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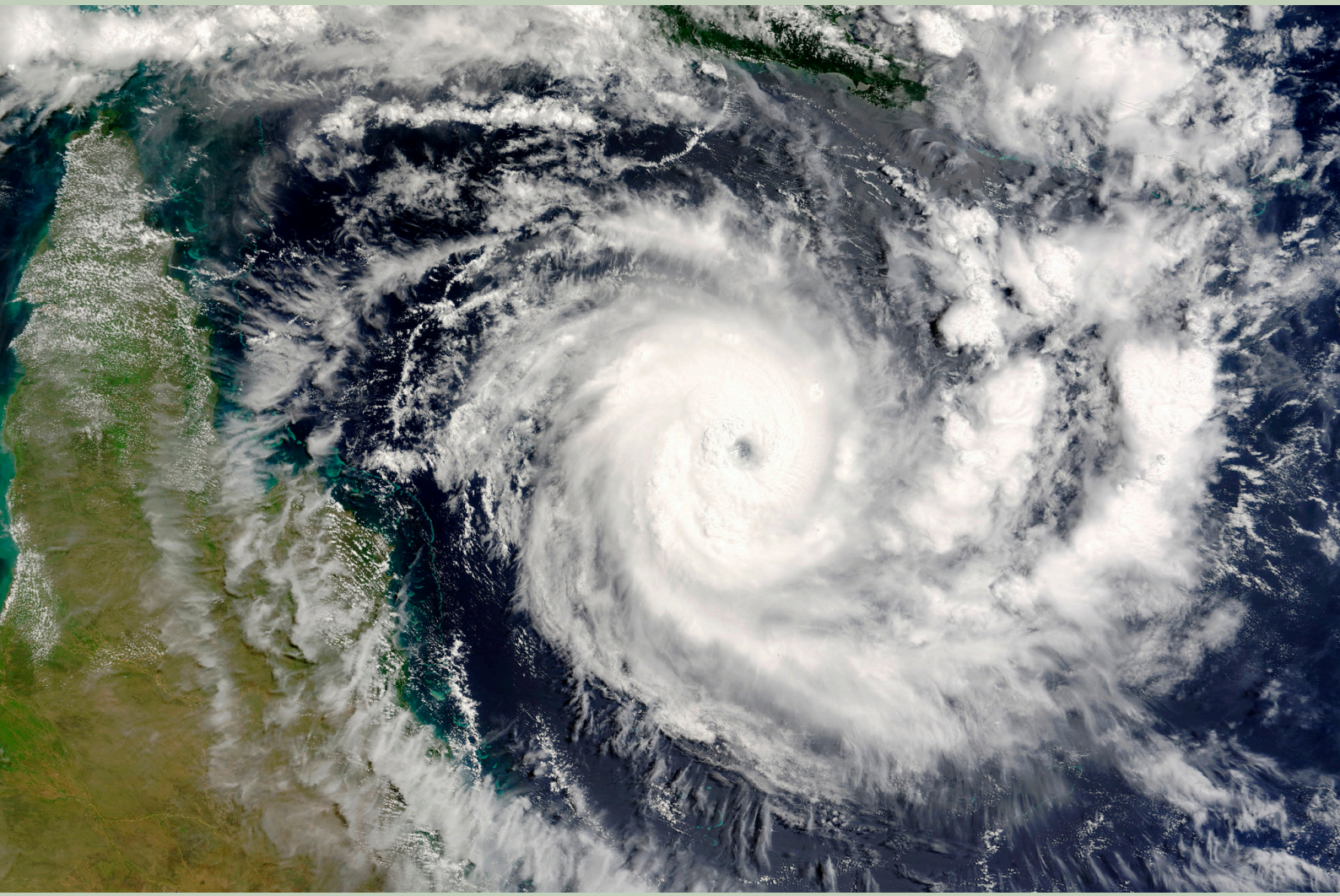
Gulf Savannah NRM

# Regional Delivery Partners

## Northern Gulf Region Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan



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Australian Government

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## FORWARD

Queensland is a global biodiversity hotspot – home to more than half of Australia's native species. Some of these species are found nowhere else in the world. Yet, some of these precious plants and animals are at risk of extinction and natural events such as cyclones, floods, drought and fire contribute to their decline. We know now that these threats are being exacerbated by climate change.

