. Arnhem Land skink) known to have extant resident populations within the park emphasises the importance of Kakadu as an important refuge for species declining more broadly across their range (IUCN Consultation, 2024).

▶ **Threatened, endemic and relict fish** **Criterion:(x)**

The site is one of the most species rich regions for freshwater fishes in Australia supporting around 60 freshwater fishes (Pusey et al. 2017; Shelley et al. 2019), However, it is somewhat subjective and difficult to fully characterise a list, as the free flowing nature of the region's rivers allows ready movement and interchange of species between estuarine and freshwater habitats (or the biology is still unknown). These species include: endemic freshwater fishes that complete their lifecycle only in the Kakadu escarpment region with a large part of their range included within Kakadu National Park, namely Mariana's hardyhead, exquisite rainbowfish, Midgley's grunter, Barraway's fish and Upper Katherine purple-spotted gudgeon; obligate freshwater species that complete their lifecycle in freshwater like sooty grunter, Butler's grunter, spangled grunter, rainbowfishes, several eel-tailed catfishes, delicate blue-eye; euryhaline species capable of maintaining populations in both fresh and estuarine marine (e.g. seven-spot archerfish); mostly estuarine or marine that are known to move into and live in freshwater, like the elasmobranchs (freshwater sawfish, bull shark), some/all forktail catfish and numerous vagrants like snub-nosed garfish, long-jawed river garfish, sunset gudgeon; other diadromous species that include large portion of their lifecycle in fresh and salt water with varying degrees of flexibility (barramundi, tarpon, Indonesian shortfin eel, soles).

▶ **Threatened and endemic invertebrates** **Criterion:(x)**

Estimates of the total invertebrate population of Kakadu range between 10,000 and 100,000 species. More research is needed to refine this estimate (State Party of Australia, 1991). Known invertebrates include 55 species of termite and several hundred species of ants (IUCN, 1992). Although the conservation status of most invertebrates in Kakadu is unknown, one species is listed as being Critically Endangered and five as Vulnerable under IUCN criteria (Woinarski and Winderlich, 2014).

Assessment information

Threats

Current Threats **Very High Threat**

The principal current direct threats to the natural and some cultural values of the site include habitat degradation by invasive plants and animals, especially large herbivores; predation by introduced mammals; fire regimes that have direct impacts on fire-sensitive plant species and result in habitat simplification and diminution of the extent of critical habitat, the longer-unburnt woodlands. Some of the invasive species are of particular concern. The establishment of cane toads has caused severe declines of many native predators in Kakadu and elsewhere. Feral cats remain uncontrolled across almost all of the park, and impacts of pigs and some weeds continue. Some of these threats interact resulting in compounding impacts and rapid and ongoing decline in key biodiversity values. There has not yet been enduring containment of most of these threats. The impacts of feral species are difficult to control across vast, remote landscapes, however significant efforts for control and monitoring are underway. The threat of mining to the park has diminished with the closure of Ranger Uranium Mine in 2021. The threat posed by mining and processing is now replaced with the uncertainty associated with the effectiveness of the long-term site remediation, revegetation, and potential leakage of contaminants. Climate change will interact with and exacerbate many threats such as unmanaged fires, feral animals, saltwater intrusions, introduced plants, and habitat loss. Climate change may also increase the likelihood of new species entering in, and establishing populations in the site. Some impacts of climate change, most explicitly through progressive saltwater intrusion into lowland wetlands, are already being seen. All these threats, and their interactions with climate change will need to be managed coherently, and management actions integrated across the site.

► Mining & Quarrying

Low Threat

(Mining)

Inside site, localised(<5%)
Outside site

Mining has long been viewed as one of the principal threats to the site and several reports about the uranium issue have been produced (World Heritage Committee, 1998; Environment Australia, 1999). Restoration of historic small-scale mining has been undertaken elsewhere in Kakadu (IUCN, 1992) and is ongoing in the south of the park (UNESCO, 2003; DNP, 2012). The Koongarra Project Area (1,228 ha), one of the three mining leases surrounded by the park, was added to the World Heritage site in 2011 (World Heritage Committee, 2011), following sustained advocacy from the senior Djok Traditional Owner and Australian environmental NGO's.

Energy Resources of Australia's Ranger uranium mine, situated on an excised statutory project area surrounded by Kakadu closed in 2021. A program of remediation and rehabilitation has begun that is guided by a comprehensive closure plan (Ranger Mine Closure Plan, 2023). The land is required to be rehabilitated back to a state in keeping with the adjacent park by January 2036. It remains uncertain whether this is possible in that time frame. Detailed rehabilitation planning, and remediation and revegetation works have been undertaken since the closure (IUCN Consultation, 2024). The major ongoing risk to the site from mining is leakage of contaminants from contained waste deposits. These are required by Australian federal law to be isolated from the wider environment for 'not less than ten thousand years'. This risk is subject to supervision and regulation but as an untested scenario, confidence in the success of the rehabilitation of the Ranger uranium mine site must be tempered by the possibility of ongoing contamination of the National Park through leakage from the mine site, particularly the tailings storage facility (IUCN Consultation, 2020b). The Australian Government has committed to monitoring the ongoing contamination risk on the values of Kakadu from the Ranger mine, with a detailed supervision and monitoring regime working with the mine's operators. Continuing current remediation works by Energy Resources Australia, and monitoring by the Office of the Supervising Scientist is essential to reducing the risk of leakage and localised contamination.

In 2019, the Australian Government committed AU$35 million towards the remediation of Jabiru township with a package of measures to shape the long-term future of the town (IUCN Consultation, 2024). Parks Australia and the Office of the Office of the Supervising Scientist have commenced a project to remediate the Koongarra site on behalf of the Director of National Parks in consultation with Traditional Owners. In 2024, the project received $2.2 million in funding from the Australian Government (IUCN Consultation, 2024). Given long term commitments to both the remediation work, and to the research that is required to evaluate remediation success or failure, important risks to manage are the funds and structures required for these tasks.

In 2024, a lease extension to Energy Resources Australia for the Jabiluka Project Area (7,300 ha) was refused, and this decision is currently under judicial review. The Australian Government and Mirarr Traditional Owners are working to seek incorporation of the Jabiluka Mineral Lease area into Kakadu National Park and the associated World Heritage property (IUCN Consultation, 2024).

► Recreational Activities

Low Threat

(Tourism)

Inside site, localised(<5%)
Outside site

Tourism in Kakadu provides a rare and essential source of income and employment for local communities. Tourism also contributes to the park's operational budget. The closure of the Ranger Mine in 2021 brings changes to the Kakadu regional economy, with tourism needing to become the key sustainable economic base for local communities. Tourism in Kakadu is carefully managed to sensitively showcase the natural and cultural values to visitors, provide economic and employment opportunities for locals and improve management programs for threatening processes through increasing operational funds. Potential impacts of more tourism opportunities and higher visitor numbers include increasing the transmission of invasive species, increasing risk of fire, and damaging landscape values through more roads, infrastructure and waste. With tourism as a key economic driver for the local Traditional Owners, the potential impacts must be managed carefully into the future through the Australian Government's

Kakadu Management Plan and statutory environmental impact assessment processes. A Tourism Master Plan 2020-2030 has been prepared and is being implemented (Parks Australia, 2020).

In 2020-2021, tourism to the site (and any associated impacts) was severely curtailed due to international and national constraints imposed in response to the COVID-19 pandemic. Post-pandemic, visitor numbers have returned to pre-pandemic levels (IUCN Consultation, 2024). Improvements have been made to the way that the assessment team that administers the regulation of activities in the park, interacts with Northern Territory and Australian Government bodies responsible for building and maintaining tourism infrastructure. Environmental Impact Assessments are routinely submitted and reviewed by the park staff and receive approval from the appropriate authority. This has resulted in greater transparency and efficacy in the way that major works projects are managed in the park and has mitigated the impact of tourism overall (IUCN Consultation, 2024).

► **Invasive Non-Native/ Alien Species**

High Threat
Inside site, widespread(15-50%)
Outside site

(Invasive plants)
Invasive/problematic species
Hymenachne amplexicaulis
Salvinia molesta
Spigelia anthelmia
Other invasive species names
Urochloa mutica

Although Kakadu currently has a low proportion of weeds, with less than 8% of the 700-plus plant species recorded in the park recognised as weeds, many of the park’s landscapes are being impacted by invasive weeds, some heavily impacted.

Highly invasive species such as annual and perennial mission grass occupy large areas of the north-east and central parts of the park and are likely to continue to spread in lowland woodland environments. These species cause a dramatic increase in the intensity of fire, and such weed-fuelled high-intensity fires may threaten many natural values. Climate change modelling for the tropical savannas indicates these impacts will worsen through grassy-weed fuelled fires under warmer temperatures (DNP, 2017).

Since 2020, targeted action against gamba grass in Kakadu has been delivered through a collaboration between a local Natural Resource Management group and Djurrubu Rangers - an on-Park Indigenous ranger group - and through the preparation and implementation of the recent ‘Gamba Grass Eradication Plan 2023-2026’, with a AU$4 million grant funding committed through the ‘Threatened Species Action Plan 2022-2032’. Additional funding from the Australian Government to support development and implementation of the gamba grass eradication plan is welcome and will help to ensure the gamba threat to Kakadu is managed, with benefits for the management of other grassy weeds, especially the mission grasses.

Aquatic grassy weeds such as para grass and olive hymenachne occur on wetland and floodplain areas and have the potential to invade and alter vast areas. Salvinia is spreading in wetland environments and is now present in the Yellow Water visitor area and adjacent waterways used for recreational fishing. Although mimosa is largely under control due to significant effort over many years, it remains an ever-present threat to floodplain areas (DNP, 2017), with plants persisting, and seeding detected in some locations in 2022 (IUCN Consultation, 2024).

Many of these weed species can outcompete native plants, transform vegetation structure and dynamics, deplete soil nutrients, affect food and shelter resources for native animals, reduce the traditional foods of Indigenous people 'bush tucker' (Adams et al., 2018), and compound fire impacts through fuelling fires of increased intensity and frequency (Rossiter et al., 2003; Rossiter-Rachor et al., 2009; Setterfield et al., 2010, 2013; Adams and Setterfield, 2013; Ens et al., 2015). The weed west indian pinkroot (Spigelia anthelmia) was recorded for the first time in Australia in 2019, in the Ranger mine area (Supervising Scientist 2019), and has potential to cause significant impact in Kakadu. Therefore while weeds in the park are generally well managed (Adams et al., 2015), the highly invasive nature of some species and the cost of managing them over such a vast area, means the threat to World

Heritage values of invasive plant species remains high.

In managing weeds in the park, general activity permits issued for miscellaneous works contain standard conditions aimed at mitigating the risk of weed introduction and spread. Special conditions are attached to higher-risk activities (such as importing earth material or plants from outside the park) that include the need for certification that imported materials are weed-free. Where possible, earth material and plants are sourced from within the park. Furthermore, a decommissioned wash-down bay at the north entrance to the park is planned to be replaced in the forthcoming precinct upgrades (IUCN Consultation, 2024).

Weeds, fire, feral animals, and climate change will all interact to impact the natural and cultural values of Kakadu National Park. Therefore weed management, fire management, feral animal control, and mitigating the impacts of climate change must all be addressed coherently with management actions integrated across all aspects of park management.

► Fire & Fire Management

(Fire)

High Threat
Inside site, throughout(>50%)
Outside site

Fire management in the park occurs in consultation and conjunction with the Binninj/Mungguy people who have managed Kakadu for generations. Active and strategic management of fire in Kakadu's sandstone environments (and by managers in adjacent Indigenous Protected Areas) has resulted in improvemed fire regimes, with a reduced incidence of extensive and high intensity fires in this 'stone country' (Murphy et al., 2015).

The 2022 - 2024 prescribed burning seasons saw a continuation of high numbers of Traditional Owners employed in fire management in the park, with most engaged in ground burning; and the highest number (27) of Traditional Owners involved in aerial burning in the 2024 season (data from Kakadu annual fire reports, IUCN Consultation, 2024).

Adding to the single fire officer role in 2023 were two new ongoing positions (fire manager and fire officer) as well as three seasonal fire coordinator roles to build a ‘fire team’. This has increased Traditional Owner engagement in fire management and improved coordination and communication.

In lowland wetlands, the cessation of traditional Indigenous floodplain burning practices in the past (McGregor et al., 2010), is thought likely to have contributed to the widespread increase in aquatic grasses and in particular the invasive para grass, on the floodplain (Bayliss et al., 2006). In more recent times, there have been efforts to reintroduce traditional fire management to areas such as the Kakadu wetlands (MacGregor et al., 2010). The decline of the small mammal fauna in the Kakadu National Park and elsewhere in northern Australia has been attributed, at least in part, to an increase in widespread and intense late season wildfires and consequent decline in the area of longer-unburnt habitat (that supports greater vegetation structural diversity, more shelter sites (e.g. hollow logs) and provides more fruit and other resources) (Woinarski et al., 2001, 2004, 2010; Griffiths et al., 2015; Lawes et al., 2015). There is now also strong evidence of the impacts of fire compounding impacts of feral cats as a threat to native mammals and many other species (McGregor et al., 2014, 2016; Woinarski et al., 2019); and most of Kakadu's threatened and declining mammals have preferences for less frequent and less severe fires than those prevailing more recently (Woinarski and Winderlich, 2014).
When carefully and skilfully managed, fire is potentially the park’s best landscape-scale management tool. A strategic burning program has been in place in the park since 2016 to carry out extensive prescribed burns in the early dry season, and some prescribed burning in the wet season. This creates mosaics of burnt and unburnt vegetation, reduced fuel along roadsides and other easily accessible areas, and creates a network of and firebreaks that help to reduce the extent and therefore damage of late season fires. The program has had success in reducing the extent and severity of fire in the park (DNP Annual Report, 2019-20), which should create conditions to support the recovery of species.

In contrast to 2019 which saw extensive fires in the park, in 2021-2023 there was a reduction in the overall proportion of the park burnt compared to previous years (KNP fire data, IUCN Consultation, 2024).

A prescribed burning program in the wet season has been implemented annually since 2021 to remove grassy fuel and has contributed to a finer-scale mosaic of fire histories across the Park. In 2024, the National Environmental Science Program funded an important multi-year research program on wet season burning to better understand traditional knowledge of wet season burning and inform the production of best-practice methods, and application of this to management approaches. Despite sustained fire management during the reporting period, challenges remain.

The extent of longer-unburnt (3+ years since fire, 5+ years since fire, 10+ years since fire) habitat, a critical resource for many of the site's threatened, endemic and relict species, has not increased during the reporting period (KNP annual fire data). Longer-unburnt (3+ years since fire) habitat, has been less than 10% of the lowland woodlands from 2020-2023: far less than the 25% recommended, for example, for maintenance of bird assemblages in the region (Woinarski and Legge, 2013). The habitat requirements of many of the site's threatened and endemic species, and the fire regimes that they depend upon, are not being met.

Some of the best results in fire management in the history of the park were achieved in the period 2016-2018 inclusive due to the large scale, highly detailed and strategic program and, it is hoped that this programme will lead to the recovery of many species (IUCN Consultation, 2020a). Overall fire regimes in the Stone Country have been demonstrated to be in a more benign state now than at any time over the last three decades, most likely due to extensive use of prescribed burning (Murphy et al 2015; Evans and Russell-Smith, 2020). Similarly, while ongoing challenges remain, numerous other improvements have been made over the life of the park (Russell-smith et al., 2017).

Unplanned, destructive fires, and high fire frequency, remains a critical driver of environmental impact on the natural and cultural values of the park. Management of fire regimes, incorporation of cultural values and strategies into fire management, and adequate resourcing of fire management practices are critical to maintaining the park's world heritage values. Fire, feral animals, weeds and climate change will all interact to impact the natural and cultural values of Kakadu National Park. Therefore fire management, weed management, feral animal control, and mitigating the impacts of climate change must all be addressed coherently with management actions integrated across all aspects of park management.

► Invasive Non-Native/ Alien Species

Very High Threat
Inside site, throughout(>50%)
Outside site

(Invasive animals)

Invasive/problematic species

Bubalus bubalis
Sus scrofa
Equus caballus
Equus asinus
Felis catus
Rattus rattus
Mus musculus
Rhinella marina

Other invasive species names

dogs (Canis familiaris)

The management objective for invasive animals in Kakadu is to limit, as far as possible, their adverse effects on the environment while taking into account the views and economic interests of its Aboriginal Traditional Owners.

Invasive animals in the World Heritage site include Asian water (swamp) buffalo (Bubalus bubalis), cattle (Bos indicus & B. taurus), pigs (Sus scrofa), horses (Equus caballus), donkeys (Equus asinus), cats (Felis catus), dogs (Canis familiaris), rats (Rattus rattus), mice (Mus musculus), house geckos (Hemidactylus frenatus) and European bees (Apis mellifera). Cane toads (Rhinella marina) spread to Kakadu (from an Australian introduction in north-eastern Queensland), arriving at the site for the first time in early 2001, and subsequently became established across the site in large numbers. Their establishment has caused severe declines in Kakadu and elsewhere of many native predators (because of the toad's toxin),

including northern quoll (Dasyurus hallucatus), Mitchell's water monitor (Varanus mitchelli), Merten's water monitor (Varanus mertensi), and plains death adder (Acanthophis hawkei) (Doody et al. 2009, 2015; Phillips et al. 2010; Woinarski & Winderlich 2014). These three reptile species are now listed by the IUCN as threatened because of this severe decline. Mitchell's water monitors are listed as critically endangered (Shea et al., 2018) and Merten's water monitors are listed as Endangered (Shea et al., 2018). Nevertheless, populations of toad-vulnerable predators are persisting in the park, with evidence that populations of some of these toad-susceptible native species have begun to recover from the impacts of cane toads with more frequent sightings of Floodplains monitor and northern quoll in some areas (IUCN Consultation, 2024).