At the same time, Queensland's agricultural output is expanding and intensifying. More than 88% of Queensland's land is used for primary production and this means how we manage agriculture is intertwined with how we manage our environment.

Across mainland Queensland there are 11 regional NRM organisations working with partners, on the ground through its 334 highly qualified staff operating out of 27 rural and regional offices, to help communities become more resilient to the effects of climate change and to farm more sustainably. Using the best possible science, regional NRM organisations are ensuring our species and ecosystems – which provide essential environmental services for all of society – can withstand the threats which would otherwise impact their survival.

By supporting communities to be prepared for disasters we will reduce the impact of these catastrophic events on species, ecosystems, agricultural natural capital assets and local economies.

Strategically the Queensland regional NRM sector works collegiately with each other and across all levels of Government and regional stakeholders to align efforts, planning and resources to maximise the efficiency and effectiveness of emergency preparedness, response and recovery.

Gulf Savannah NRM works to build the disaster resilience of the Northern Gulf Region, a region which encompasses a distinctive landscape characterised by extensive tropical savannas, coastal wetlands, and dynamic river systems. This region is notable for its vast grasslands and rich biodiversity, supporting a variety of flora and fauna endemic to the area. The Northern Gulf is also a repository of significant cultural heritage, with numerous Indigenous sites that offer insight into the region's ancient history. Economically, the region thrives on agriculture, particularly cattle grazing, which occurs across the expansive rangelands. Mining for bauxite and zinc also occurs on a small scale in the region. The Agricultural industry within the Mareeba-Dimbulah area is characterised by intensive farming practices, with a focus on high-value crops such as mangoes, avocados, and sugarcane, supported by sophisticated irrigation systems and favourable climatic conditions. Additionally, tourism is burgeoning, with unique attractions such as the Undara Lava Tubes, recreational fishing opportunities along the coasts, and the sweeping outback landscapes drawing increasing numbers of visitors. These natural resources and environmental features underscore the region's ecological importance and multifaceted economic activities.

The Northern Gulf Region's unique assets face significant threats from natural disasters, which pose substantial risks to its ecological integrity and economic stability. The region is vulnerable to a range of environmental disasters such as cyclones, floods, droughts and wildfires which can cause extensive damage to infrastructure, disrupt agricultural activities, and lead to severe erosion and habitat destruction. Droughts present a recurring challenge, stressing water resources, diminishing agricultural productivity, and heightening the risk of bushfires. These natural disasters not only jeopardise the region's economic ventures but also threaten its rich biodiversity. Effective natural resource management and disaster preparedness strategies are essential to mitigate these risks and safeguard the Northern Gulf Region's unique landscape and economic vitality.

**This project is funded by the Australian Government Natural Heritage Trust and delivered by Gulf Savannah NRM, a member of the Commonwealth Regional Delivery Partners panel.**

Zoe Williams
Chief Executive Officer
Gulf Savannah NRM

# 1. ACRONYMS

| | |
|---|---|
| AWC | Australian Wildlife Conservancy |
| BQ | Biosecurity Queensland |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DAF | Department of Agriculture and Fisheries' |
| DESI | Department of Environment, Science and Innovation |
| GSNRM | Gulf Savannah NRM |
| GSPRT | Golden-shouldered Parrot Recovery Team |
| HLW | Healthy Land and Water |
| JCU | James Cook University |
| MBFWG | Magnificent Brood Frog Working Group |
| MLA | Meat and Livestock Australia |
| NG | Northern Gulf |
| QPWS | Queensland Parks and Wildlife Service |
| QRFS | Queensland Rural Fire Service |
| QSDR | Queensland Strategy for Disaster Resilience |
| SFFRT | Spectacled Flying Fox Recovery Team |

## 2. BACKGROUND

There is a growing need to enhance our preparedness for natural disasters and their impact on biodiversity and agricultural natural capital assets. Ensuring the survival of species and places helps to preserve key ecosystem services such as clean air, water, and climate regulation, all of which profoundly affect human well-being. Disaster preparedness bolsters the resilience of ecosystems, enabling them to recover and flourish following catastrophic events. Better preparation and response also contribute to stronger regional economies through sectors such as tourism and agriculture. For example, by investing in disaster preparedness, long-term costs for recovery and restoration post-disaster are reduced.