For at least some invasive introduced animal species, there has been no substantial and enduring reductions in population sizes and distributional extent (and hence impact) in the site over recent decades. Some introduced pest species (such as feral cats) probably occur ubiquitously across the site, other than on the small offshore islands. Predation by feral cats, operating interactively with the effects of extensive fires on habitat conditions, is a significant threatening process (Department of the Environment 2015; Ziembicki et al., 2015; Stokeld et al. 2018; Murphy et al. 2019), contributing to the decline of many of the site's native mammals, including the probable recent extirpations from the site of some native mammal species such as brush-tailed rabbit-rat (Conilurus penicillatus).
The park managers are undertaking a trial of different methods for feral cat management including a trial of cat grooming traps (FELIXER) in non-lethal mode in 2022-2023, but these efforts have not yet resulted in any sustained reduction of this major threat (IUCN Consultation, 2024).

Feral pigs are now widespread across the site. Their impacts are diverse. They forage extensively on the corms of sedges (primarily Eleocharis dulcis), competing directly with waterbirds such as magpie geese (Anseranas semipalmata) and brolgas (Antigone rubicunda), for which this is a key food resource (Bayliss et al., 2006, Pettit et al. 2011). But pigs are also major predators of (and a significant threat to) aestivating freshwater turtles (Fordham et al. 2006, 2007), many native yams and ground-nesting birds. A study by Stobo-Wilson et al. (2020) indicates that the impact of feral herbivores such as buffaloes, horses, cattle and donkeys on habitat and native species has been largely underestimated.

In 2022, landscape-level feral pig control (aerial culling) was reinstated, and over 10,000 pigs were culled in the northern half of the park, with activities aligned to an important site for the threatened Alligator Rivers yellow chat (IUCN Consultation, 2024).
In 2022, water buffalo, horses and donkeys were also removed from some areas of the park. In 2024 feral pig control (aerial culling) continued in some focal areas including coastal floodplains and vulnerable wetland areas. In 2021, a drone-based annual monitoring program was developed to map and measure feral pig impacts on floodplains to accurately assess the effectiveness of feral pig culling on environmental health (IUCN Consultation, 2024). In 2024, a park wide feral herbivore and pig aerial survey was completed, to inform the preparation of an updated feral animal strategy. From 2022-2024, park staff have been trained in the application of a range of feral animal trapping methods, with successful use of baited traps for small scale feral pig control. Recent successful control activities have resulted from substantial clan-based consultation and agreements on target species and densities.
In 2017, a feral animal working group, made up of Kakadu Traditional Owners, developed a set of feral animal management protocols. These protocols set out the ways in which feral animals are managed in Kakadu, including provisions for economic opportunities for Bininj/Mungguy.

Through a collaborative project with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Traditional Owners in the south of the park have begun a project co-designing a monitoring program to assess feral animal impacts at waterholes (IUCN Consultation, 2024). In 2023, the Kakadu Board of Management approved a 3-year mustering permit in the south of the park – due to commence in 2025 - with the aim of reducing densities of water buffalo and cattle while providing economic benefits to Traditional Owners. This program builds on other industries that provide Traditional Owner livelihood opportunities in reducing feral animals numbers, such as pet-meating businesses (IUCN Consultation, 2024).

Kakadu has been the site of on-ground research to collect data on gaseous exchange data from feral

animal damaged floodplains and wetlands to inform the development of a carbon abatement scheme (blue carbon) centred around feral ungulate (buffalo, cattle) removal. Implementation of this approach may provide economic incentives that lead to income for Traditional Owners when reducing densities of feral herbivores in the park (IUCN Consultation, 2024).

Management of invasive species and developing programs that integrate cultural values for landscape, conservation and economic security requires adequate resourcing. Management of invasive species as a whole is critical to maintaining the park's world heritage values. Feral animals, fire, weeds and climate change will all interact to impact the natural and cultural values of Kakadu National Park. Therefore feral animal control, fire management, weed management, and mitigating the impacts of climate change must all be addressed coherently with management actions integrated across all aspects of park management.

► Changes in Physical & Chemical Regimes

Low Threat
Inside site, scattered(5-15%)
Outside site

(Woody encroachment)

It has been hypothesised that increasing levels of CO_2 in the atmosphere is favouring woody plant growth to the detriment of treeless floodplains, important habitat for numerous species and migratory waterfowl (Bowman et al., 2008). While other factors could also be causing woody encroachment, this rapid environmental shift could be a threat to a number of values of the World Heritage site.

► Changes in Physical & Chemical Regimes, Changes in Temperature Regimes, Changes in Precipitation & Hydrological Regime

Very High Threat
Inside site, throughout(>50%)
Outside site

(Climate change (especially saltwater intrusion))

Climate change is already affecting the natural values of Kakadu and it will affect all natural and many cultural World Heritage values in the site. Effects of climate change are already evident, and these impacts will be magnified in the coming decades.

Changes to salt and freshwater wetlands through saltwater intrusion have been observed in the park over the past few decades (Hyder, 2008). Saltwater intrusion can lead to the conversion of freshwater paperbark (Melaleuca spp.) swamps and other floodplain vegetation communities into extensions of the mangrove margin. Dieback of some Melaleuca (Bowman et al., 2010) and the extension of mangrove species (Asbridge et al., 2019) has been observed in Kakadu’s northern wetlands. Saltwater intrusion will increasingly cause major changes in the composition, productivity, ecological dynamics and values of the site's significant lowland wetland assemblages (Stephenson et al., 2018).

Extreme weather events have recently caused large scale losses of mangroves within the site and in the broader region (Asbridge et al., 2019; Duke et al., 2017). In 2021, Parks Australia ran a climate change vulnerability workshop in Kakadu with Bininj/Mungguy, park staff and other participants. A vulnerability assessment report was prepared (IUCN Consultation, 2024).

Park managers are implementing a climate change strategy that includes a range of adaptation, mitigation and communication actions to manage the anticipated changes. A challenge identified in 2003 is whether management will be able to cope with unpredictable changes in temperature, storm frequency, flooding, drought and changes in sea water composition to conserve the World Heritage values (UNESCO, 2003) – the strategy adopted in Kakadu is the adoption of management practices that maximise ecological resilience to increase capacity to adapt as climate change manifests (DNP, 2017).

In late-2024, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) with funding from the National Environmental Science Program's Climate Systems Hub, commenced a multi-year project to prepare an adaptation plan for Kakadu by applying the Climate Change Toolkit for World Heritage Properties in Australia. This work will heavily engage parks staff, Traditional Owners (Bininj/Mungguy) and the community to guide planning decisions over the next decade (IUCN Consultation, 2024).

Climate change is often referred to as a threat-multiplier. In Kakadu climate change will increase the impacts of feral animals, destructive fires, change to wetlands, species loss, and it is likely to reduce habitat resilience.

Climate change should not be seen or managed in isolation from other threats such as fire or feral animal impacts, because those impacts will also increase the effects of climate change. All threats to the natural and cultural values of the site must be managed together, and not in isolation. This requires adequate and integrated planning, and the resources necessary to achieve positive outcomes.

Potential Threats

Very High Threat

While climate change is already affecting the cultural and natural values of Kakadu (for through example sea-level rise and saltwater intrusion), its impacts will magnify. These impacts may not evolve linearly, as recent global extreme climate events demonstrate. The most critical immediate impact for World Heritage values is the ongoing increase in extent of saltwater intrusion to the park's diverse and productive wetland and coastal floodplain systems. Climate change may also increase fire frequency and intensity. New or increased populations of alien species including pathogens causing plant and animal diseases, again compounded by climate change, are another risk. Climate change will interact with all current threats to the site, and will most likely increase all their impacts on the site’s natural and cultural values.

► Pathogens

Very High Threat

(Introduction of disease or pathogens)

Inside site, extent of threat not known
Outside site

Avian influenza poses a significant threat to the natural and cultural values of Kakadu National Park. The recent spread of Highly Pathogenic Avian Influenza (HPAI H5N1 clade 2.3.4.4) to remote islands in the Southern Ocean and to Antarctica was almost certainly introduced by wild birds. It is now spreading steadily through the Antarctic region with mortality rates of around 50-60% (SCAR, 2023). This example of avian influenza in remote environments underlines the potential threat these diseases pose to the Kakadu site.