Preparedness for natural disasters and effective responses for biodiversity and agricultural natural capital assets are paramount in the Northern Gulf Region. Given the region's vulnerability to various natural disasters, proactive measures are essential to safeguard both the environment and agricultural productivity and the long-term environmental sustainability of the region.

Prioritising ecosystem resilience through conservation efforts, such as preserving critical habitats, and reducing threat risks through on-ground land management can mitigate the adverse impacts of disasters on native flora and fauna. Filling critical knowledge gaps of how disaster scenarios impact species in this region and using this knowledge to implement activities to safeguard these species during and after disaster scenarios is paramount to ensuring the effective conservation of valuable biodiversity assets.

Additionally, implementing sustainable land management practices, such as regenerative agriculture, rotational grazing to maintain ground cover, destocking, water conservation strategies, maintaining cool burning regimes, and monitoring animal health can enhance agricultural resilience and minimise soil erosion during extreme weather events. Fostering community engagement and providing land managers with access to early warning systems, emergency resources, and financial support mechanisms can facilitate swift and effective responses to mitigate the impacts of disasters on both biodiversity and agricultural natural capital assets in the region. By integrating preparedness measures and response strategies tailored to the unique landscapes and challenges of the Northern Gulf Region, stakeholders can enhance resilience and ensure the long-term sustainability of natural and agricultural assets in the face of increasing climate variability.

This Plan considers the most likely disaster scenarios for the Northern Gulf Management Unit (NGMU) including risk assessments for natural disaster scenarios including, cyclones, floods, droughts, late-season wildfires, disease, and extreme heat wave events.

The Plan is built on information gathered from:

a) previous natural disasters in the Northern Gulf Region including:
   - late dry season wildfires in 2009 and 2012 that burned out over 5.5 million ha over 49 large grazing properties across the Northern Gulf (NGRMG, 2013)
   - Devastating impacts from Cyclone Larry and Yasi in 2006 and 2011 respectively, and the increased wildfire risk (on an individual property and regional scale) for several years following the cyclone due to fallen timber;
   - 2009, 2018 and 2023 floods which resulted in extensive areas of flooding and long periods of inundation; and
   - Drought declarations in 2013, 2014,2015, and 2016
b) science reviews including peer-reviewed publications, conservation advice, recovery plans, government reports, regional disaster management plans, and regional NRM assessments for the subregions: Northern Tablelands, Inland Waters, Grazing Lands and Gulf Coasts and community/stakeholder consultation undertaken by Gulf Savannah NRM during the

development of the Northern Gulf Regional Natural Resource Management (NRM) Plan 2017-2022;

c) comprehensive spatial mapping of assets and known and predicted environmental extremes to determine risks and priority locations; and
d) The 2023-2033 Natural Resource Management Plan for the Northern Gulf Region.

The Plan also contributes, in part, to actions under Target 17 of the *Threatened Species Action Plan 2022-32*[1] and Outcomes 1, 2 and 3 of the Natural Heritage Trust (NHT), by addressing vulnerability from extreme weather events relevant to biodiversity[2] and agricultural natural capital assets[3] identified in the management unit and improving emergency response and planning within jurisdictions. The Plan also contributes to Outcomes 1 and 3 of the Climate-Smart Agriculture Program by supporting the agriculture sector to build resilience to climate change and conserve natural capital and biodiversity on-farm.

Given the looming threat of severe weather seasons in the future, along with the critical role of Regional Delivery Partners in supporting NRM preparedness and response, Gulf Savannah NRM was invited to deliver a 'Biodiversity and Agricultural Natural Capital Emergency Preparedness & Response Plan' to safeguard biodiversity and agricultural natural assets. This plan will be utilised to direct preparedness actions and respond in the event of natural disasters in the future and will be reviewed and updated on a 5 yearly basis.

The Queensland Strategy for Disaster Resilience 2022-2027 (QSDR) promotes a systems approach to resilience that connects with a range of agencies and sectors to deliver improved outcomes for Queensland. A systems approach is built into this plan where stakeholders across the Northern Gulf region work collaboratively to deliver a locally-led, strategic, proactive, and planned approach to disaster resilience. This approach also extends through the alignment of this plan with the Gulf Hinterland Regional Drought Resilience Plan 2024-2030 and the 2023-2033 Natural Resource Management Plan for the Northern Gulf region (QG, 2024; Gulf Savannah NRM, 2023).

[1] https://www.dcceew.gov.au/sites/default/files/documents/threatened-species-action-plan-2022-2032.pdf

[2] Biodiversity assets refer to assets identified by jurisdictions, environment management agencies or environmental law as important to preserve during emergencies or natural disasters e.g., species, ecological communities, habitat features.

[3] Agricultural natural capital assets relate to the on-farm natural resources that we rely on for food and fibre production, including soil, air, water, riparian areas, remnant native vegetation, agroforestry and environmental plantings and animals.

## 3. OBJECTIVES OF THIS PLAN

The objectives of the Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan are twofold. Firstly, this plan aims to improve preparedness for, and response to, emergency events in the Northern Gulf Region by integrating biodiversity and agricultural natural capital assets more effectively into emergency planning and response efforts. This firstly entailed identifying biodiversity and agricultural natural capital assets that are most likely impacted by natural disasters, identifying the risks and threats posed by natural disasters and undertaking proactive planning to mitigate these risks. Secondly, the plan seeks to enhance the resilience of biodiversity and agricultural assets by implementing measures before, during (to the extent possible), and after emergencies to support recovery. These measures include but are not limited to conservation efforts to preserve critical habitats, building knowledge to inform actions, and implementing sustainable land management practices such as regenerative agriculture, utilising seasonal forecasting to direct grazing land management, and hazard reduction fire management. By integrating tailored preparedness measures and response strategies, this plan endeavours to safeguard both biodiversity and agricultural natural capital assets, ensuring their long-term sustainability amidst increasing climate variability in the Northern Gulf Region.

## 4. SCOPE

The Gulf Savannah Natural Resource Management (NRM) region encompasses a vast and diverse landscape, presenting both challenges and opportunities for delivering disaster preparedness and response actions. The scope of Gulf Savannah NRM to deliver preparedness actions is influenced by several factors, including financial ability, organisational capacity, stakeholder engagement, and available resources. Gulf Savannah NRM currently has the capacity to identify preparedness and response actions and also complete stakeholder engagement through the development of this plan. The ability of Gulf Savannah NRM to deliver the actions outlined in this plan will be largely dependent on available funding and the capability of the organisation, which can change over time

The financial resources available to Gulf Savannah NRM will play a significant role in determining the scope of preparedness and response actions that can be implemented and the actions that are suggested do not take into account financial and organisational capacity, as funding can be sought through various streams to deliver actions when the need arises. It is important to note that adequate funding is essential for conducting risk assessments, training personnel, acquiring necessary equipment, and conducting outreach and education initiatives.

The capacity of Gulf Savannah NRM, including staff expertise, technical capabilities, and administrative infrastructure, will also impact the organisation’s ability to deliver preparedness actions. Building internal capacity through training and partnerships can enhance the organisation's ability to effectively plan and respond to emergencies, training and development of staff has not been built into this plan but is a factor that needs to be considered following the implementation of this plan.

Resource availability including data, technology, equipment and support services is also crucial to delivery of the identified actions as this will influence the range and scale of preparedness and response actions that can be undertaken. Access to reliable information, including hazard mapping, weather forecasts, and environmental monitoring data, is essential for informed decision-making and risk assessment. One of the major limitations to developing this plan is the region’s size, the remoteness of much of the region, and the paucity of environmental and spatial data to inform decision-making.

Considering these factors, Gulf Savannah NRM will deliver disaster preparedness and response actions that align with its organisational goals, strategic priorities, financial and organisational capacity, and available resources. The organisation where deemed fit will also seek further funding to extend and build on the capacity of the organisation and other stakeholders, where possible, to deliver actions outlined in this plan. Collaborative partnerships and strategic alliances can assist with leveraging additional resources and expertise to enhance the scope and impact of preparedness and response efforts in the Northern Gulf NRM region.