Historically, unlike many other World Heritage sites in Australia, specific diseases have not been signalled as affecting biodiversity in the park. However, the potential for novel diseases or pathogens to enter the park remains and accordingly the park has risk preparedness plans in place (DNP, 2007). The park works closely with government biosecurity officers who conduct tests of feral pigs and other species annually. One disease of concern to plant communities is the pathogen, myrtle rust (Austropuccinia psidii), which was inadvertently introduced recently to Australia and has since spread widely including to areas near Kakadu (Pegg et al., 2018). It can cause severe impacts on many myrtaceous plants, with significant potential impacts in Kakadu on endemic plants, plants of cultural significance, including 'bush tucker' species, and plants that are major components of many vegetation communities.

In mid-2024 Kakadu commenced preparedness for the arrival of Highly Pathogenic Avian Influenza (HPAI, H5N1) through the preparation of a Trigger Action Response Plan; preparation and implementation of a communications plan; and the adoption of existing Australian Government Response Plans aimed at surveillance, monitoring, and rapid response to the expected arrival of the virus (IUCN Consultation, 2024).

► Changes in Precipitation & Hydrological Regime

Very High Threat

(Climate change)

Inside site, throughout(>50%)
Outside site

The impacts of climate change will progressively increase. The most critical impact for World Heritage values is the ongoing increase in extent of saltwater intrusion to the park's diverse and productive lowland aquatic systems. Studies indicate that extensive areas of Kakadu’s floodplains and wetlands are highly likely to be inundated in coming decades (Asbridge & Lucas, 2016; Pettit et al., 2018; Dutra et al., 2018; Bayliss et al., 2018a). A tidally-driven hydrodynamic model was developed to simulate the frequency and extent of salt water intrusion (SWI) in the Kakadu Region (Bayliss et al., 2018a). The model scenarios were used to assess potential loss of freshwater floodplains from climate model

predictions of sea level rise and subsequent SWI. Results predict that by 2030 3% of the floodplain will be impacted by SWI and 42% by 2070. Results suggest that all floodplains on Kakadu will be impacted by SWI by 2132 (Bayliss et al., 2018a). The extent of saltwater inundation during the simulation period (2013–2100) was greater for coastal floodplains closer to the coast, reflecting tidal influence. Freshwater refuge areas will likely be created. By 2100 and beyond Kakadu is predicted to become a 'no-analogue' environment, and that creation of novel ecosystem states will render traditional management restoration and intervention goals unachievable. Catford et al (2013) provides a conceptual model of potential impacts on Kakadu floodplain flora and fauna. This highlights the need to consider freshwater refugia in good condition now and well into the future, even if they will eventually be lost to SWI. Given the potential benefits to the survival of iconic freshwater species, such an investment is considered an opportunity cost rather than a sunk cost (Bayliss et al., 2018).

Overall assessment of threats **Very High Threat**

The current and future threat environment for this site is complex and of severe concern. Many threats such as fire and invasive animals operate across the entire extent of the site. Some management efforts have resulted in at least intermittent reduction in the impacts of fire, and positive results over the period 2016-2018 were some of the best in the history of the park. Several invasive species are of particular concern. The establishment of cane toads has caused severe declines in Kakadu and elsewhere of many native predators. Feral cats remain uncontrolled across almost all of the park and impacts of pigs and some weeds continue. Some of these factors interact resulting in compounding impacts. The most drastic decline in biodiversity occurred in the period 1995-2005 and species richness and abundance have not significantly changed since then. Climate change is already having detrimental impacts on the site's values, mostly through sea-level rise and saltwater intrusion. These impacts will increase in severity and consequence over coming decades, with marked detriment to the site's biodiversity and cultural values. The focus of park management is on reducing the impact of invasive species and fire to improve habitat condition and resilience in the face of increasing threats. Preparedness for the potential occurrence of avian influenza is also a high priority.

Protection and management

Assessing Protection and Management

▶ **Involvement of stakeholders and rightsholders, including indigenous peoples and local communities, in decision-making processes** **Mostly Effective**

Much of the land in Kakadu National Park is Aboriginal Land leased by the Traditional Owners to the Australian Government. Kakadu is jointly managed by the Traditional Owners and Parks Australia through a Board of Management. The joint management arrangements between the Aboriginal Traditional Owners and park management has, in the past, been highlighted as exemplary, "a model of effective park management" (IUCN, 1992). The park's Traditional Owners constitute a majority of Kakadu Board of Management members (World Heritage Committee, 2013). However, the governance structure for joint management was established in the 1980s and is overdue for review (IUCN Consultation, 2020b). A Joint Management Unit set up with the purpose of addressing joint-management concerns and challenges was established in 2018 (IUCN Consultation, 2020a).
On 2 July 2020, the Kakadu Board of Management wrote to the then Minister for the Environment to express their lack of confidence in the management of Kakadu. The Director of National Parks acknowledged the concerns raised by Kakadu's Board and Traditional Owners, and committed to driving significant change to improve the joint management relationship (IUCN Consultation, 2024).
Since 2020 a broad range of initiatives have been implemented to elevate Traditional Owners' voices in decision-making. These include:
-Board member positions increased from 10 to 16 to ensure all clans are represented on the Kakadu

Board of Management;
-Bi-annual on-Country Board of Management meetings;
-Bi-annual Joint Board forums and Annual Joint Chairs' meetings were established to facilitate exchange of knowledge, expertise and ideas about joint management governance and priorities;
-Three new joint management positions were dedicated to delivering park-wide improvements in Indigenous training and employment;
-Establishment of a Bininj Research and Management Advisory Committee to guide park research priorities;
-An Annual Healthy Country forum was established, bringing together neighbouring ranger groups to share knowledge and build cross-border partnerships to monitor and protect natural and cultural values;
-The Threatened species program has increased participation by Traditional Owners and collaboration with Djurrubu Rangers, Njanjma Rangers, Warnbi Rangers, Werenbun Rangers and Warddeken rangers;
-A Draft Kakadu Research Strategy was prepared based on Traditional Owner consultations to guide how research is to be conducted on-park, to encourage co-designed projects, and maximise opportunity for two-way knowledge exchange;
-On-Country camps for intergenerational learning about culture, Country, and language;
-Broadening opportunities for Indigenous Training and Employment on-country through ranger programs, rock art and cultural heritage conservation training, and field work;
-Development of the 2023 Kakadu recruitment guidelines to drive opportunity for Traditional Owner employment through advertising all on-park positions as 'Affirmative Measure – Aboriginal and Torres Strait Islander ' in the first instance;
-Funding to the Northern Land Council to provide three joint management positions to facilitate Traditional Owner consultation seeking free, prior and informed consent (FPIC) on decisions under the Plan of Management and to facilitate Traditional Owner involvement; and
-A regional country-based planning approach to prepare the next Kakadu Management Plan, ensure Traditional Owners and their culture and knowledge are central to the process (IUCN Consultation, 2024).

Other stakeholder involvement is guided through the Kakadu Plan of Management.

► Legal framework — Mostly Effective

Kakadu National Park is managed under the Kakadu National Park Management Plan 2016-2026, developed pursuant to the EPBC Act (1999). Much of the park is Aboriginal Land, and leased to the Australian Government for the purposes of the park. A Board of Management with a majority of Traditional Owners is responsible for overseeing the park's Management. The Director of National Parks performs functions and exercises powers under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) in accordance with the park's management plan and relevant decisions of the Kakadu National Park Board of Management. These arrangements ensure that the park has effective legal protection, a sound planning framework and that management issues are addressed (World Heritage Committee, 2013). Co-management of the site with the Aboriginal Traditional Owners - an essential aspect of the management system - has been subject to tension in recent years (IUCN Consultation, 2020b; IUCN Consultation, 2024). These tensions and other substantive deficiencies were addressed in a 2019 report by the Australian National Audit Office on the management of Commonwealth National Parks (Director of National Parks, 2019). Other national legislation relevant to the management of Kakadu National Park includes: Aboriginal and Torres Strait Islander Heritage Protection Act 1984; Native Title Act 1993; Aboriginal Land Rights (Northern Territory) Act 1976; and Jabiru Town Development Authority Act 1978 (UNESCO, 2003). The EPBC Act (at s. 269 (1)) obliges the Commonwealth to implement national recovery plans for threatened species and ecological communities and recovery plans in Commonwealth areas (including Kakadu National Park). The Northern Territory Aboriginal Sacred Sites Act 1989 applies to Kakadu National Park.