## 5. REGIONAL PROFILE

The Northern Gulf region spans approximately 196,100 km² and includes twelve local government authorities, mainly Carpentaria, Cook, Croydon, Etheridge, Kowanyama, and Mareeba (Figure 1). The area is predominantly used for extensive beef cattle production, with pastoral properties covering about 84% of the region. Conservation and natural environments account for 11%, while intensive agriculture makes up the remaining 5%. The regional economy is a rural economy based on four activities, including agriculture (grazing and horticulture), fishing, mining, and tourism.  Between 2017 and 2021 total agricultural production from the Northern Gulf NRM region varied from $600,000,000 to $750,000,000 per year, with total crops at $150 to $200 million and livestock contributing $400 to 600 million.

The majority of the region has Native Title Determinations, Applications in process or Indigenous Land Use Agreements in place. Traditional Custodians have Native Title interests over the region, whether they reside on Country or not (Map 65, Map 66 and Map 67).

This region encompasses four bioregions: Cape York, the Wet Tropics, the Gulf Plains, and the Einasleigh Uplands. Together, these bioregions create a mosaic of habitats that support a wide range of plant and animal life, making the Northern Gulf region an area of significant ecological importance.

The region comprises mostly tropical savannah and includes a stretch of the Gulf of Carpentaria coastline to the west that is characterised by low-lying floodplains with regionally significant coastal wetlands. To the west, wet tropical rainforest supports a diverse array of fauna and flora. The region also features four river catchments: the Mitchell, Staaten, Norman, and Gilbert. All catchments drain into the Gulf of Carpentaria and therefore any effects upsteam (positive or negative) impact areas downstream.’