► Governance arrangements — Some Concern

The legislation that establishes Kakadu National Park, the park's management authority, and the development of the park's Plan of Management is of the highest standard. All of the legislative actions and governance are subject to the scrutiny of the Australian Parliament, and to government authority

such as audit. The site is co-managed with Traditional Owners through a Board of Management. A recent unprecedented breakdown in trust between Traditional Owners and Parks Australia has led to significant reassessment of the way Parks Australia works with the Traditional Owners, the Board of Management, and communities within and surrounding Kakadu (IUCN Consultation, 2024). The efforts taken by Parks Australia, and the attention of the Australian Government should go a long way to rebuild what was a long standing and significant partnership focussed on the protection of the natural and cultural heritage of the site.

▶ Integration into local, regional and national planning systems (including sea/landscape connectivity) — Highly Effective

The Director of National Parks' Annual Reports show there is good integration into regional and national planning systems (e.g., DNP, 2017, 2019).

▶ Boundaries — Highly Effective

Kakadu National Park covers a large area, almost 20,000 square kilometres. Delineation of the site includes some straight-line boundaries, and other parts of the boundary are defined by rivers. The Wildman River arises within the park and its eastern bank defines part of the north west boundary; the north eastern boundary is defined by the East Alligator River; in the south west, part of the Mary River defines the boundary. The South Alligator River drainage basin is almost entirely contained within the park (with a small part of one tributary in the neighbouring Warddeken Indigenous Protected Area). Some collaborative research, monitoring and management with managers of the Indigenous Protected Areas (Djelk and Warddeken) to the east of the site, and with Nitmiluk National Park in the south-west help extend the conservation management impact and effectiveness beyond the tenure of the site alone (e.g., Russell-Smith et al. 2014). The inclusion in 2011 into the World Heritage site of one of the three mineral leases (enclaves) that pre-date the establishment of the park (Koongarra), and preventing mining in this site, is extremely positive (IUCN, 2011). The planned incorporation of the Jabiluka mineral lease area into the park reflects the longstanding wishes of Traditional Owners and is also seen as extremely positive, although this effort is being challenged by the Jabiluka mineral leaseholder (IUCN Consultation, 2024).

▶ Overlapping international designations — Highly Effective

The entire Kakadu National Park site is a designated Ramsar site because of its significance as a waterbirbird and migratory bird habitat. These values face the same threats as those described for Kakadu as a whole. The values of the Ramsar site are managed by Parks Australia through the Kakadu National Park Plan of Management.

▶ Implementation of World Heritage Committee decisions and recommendations — Data Deficient

Since the State Party report of 2003, there has been greater focus on implementing Committee decisions and recommendations. The decision by Traditional Owner, Jeffery Lee PSM, State Party, and managers to integrate the 1,228 ha enclave known as the Koongarra Project Area into the World Heritage site in 2011 is exemplary (IUCN, 2011). However, since 2013 no Committee decisions or recommendations were developed, so there is no evidence in recent years regarding the implementation by the management authorities.

▶ Climate action — Mostly Effective

The Kakadu National Park Management Plan, decisions of the the Kakadu Board of Management and the actions of the park's managers are the means through which the values of the sire are protected. These are appropriate. Climate change is already affecting the natural values of Kakadu and it will affect all natural and many cultural World Heritage values in the site. Effects of climate change are already evident, and these impacts will be magnified in the coming decades. Climate change is often referred to as a threat-multiplier. In Kakadu climate change will increase the impacts of feral animals, destructive fires, change to wetlands, species loss, and it is likely to reduce habitat resilience. Climate change should not be seen or managed in isolation from other threats such as fire or feral animal impacts, because

those impacts will also increase the effects of climate change. All threats to the natural and cultural values of the site must be managed together, and not in isolation. Future management plans and decisions will require adequate and integrated planning, and the resources necessary to achieve positive outcomes in the face of climate change.

Recent decisions taken by the site's mangers to integrate fire, pest, and climate action, and to improve monitoring on the site, are important steps in effective climate action. In 2021, Parks Australia ran a climate change vulnerability workshop in Kakadu with Bininj/Mungguy, park staff and other participants. A vulnerability assessment report was prepared (IUCN Consultation, 2024). Park managers are implementing a climate change strategy that includes a range of adaptation, mitigation and communication actions to manage the anticipated changes. A challenge identified in 2003 is whether management will be able to cope with unpredictable changes in temperature, storm frequency, flooding, drought and changes in sea water composition to conserve the World Heritage values (UNESCO, 2003) – the strategy adopted in Kakadu is the adoption of management practices that maximise ecological resilience to increase capacity to adapt as climate change manifests (DNP, 2017). In late-2024, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) with funding from the National Environmental Science Program's Climate Systems Hub, commenced a multi-year project to prepare an adaptation plan for Kakadu by applying the Climate Change Toolkit for World Heritage Properties in Australia. This work will heavily engage parks staff, Traditional Owners (Bininj/Mungguy) and the community to guide planning decisions over the next decade (IUCN Consultation, 2024).

However, protection of the Outstanding Universal Value of Kakadu requires actions to reduce greenhouse gas emissions alongside adaptation actions (Australian Academy of Science, 2022). Currently, Australia’s climate policies and planned actions are not aligned with limiting temperature increases to 1.5°C above pre-industrial levels (CAT, 2025).

► Management plan and overall management system — Some Concern

The Kakadu National Park Management Plan, statutory and other obligations of Parks Australia including the rights of the park’s Traditional Owners, drive the performance goals of the site’s management. Management effectiveness of some the site’s attributes can be measured by trends for native species and threatening processes (Parr et al., 2009). The park has an extensive network of monitoring sites (and ongoing assessment through satellite imagery) that can help monitor fire and its impacts (Russell-Smith et al. 2014). Ambitious outcome targets and performance measures for fire management have been proposed in the scientific literature (Russell-Smith et al. 2017); however, the most recent available reporting of this management aspect (for 2022) indicates that performance for environmental outcomes was only 'poor' or 'fair' (Kakadu National Park Program report 2022 - fire). This occurred in the context of improvements in the past 10 years overall and some of the best fire management results in the history of the park in 2016-2018. The park has an extensive network of monitoring sites for Mimosa pigra, with annual re-surveys of a large proportion of sites being the primary means of gauging success in the control of this floodplain weed (IUCN Consultation, 2024). At the national level, the threat abatement plan for predation by feral cats 2024 (DCCEEW, 2024) and the threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DCCEEW, 2011) are national strategies to help guide Australia’s response to the impacts of feral cats and cane toads on biodiversity.

In 2022/23, a comprehensive and fully integrated data collection and reporting platform was designed and implemented to drive strategic land management and improved protection of World Heritages values. The platform manages work programs and operational activities, permits and resourcing and includes new digital data capture and visualisation tools for feral animal and weed control activities. This digital data collection tool has enabled a more rigorous approach to data collection and monitoring for all weeds, with data feeding into Kakadu’s broader information management system to enable real time reporting on management implementation and effectiveness. Monitoring includes threatened flora and fauna with species such as marine turtles, and birds, reptiles and small mammals all subject to long-term programs. The long-term ecological monitoring (fire plot) program is the primary means of detecting and reporting on trends in many plant species, as well as birds, reptiles and small mammals. This program commenced in 1996 and was revised in 2019, with the most recent 5 yearly round of re-survey for plants

completed in 2024, with plans for the fauna re-survey in 2025. Responsibility for coordinating the delivery of this long-term monitoring program has recently been taken on by Parks Australia in recognition of the importance of its continuation and its value in informing park managers and Traditional Owners on the effectiveness of management actions to address threats to biodiversity including feral cats, other introduced species and fire regimes (IUCN Consultation, 2024).
The long-term ecological monitoring program has demonstrated marked decline for many native mammal species, most drastically over the period 1995-2005, with few signs of recovery in the 2019 round of monitoring (IUCN Consultation, 2024).

Since 2022, the role of research permits officer has expanded to three permanent, full-time positions dedicated to the assessment and administration of authorisations of research, building works, commercial activities and other miscellaneous activities in the park. Additionally, the regulation of tour operator license, bushwalking, camping, media and drone use is currently administered separately by the Tourism and Visitor Services team which has also expanded. The increased resourcing in authorisations has led to more efficient and effective regulation in the park. However, the volume of approvals requires increased compliance efforts to ensure authorisation holders are meeting their conditions. This post-approval regulation space requires further development (IUCN Consultation, 2024).

► Law enforcement — Mostly Effective

Enforcement of the relevant laws and regulations is mostly effective, although challenges remain with respect to feral animals, including unauthorised hunting of feral pigs and buffalo within the park (IUCN Consultation, 2020b). Reducing the overall numbers these animals will mitigate some of this unauthorised hunting.

► Sustainable finance — Mostly Effective

The Australian Government provides funds annually for the management of the park, and to fulfil the terms and conditions of the lease arrangements with Traditional Owners. In the 2022-23 financial year, Kakadu National Park’s operating costs were A$46.8 million, including A$16.4 million for remediation of the Jabiru townsite. In 2022-23 the external revenue generated for Kakadu was A$4.16 million. Lease payments – including rental and a share of revenue generated from park use fees and charges – are made to the Northern Land Council on behalf of the Land Trusts. The Kakadu National Park payment to Traditional Owners was A$1.25 million in 2022-23 (Director of National Parks, 2022; IUCN Consultation, 2024).
Tourism revenue contributes to the park's total budget. In 2020, this contribution was substantially less, as constraints on international and national travel due to the COVID-19 pandemic markedly reduced tourist visitation (IUCN Consultation, 2024).
Responding to increasing impacts on natural and cultural heritage values will require the maintenance of substantial funding for Kakadu National Park.

► Staff capacity, training and development — Mostly Effective

Parks Australia runs an intensive program of training across a broad range of areas with a focus on capacity building, training and upskilling Bininj/Mungguy. For example, in March and October each year a ‘ranger ready’ program is delivered to ensure staff have the required skills and licences to take on ranger duties, with training modules aligning with certification and diplomas (IUCN Consultation, 2024).

► Education and interpretation programmes — Highly Effective

Kakadu’s Seasonal Guided Program has been connecting visitors to the park’s World Heritage values for three decades. The program offers a variety of interpretive services, such as guided rock art walks, slideshows, cultural demonstrations, and educational activities. These activities cater to diverse audiences, including school groups, and visitors of all ages from interstate and around the world.
Since 2020, this program has been entirely delivered by Bininj/Mungguy. This initiative supports the growth of businesses within local communities and aligns with Kakadu’s management plan. It also ensures the preservation of cultural stories for future generations by giving Bininj/Mungguy the opportunity to share their cultural heritage. This provides visitors with a rich cultural experience by

walking alongside the Traditional Owners of Kakadu learning stories of Country. In 2023, the program hosted 18 events, delivered 456 activities, and welcomed over 9,555 attendees. Recognised for its excellence, the program received the Tourism Top End Territory Champion Award, honouring outstanding contributions to enhancing visitor experiences.
Additionally, there are numerous publications providing educational information on the values of Kakadu National Park, including guidebooks, Park Notes, maps, information pamphlets, and a well functioning website (IUCN Consultation, 2024).

► Tourism and visitation management — Highly Effective

Interpretive programs, guided walks and cultural activities with traditional owners are given at selected sites, with increasing development and success of Indigenous-owned operations. About 181,300 tourists visited the park in 2023 (KNP internal data). With the closure of the Ranger mine in 2021, the future of the site's main town, Jabiru, is somewhat unsettled (IUCN Consultation, 2024).
In January 2019, the Australian Government announced that it will invest A$216 million to upgrade Kakadu National Park and assist the township of Jabiru (within the Park) transition to a tourism-based economy. The initiative includes: up to A$70 million to upgrade roads to improve access to the park; A$51 million for tourism infrastructure and attractions, including upgrades to camp grounds, walking tracks and viewing platforms, improved signage, mobile and WiFi services; up to A$60 million to support a world-class, Indigenous-led World Heritage Kakadu Visitor Centre in Jabiru; and A$35 million to support remediation of Jabiru (IUCN Consultation, 2024).
In 2020, the Australian Government announced a further A$60 million towards infrastructure upgrades across Kakadu. In 2023, the Australian Government also announced funding for Commonwealth National Parks estate for A$262 million over four years plus A$67 million of ongoing funding per year. This figure includes A$41 million towards Kakadu infrastructure (IUCN Consultation, 2024).
Further to this commitment, in 2024, the Australian Government announced an additional A$11.35 million towards meeting its remediation obligations in Jabiru. Remediation projects include:
• A$1.2 million towards contamination management plans for Per- and Polyfluoroalkyl Substances (PFAS), Total Recoverable Hydrocarbons (TRH) and asbestos;
• A$3.6 million towards roads and pavement maintenance and upgrades;
• A$2.2 million for the remediation of a former uranium ore exploration site at Koongarra;
• A$2.8 million to complete housing upgrades in Jabiru;
• A$1 million for further work on Jabiru Lake remediation plans; and A$0.5 million for support (legal, technical, project management) to deliver Jabiru remediation (IUCN Consultation, 2024).
Fulfilling the Commonwealth’s remediation commitments will help realise the aspirations of Traditional Owners to transform the town into a tourism and government services-based hub.

► Sustainable use — Highly Effective

Limited sustainable use, including hunting (with lead shot banned), is allowed within the park for Traditional Owners. A Cultural Heritage Strategy, developed with stakeholders through consultations, was implemented in 2012 (DNP, 2012) and reviewed in 2023 (IUCN Consultation, 2024). Tourism, and the establishment and growth of tourism enterprises owned and controlled by Traditional Owners is a very effective sustainable use of the site.

► Monitoring — Some Concern

There is a substantial long-running monitoring program in Kakadu reporting on parameters of fire, and on trends in many plants and animals (Russell-Smith et al. 2014; Einoder et al., 2018), with the most recent round of major flora monitoring completed in 2024 and fauna monitoring planned for 2025. The responsibility for coordinating the delivery of this long-term monitoring program has recently been taken on by Parks Australia in recognition of its importance (IUCN Consultation, 2024). There is also ongoing monitoring of some invasive species and some threatened species, and of climate change and tourism. Following priorities set in the Kakadu Threatened Species Strategy (Woinarski and Winderlich, 2014) several threatened species were the focus of targeted monitoring programs through 2020 – 2024 including: Hibiscus brennanii, northern quoll, white-throated grasswren, northern masked owl, Arnhem rock skink and the continuation of the long-term marine turtle program (Groom, 2017; IUCN

Consultation, 2024).
In 2021, drone-based programs have been established to monitor pig damage on floodplains and map priority mission grass infestations. In 2024, a fine scale map of vegetation communities was prepared for the entire park to establish a valuable baseline from which change in habitat extent (especially fire sensitive rainforest vegetation) can be assessed. Since 2020, Indigenous indicators of “healthy country” have been used to guide decisions on priority projects and measure success of projects, based on Traditional Owner’s values, knowledge sharing, and involvement and employment (IUCN Consultation, 2024). However, there are also some gaps in monitoring, including of many threatened species (Woinarski and Winderlich, 2014) and floodplain assets and threats (Bayliss et al., 2018). For example, there is no in situ monitoring program to detect impacts and support modelling efforts of sea level rise. Bayliss et al. (2018), proposed the establishment of a network of inexpensive tidal gauges with water depth recorders on all major rivers and floodplains to increase the reliability of hydrodynamic models used to simulate future SLR impacts as better global and regional SLR predictions become available.

► Research — Highly Effective

There has been a long history of environmental and other research in Kakadu, including on fire (e.g. Andersen et al. 2003; Russell-Smith et al. 2009), weed and floodplain management. Many co-designed research projects have been implemented, particularly through the Australian Government supported Commonwealth Environmental Research Facilities, National Environmental Research Program and National Environmental Science Program (IUCN Consultation, 2024). With the support of NESP, the Kakadu Indigenous Research Committee and Kakadu Research and Management Advisory Committee have continued through 2022-2024. The Kakadu Indigenous Research Committee was established in 2018 and has been guiding decisions on research priorities and how research should be conducted through the preparation of a set of Indigenous research protocols and priorities. The Kakadu Research and Management Advisory Committee - a sub-committee of the Board Of Management - has a membership of experts across bio-physical and cultural heritage disciplines who advise the Board on research and management needs. In 2023 and 2024, these two committees played a key role in guiding a National Environmental Research Program project to update the Kakadu Research Strategy. There have been notable examples of focused research forums at which research knowledge has been exchanged among land-holders, managers, and other groups (e.g., Walden and Nou, 2008; Atkins and Winderlich, 2010; IUCN Consultation, 2024).
In 2022, the Kakadu research permit team grew to three permanent roles to bolster the delivery of culturally appropriate consultation and increase the engagement and participation of Traditional Owners and families in the co-design and delivery of research on park. Numerous permits for research in the park are granted each year (IUCN Consultation, 2024).

► Effectiveness of management system and governance in addressing threats outside the site — Mostly Effective

The legislation that establishes Kakadu National Park, the park's management authority, and the development of the park's plan of management is of the highest standard. All of the legislative actions and governance are subject to the scrutiny of the Australian Parliament, and to government authority such as audit. These systems, and the implementation of the Plan of Management, mean that key threats have the framework be adequately addressed.