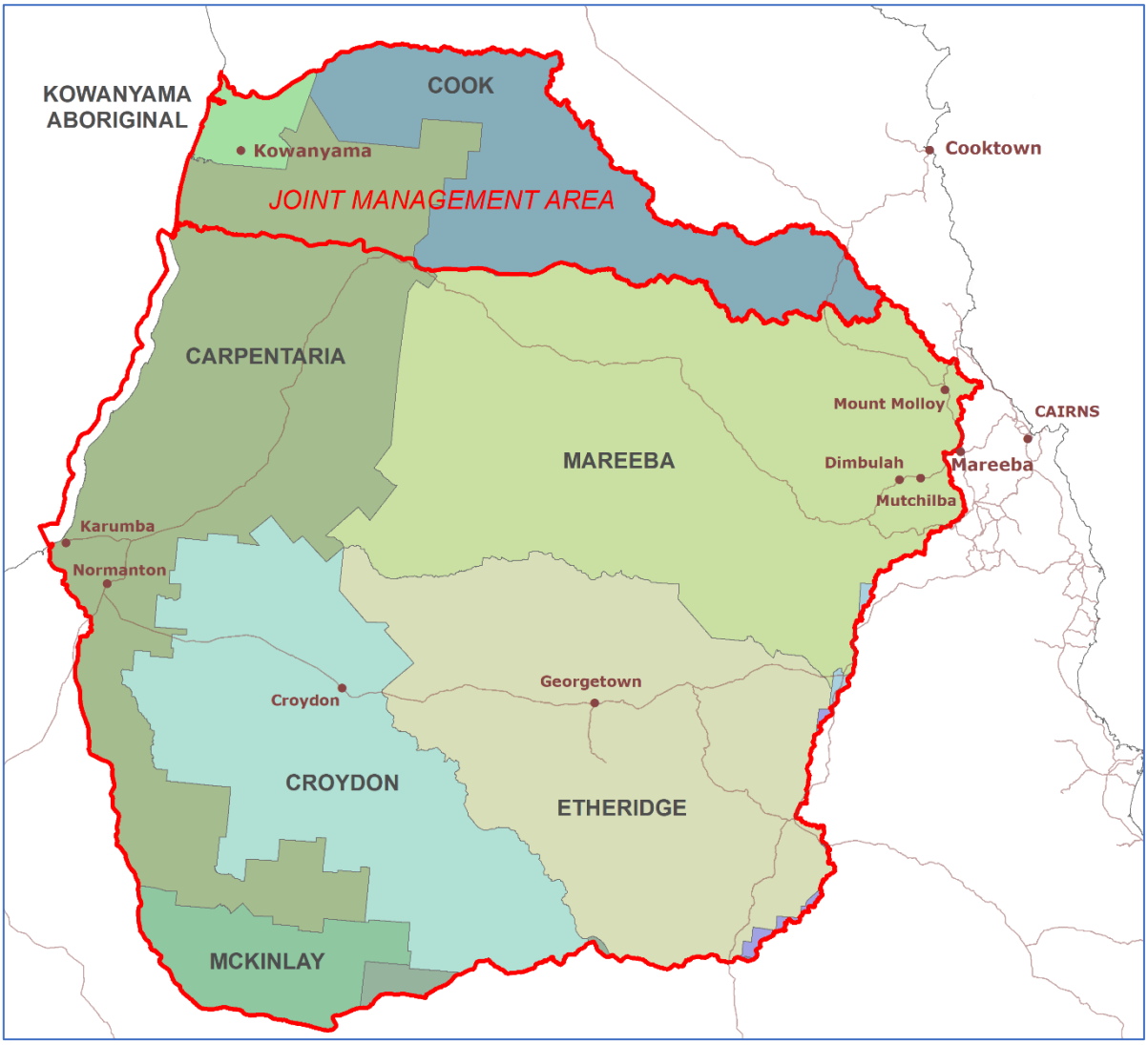


Figure 1 - Local Government Authorities of the Northern Gulf Region

# 6. ROLE OF RDP IN EMERGENCY PREPAREDNESS AND RESPONSE

Gulf Savannah NRM will play a crucial role in supporting emergency preparedness and response efforts in the Northern Gulf Region. The organisation's responsibilities will span across various stages of the disaster management cycle, including mitigation, preparedness, response, and recovery, alongside identifying risks and hazards (Figure 2).


Figure 2. The stages of the disaster management cycle

A brief draft outline of Gulf Savannah NRM's roles and responsibilities, along with how the organisation will interact with other entities before, during, and after natural disasters is provided below:

## 6.1 Mitigation and Preparedness

Gulf Savannah NRM undertakes a multifaceted approach to address the risks posed by natural disasters. This encompasses the current project that identifies and prioritises biodiversity and agricultural natural assets most vulnerable to natural disasters. Gulf Savannah NRM actively develops and implements strategies aimed at mitigating risks and bolstering community resilience. These strategies currently include collecting monitoring data for supporting the condition of biodiversity and agricultural natural assets, the promotion of sustainable land, and freshwater management practices that aim to preserve and protect regional assets. Additionally, the organisation fosters collaboration with local communities, government agencies, Indigenous groups, and other stakeholders to heighten awareness and build collective knowledge and capacity for environmental management which builds the resilience of these systems to the impacts of natural disasters. Gulf Savannah NRM will also collaborate with the Local Disaster Management Group's (LDMG's)by leveraging their expertise in natural resource management and sustainability to develop and refine disaster management plans. Further, the organisation plays a pivotal role in facilitating various training sessions and workshops geared towards drought-proofing properties, and land management for the protection of biodiversity and maintenance of agricultural systems. Through these concerted efforts, Gulf Savannah NRM strives to fortify the region's readiness to effectively respond to natural disasters and minimise their adverse impacts on communities and ecosystems.

### 6.2 Response

Gulf Savannah NRM is committed to alleviating the adverse effects of natural disasters and advancing the long-term well-being and sustainability of the Northern Gulf Region. Where possible Gulf Savannah NRM will play a role in the following actions during disaster scenarios:

- Support the LDMG's by providing expertise and resources to mitigate the immediate impacts of disasters;
- facilitating communication and collaboration among pertinent agencies and stakeholders to guarantee a unified and efficient response;
- seeking and coordinating crucial assistance to impacted communities, the organisation will help facilitate access to essential resources, information, and technical aid necessary for navigating the aftermath of natural disasters.
- Facilitating the active participation of local volunteers and groups, and the acquisition of funding and support to assist in emergency response tasks and evaluation; and
- monitoring and evaluation of environmental repercussions of natural disasters where funding is available, gaining invaluable insights and data crucial for post-disaster recovery and restoration endeavours