The Ranger uranium mine, enclaved within the park, stopped processing in January 2021. This poses an opportunity and challenge to rehabilitate the mine site back to a condition equivalent to adjoining areas. The responsibility for rehabilitating the area to an appropriate condition lies with the lease holder – Energy Resources of Australia and its parent company, Rio Tinto, with specific legislative stipulation and conditions for restoration, and oversight by the Australian Government’s office of the Supervising Scientist (IUCN Consultation, 2024).

There is some coordination in management, monitoring and research with conservation reserves bordering Kakadu, including Warddeken and Djelk Indigenous Protected Areas and Nitmiluk National Park, and collaboration with the Njanjma Rangers on weed research and management within Kakadu. Examples include, working with neighbouring ranger groups to mount a coordinated response to late dry

season fires along the park boundary, and participation of Warddeken rangers in recent threatened species surveys and monitoring along the park boundary. Such coordination has resulted in increases in efficiency and effectiveness of some wide-ranging threats (Russell-Smith et al. 2009). Pastoral properties adjoining the park's western boundary are sources of some weed species such as non-native pasture grasses that are matters of national environmental significance (IUCN Consultation, 2024).

▶ **Effectiveness of management system and governance in addressing threats inside the site** — **Mostly Effective**

The legislation that establishes Kakadu National Park, the park's management authority, and the development of the park's plan of management is of the highest standard. All of the legislative actions and governance are subject to the scrutiny of the Australian Parliament, and to government authority such as audit.

The management systems of the park are being significantly improved (IUCN Consultation, 2024). The governance arrangements, particularly through changes to the Kakadu Board of Management, should mitigate recent tensions in the relationship between the site's management and Traditional Owners and provide the framework for improved actions in addressing threats to the natural and cultural heritage of the park.

Overall assessment of protection and management — **Mostly Effective**

Conservation management in Kakadu involves dedicated planning, consistent resourcing, and with appropriate involvement and control by the park's Traditional Owners. Since 2020, there is substantial investment in the implementation of landscape-level management of some threats, including fire, feral herbivores, and weeds. However, some threats (such as feral cats, cane toads, and saltwater intrusion) require further management efforts because they are intractable, beyond local control or effective responses are not yet formulated. Furthermore, fire management remains challenging, despite increased resourcing and staffing since 2020. As a consequence of the limited control of at least some threats, important components of biodiversity have to date shown no recovery from previous decline. Climate change will exacerbate threats to natural and cultural values of the site. Recent decisions taken by the site's mangers to integrate fire, pest, and climate action, and to improve monitoring on the site, are important steps in effective climate action at the site level. Improved governance arrangements, particularly through changes to the Kakadu Board of Management, should mitigate recent tensions in the relationship between the site's management and Traditional Owners and provide the framework for improved actions in addressing threats to the natural and cultural heritage of the park.

State and trend of values

Assessing the current state and trend of values

World Heritage values

▶ **Great natural beauty and sweeping landscapes** — **Low Concern** **Trend:Stable**

The site retains its outstanding landscape values, and sympathetic infrastructure development and onsite remediation works ameliorate localised impacts. The existence of mining leases in enclaves of the site has been of concern and has had localised impacts on this value. However, one of the three enclaves, Koongarra Project Area (1,228 ha) was incorporated into the World Heritage site in 2011 (IUCN, 2011) and will not be mined. The Ranger uranium mine ceased mining in 2021; it is obliged to restore the disturbed area using local native plant species similar in density and abundance to those existing in adjacent areas of Kakadu National Park. Furthermore, no further expansion of the town of Jabiru is

foreseeable. Fires characterise the site for much of the dry season, potentially reducing visitors' perception of 'great natural beauty'. Ongoing and likely accelerating saltwater intrusion will reduce the diversity and productivity of lowland wetland systems (Stephenson et al., 2018), and the spectacular congregations of waterfowl supported by them.

▶ Vast congregations of waterbirds

High Concern
Trend:Deteriorating

All of Kakadu National Park is a designated Ramsar site, and the Alligator Rivers Floodplain is a designated Important Bird Area, with estimates (mostly from the 1980s and 1990s) of some 5 million waterbirds using the area (Birdlife International, 2009). These birds are most likely in decline globally, in Australia at the national level (Bennett et al. 2024), and the global population sizes of many other migratory shorebirds present at the site are undergoing continuing decline (Garnett et al. 2011). The habitat on which the waterbirds depend is also subject to current, and escalating future impacts due to saltwater intrusion, affecting the critical food resources such as Eleocharis dulcis (water chestnut) and Oryza meridionalis (wild rice), for the most abundant waterbird, the magpie goose. Its critical food resources are also being depleted by feral pigs (Bayliss et al., 2006, Pettit et al. 2011; Bayliss and Ligtermoet, 2018) and displaced by invasive grasses (e.g. Adams et al., 2018; Adams et al., 2015). Since 2021, a bi-annual survey of shorebirds and waterbirds - involving aerial survey transects - over the northern seasonal floodplains of Kakadu has provided valuable data on the health of waterbirds, revealing that large and diverse communities persist in these areas (IUCN Consultation, 2024). In the 2022 survey a total of 41,586 birds of 41 species were counted (Kakadu National Park, 2022). The threat of avian influenza has increased and its potential impacts on this value are severe.

▶ Large and relatively intact landscape allowing continued evolutionary processes

High Concern
Trend:Deteriorating

The value 'relatively intact landscape' is challenged by the loss, and ongoing decline, of some of the park's native species, especially mammals, over recent decades (Woinarski and Winderlich 2014). Importantly, these declines are not confined to Kakadu, and have occurred broadly across much of northern Australia. The value of 'relatively intact landscape' is also affected by declines over recent decades in some of the site's key habitats including Allosyncarpia rainforests and sandstone heathlands, and threatened by the risks that saltwater intrusion poses to lowland wetlands (Bayliss et al., 2018). The occurrence within the site of almost the entire catchment of a large tropical river system (the South Alligator River), and the extraordinary diverse landscapes it passes through, remains the key component of the 'large and relatively intact landscape allowing continued evolutionary processes' value.

▶ Conservation of significant habitats

High Concern
Trend:Deteriorating

Late dry season fires have also been shown to negatively impact the riparian vegetation along intermittent streams in the lowland woodlands (Douglas et al., 2015) However, larger areas of unburnt habitat are being retained through the strategic use of fire. This involves the use of patch burning which creates a temporal and spatial mosaic of small burnt areas that protect larger areas of unburnt habitat. Fire performance thresholds affecting the extensive lowland woodland habitat were shown not to have improved in the decadal assessment conducted by Russell-Smith et al. (2017). However, the intensive strategic program being implemented since 2016 aims to address this and has shown some positive results over the past ten years. In 2024, implementation of a priority-places project, with A$4 million Australian Government funding through the Threatened Species Action Plan 2022-2032, will see the delivery of site-based fire, feral animal and weed works to protect fire-sensitive shrubland, rainforest and cypress pine communities in Kakadu (IUCN Consultation, 2024).

▶ Threatened, endemic and relict plants

Data Deficient
Trend:Data Deficient

Declines in many fire-sensitive plant species, especially in the sandstone plateau area (Russell-Smith et al. 2002; Russell-Smith 2006), have been reported, but some subsequent improvements in fire management in the plateau areas (Murphy et al. 2015) may have halted such declines. Surveys of a

number of threatened species have been conducted between 2015 and 2024, with data currently being used to inform species specific management plans (IUCN Consultation, 2024).

▶ Threatened, endemic and relict mammals

Critical
Trend:Deteriorating

There has been a severe decline of the native terrestrial mammal fauna across much of Northern Australia, including in the World Heritage site, including of threatened, endemic and relict species (Woinarski et al., 2001; 2010; Ibbett et al., 2018). The decline of most of these species in Kakadu post-dates the site's inscription as a World Heritage site. Many formerly widespread and abundant mammal species have declined to such an extent that they are now recognised nationally and globally as threatened. Some species have probably been extirpated from the site over recent decades: most likely, these include brush-tailed rabbit-rat (Conilurus penicillatus), golden-backed tree-rat (Mesembriomys macrurus), northern brush-tailed phascogale (Phascogale pirata) and nabarlek (Petrogale concinna). Others, such as northern quoll (Dasyurus hallucatus), have persisted in reduced populations. An extensive monitoring program reported that the abundance and richness of native mammal species at sampled plots across the site declined by 71% and 54% respectively over the period 1996 to 2009, and the number of sampled plots that had no native mammals increased from 13% to 55% over that period (Woinarski et al., 2010). The most drastic declines occurred in the period 1995-2005 and research results, including from 2019, show species richness and abundance have not changed since then (IUCN Consultation, 2020d).
Populations of many formerly abundant mammal species are now so low that the long-established monitoring program is inadequate to detect them sufficiently and has been redesigned to address this (Einoder et al 2018; National Environmental Science Programme, 2019). The 2019 round of sampling of the long-established monitoring program revealed some stability in mammal community, albeit at low levels (Einoder et.al., 2022). The five yearly re-sample of the long-established monitoring program is intended to take place for mammals and other fauna in 2025. Recent opportunistic sightings of northern quoll in some areas of the park, and one brush-tailed phascogale sighting in 2022 suggests there may have been some recovery in populations, although these trends require confirmation through a formal monitoring program (IUCN Consultation, 2024). There have been no reintroductions of any of the site's extirpated mammal species, although a largely unsuccessful attempt to bolster the small remnant population of northern quolls was made recently (Jolly et al. 2018ab). The factors that are most likely to have caused (and continue to cause) the decline are fire regimes (notably with the need of many mammal species for a higher proportion of long-unburnt vegetation), damage to habitat by feral herbivores, and predation by feral cats (Woinarski et al., 2010, 2011; Ziembicki et al., 2015), with cane toads contributing to the decline of northern quoll.

▶ Threatened, endemic and relict birds

High Concern
Trend:Deteriorating

Population trends for most of the site's threatened, endemic and relict birds are not substantially documented. A monitoring program for terrestrial birds reported no overall decline in bird species richness or abundance over the period 1996 to 2009 (Woinarski et al. 2012), although indicated some declines for two threatened species, the partridge pigeon (Geophaps smithii) and white-throated grass-wren (Amytornis woodwardi). Two specific surveys for the largely endemic Alligator Rivers yellow chat (Epthianura crocea tunneyi) have indicated ongoing decline (Kyne and Jackson, 2016). The most recent scorecard from 2022 confirms ongoing decline and notes that the population is now only about 100 individuals (National Environmental Science Program Threatened Species Research Hub, 2022). Broad-scale surveys of waterbirds have indicated no consistent trends in abundance, with marked fluctuations among years for the most abundant species, the magpie goose (Bayliss et al., 2018; Clancy, 2019). However, saltwater intrusion is likely to lead to ongoing reduction in habitat suitability for many waterbirds in the site. Populations of migratory shorebirds utilising coastal habitat are likely to be declining due to habitat reduction in critical areas outside the site. The threat of avian influenza has increased in very recent years.

▶ Threatened, endemic and relict frogs

Low Concern
Trend:Data Deficient

There are no reports of chytrid fungus affecting frogs in the World Heritage site, although the invasion of cane toads, which can predate or compete with other smaller species of frogs, may have reduced the population size of some native frog species. Other possible threats include saltwater intrusion (leading to reduced habitat quality for frogs in lowland wetlands), feral pigs (through direct predation of burrowing frogs and habitat degradation), water buffalo (habitat degradation), and inappropriate fire regimes (leading to habitat degradation - e.g. through decline in riparian vegetation).

▶ Threatened and endemic reptiles

High Concern
Trend:Deteriorating

Some snake and lizard species are declining in the site (IUCN Consultation, 2017). Populations of formerly abundant monitors (notably Mitchell's water monitor Varanus mitchellii, Merten's water monitor V. mertensi and floodplain monitor V. panoptes) and of some snakes (such as plains death adder Acanthophis hawkei) declined catastrophically and rapidly following the arrival in the site of cane toads around 2001; and these populations have not recovered to pre-toad levels. One reptile species endemic to the site (or nearly so), the Arnhem Land skink (Bellatorius obiri), is listed as Endangered (Chapple et al., 2019), with no targeted conservation management response. Arnhem Land skink has been the focus of a collaborative project funded by Office of Threatened Species Commissioner involving surveys of historical sites and monitoring at the site of an extant population. Results have revealed extant populations at five sites across the park, with funding secured for a follow up multi-year project commencing in 2025 (IUCN Consultation, 2024). The near-endemic Oenpelli python (Narawan oenpelliensis) is likely to be undergoing continuing decline (Gillespie et al., 2020), probably because of decline in native mammal prey species and unfavourable fire regimes of previous decades. Radio-tracking studies have shown that feral cats kill a high proportion of some reptile species, including arboreal varanids (Sweet 2007); and there is no effective control of feral cats across the site. The near-endemic yellow-snouted gecko (Lucasium occultum) is endangered, with the main threat probably unfavourable fire regimes; and it has no targeted conservation management program (Chapple et al., 2019). The recently discovered and near-endemic Arnhem phasmid gecko (Strophurus horneri) is considered vulnerable: it is associated with long-unburnt spinifex patches in sandstone environments and is threatened mostly by a fire regime of too frequent fire (Chapple et al., 2019). There is no existing monitoring program (or at least no publicly reported trend information) for the pig-nosed turtle (Carettochelys insculpta) at the site.

▶ Threatened, endemic and relict fish

Good
Trend:Stable

No changes in native fish diversity and abundance have been reported; and although monitoring programs are limited for some species, there is no evidence of sustained decline of threatened fish species at the site (Kyne 2014). Ongoing habitat change through saltwater intrusion is likely to affect some of the site's fish species with saltwater intrusion to coastal floodplains being identified as the major process that will alter assemblage dynamics and system energy flow (Humphrey et al., 2016).

▶ Threatened and endemic invertebrates

Data Deficient
Trend:Data Deficient

There is insufficient ongoing monitoring to estimate trends for most of the site's threatened and endemic invertebrate species (Woinarski and Winderlich 2014).

Summary of the Values

▶ Assessment of the current state and trend of World Heritage values

High Concern
Trend: Deteriorating

Despite its large size, and the good management of some threats in the World Heritage site, a significant decline in many species of small mammals and reptiles, some birds, and probably some plants, has occurred since inscription. Extirpation from the site of some threatened species has occurred. Many species continue to be at risk of decline at the site and across the region. Although a

conservation strategy for the park's threatened species exists, for many threatened and endemic species there are no specific targeted management actions. However, research shows improvements in fire management in the stone country. Research has also established that enhancing or recovering habitat condition via fire management and feral herbivore culls are most effective management responses. The ongoing loss of the site's biodiversity has been assessed as of high concern in previous assessments and many threatened (and non-threatened) species continue to decline, along with associated World Heritage values. Climate change will have increasing impacts, enhancing threatening processes in the site.

Additional information

Benefits

Understanding Benefits

- **Collection of medicinal resources for local use,**
  Outdoor recreation and tourism,
  Natural beauty and scenery

  Kakadu National Park contributes tens of millions of dollars to the Northern Territory economy each year through tourism and purchase of significant quantities of goods and services from local suppliers. (DNP, 2007).

  The site continues to provide for bush tucker and bush medicines used by Traditional Owners, whose personal and community health is linked to the health of the country.

- **Sacred natural sites or landscapes,**
  Cultural identity and sense of belonging

  This site has been occupied for >60,000 years, and there are numerous places in the landscape connected to, and illustrating, that long occupation. Traditional Owners have a very strong sense of identification with this country, with that sense and understanding of place passed on across generations.

- **Importance for research**

  There has been a long history of outstanding environmental research, across many disciplines undertaken at the site. Traditional knowledge is deeply held, and provides a robust foundation for management.

- **Wilderness and iconic features**

  Conservation of sacred sites and historical Aboriginal sites

- **Carbon sequestration,**
  Coastal protection,
  Water provision (importance for water quantity and quality)

  The site provides outstanding environmental services, including water purity and catchment, soil stabilisation and coastal protection, over a vast area. Effective management of fire across the site can help constrain carbon emissions.

  Factors negatively affecting provision of this benefit :
  - Climate change Impact level - Moderate, Trend - Increasing

- **Legal subsistence hunting of wild game,**
  Collection of wild plants and mushrooms,
  Fishing areas and conservation of fish stocks

  Traditional food is harvested from ~25% of the total floodplain area (Adams et al., 2018).

  Factors negatively affecting provision of this benefit :
  - Climate change Impact level - Low, Trend - Increasing
  - Invasive species Impact level - Moderate, Trend - Increasing

  Interviews conducted by Adams et al. (2018) revealed that reduced visitations to areas that were used in the past but no longer used by Indigenous land-owners for hunting and gathering, are due to weed infestation and saltwater inundation.

Summary of benefits

Due to the large size of Kakadu National Park and the fact that it is owned by Indigenous people who still have traditional land use rights, the park is of primary benefit to the people who live within and near its borders. It provides significant benefits to the wider Australian and global community. In addition to nature conservation and conserving cultural values, the site provides a wide range of ecosystem services, furnishes a wealth of scientific knowledge and provides jobs through park management, tourism, research and education.

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