### 6.3 Recovery

Where funding is available, Gulf Savannah NRM will aim to collaborate closely with landowners, local governments, community organisations, conservation organisations and LDMG's to develop and execute post-disaster monitoring and recovery plans. This collaborative approach ensures a coordinated and effective response to monitor the recovery, restore affected ecosystems and rehabilitate natural resources. Gulf Savannah NRM supports efforts such as erosion control, fire management, grazing land management, and habitat restoration projects, aiming to mitigate the environmental impact of disasters. Additionally, the organisation will assist and provide advice to communities to access financial assistance and grants for recovery and rebuilding efforts, providing essential resources to facilitate the restoration process. Moreover, Gulf Savannah NRM facilitates community-led initiatives focused on long-term resilience-building, promoting sustainable land management practices and climate adaptation strategies to enhance the region's capacity to withstand future disasters. Through these collaborative efforts, Gulf Savannah NRM will contribute to the restoration and resilience of the Northern Gulf Region's biodiversity and natural agricultural assets, ensuring the region's continued sustainability.

### 6.4 Collaboration with Community Stakeholders

Gulf Savannah NRM recognises the invaluable role of community stakeholders in disaster preparedness and management, fostering close collaboration and engagement to enhance resilience in the face of natural disasters. Through proactive measures, such as regular meetings, workshops, and community forums, Gulf Savannah NRM facilitates meaningful dialogue and information sharing with local residents, Indigenous groups, and community organisations. This collaborative approach ensures that diverse perspectives and local knowledge are integrated into preparedness efforts, resulting in more informed decision-making and tailored response strategies. Moreover, by actively involving community stakeholders in disaster planning and response activities, Gulf Savannah NRM strengthens social cohesion and fosters a sense of ownership and empowerment within the community. This grassroots engagement is crucial to ensuring the sustainability of disaster management initiatives, as it fosters a collective commitment to safeguarding the well-being and livelihoods of people residing in the Northern Gulf Region.

## 6.5 Role of the RDP with Local and District Disaster Management Groups

In North Queensland, disaster management groups are essential to the region's ability to prepare for, respond to, and recover from various disasters. The structure includes Local Disaster Management Groups at the community level, District Disaster Management Groups (DDMGs) overseeing multiple local governments, and the State Disaster Management Group (SDMG) coordinating state-wide efforts (Figure 3). LDMGs focus on developing localised disaster management plans, conducting risk assessments, and coordinating emergency responses. DDMGs support LDMGs by providing additional resources and facilitating interagency collaboration. Together, these groups ensure a cohesive and efficient approach to disaster management, enhancing community resilience and safety.

Gulf Savannah Natural Resource Management (NRM) integrates into this framework by participating in the disaster management (natural environment) sub-committees for Mareeba, Croydon, and Etheridge Shires within the LDMGs. Their involvement brings a critical environmental perspective, ensuring that disaster management plans consider long-term sustainability and natural resource conservation. Gulf Savannah NRM's expertise helps mitigate the impacts of disasters on local ecosystems, promoting strategies that support both immediate recovery and future resilience. By collaborating with local and district disaster management groups, Gulf Savannah NRM enhances the overall effectiveness of disaster preparedness and response efforts, contributing to the sustainability and resilience of both the environment and the communities in the Northern Gulf region.

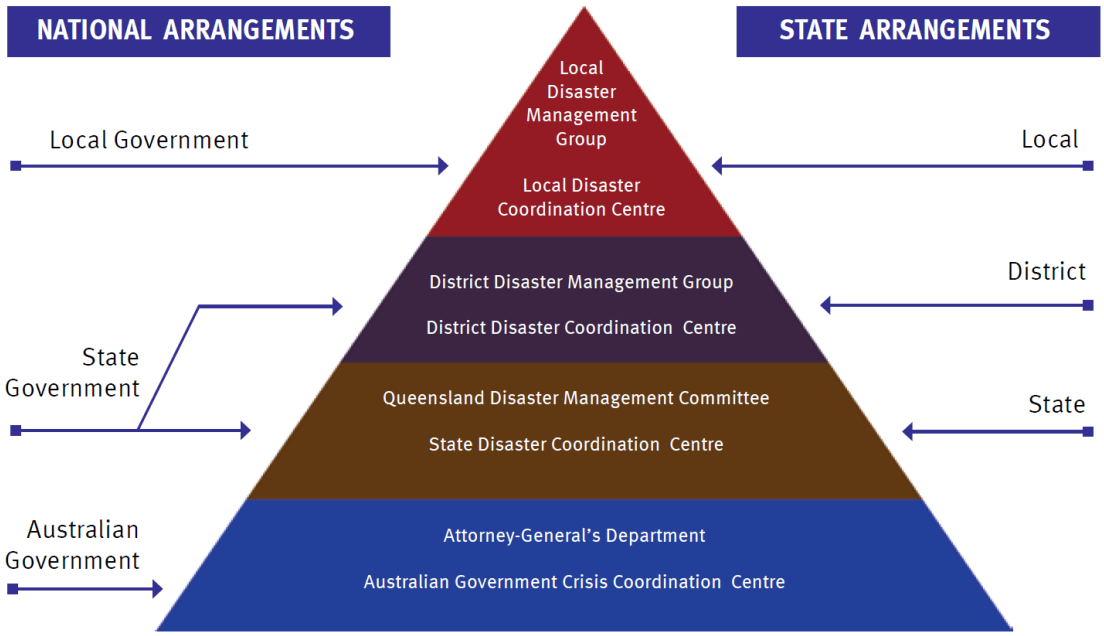


Figure 3. Queensland Disaster Management Structure

# 7. IDENTIFICATION OF MANAGEMENT UNIT ASSETS AND SUSCEPTIBILITY

The identification of biodiversity assets initially involved a comprehensive assessment of Matters of National Environmental Significance (MNES) governed by *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), as well as an internal Gulf Savannah NRM prioritisation of species and ecological communities considered regionally significant. Species distribution maps were then juxtaposed with spatial threat layers, utilising both historical and predictive data. Species and ecological communities that were not identified to be threatened by disaster scenarios or had limited distribution in the Northern Gulf region were omitted from the asset list to ensure a targeted approach to disaster preparedness and response.

Determining the susceptibility of threats to each species and ecological community involved a review of spatial layers alongside a thorough examination of relevant literature for each asset. Peer-reviewed publications, conservation advice, government reports, recovery plans, and other regional strategies were reviewed to identify potential emergency scenarios posing threats to each species and actions that could be used to build the resilience of each asset. Biodiversity assets included in this plan and their conservation listing under the EPBC Act 1999 are provided in Table 1 below.

Table 1. Priority species and ecological communities and their conservation listing under the Environment Protection and Biodiversity Conservation Act 1999.

| **Species** | **Scientific name** | **EPBC** |
|---|---|---|
| Armoured mist frog | *Litoria lorica* | Critically Endangered |
| Freshwater sawfish | *Pristis pristis* | Vulnerable |
| Golden-shouldered parrot | *Psephotus chrysopterygius* | Endangered |
| Gouldian finch | *Erythrura gouldiae* | Endangered |
| Green turtle | *Chelonia mydas* | Vulnerable |
| King blue-grass | *Dichanthium queenslandicum* | Endangered |
| Koala | *Phascolarctos cinereus* | Endangered |
| Limbless fine-lined slider | *Lerista Ameles* | Not listed |
| Magnificent brood frog | *Pseudophryne covacevichae* | Vulnerable |
| Mountain-top nursery frog | *Cophixalus monticola* | Critically Endangered |
| Mount Surprise slider | *Lerista Storri* | Not listed |
| Northern bettong | *Bettongia tropica* | Endangered |
| Northern greater glider | *Petauroides minor* | Vulnerable |
| Northern quoll | *Dasyurus hallucatus* | Endangered |
| Olive ridley turtle | *Lepidochelys olivacea* | Endangered |
| Red goshawk | *Erythrotriorchis radiatus* | Endangered |
| Spectacled flying fox | *Pteropus conspicillatus* | Endangered |
| | | |
| **Ecological communities** | | |
| Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland | | Endangered |
| Semi-evergreen vine thicket - 40 mile/Undara National Parks | | Endangered |

Agricultural Natural Capital Assets were identified by an initial review of the Agricultural industries in the region and natural assets critical to supporting these industries. Currently, over 90% of the region is used for pastoral production, estimated to support 933,000 cattle over 160 pastoral properties. Small areas in the grazing lands are used for dryland cropping. More intensive agricultural production occurs in the Mareeba / Dimbulah areas, primarily for tropical fruit crops and sugarcane. Some small intensive animal

production systems occur in the region. Assets including soil (high-value grazing and agricultural soils), freshwater, perennial pastures, Horticultural crops, tropical fruit, and livestock (including beef cattle, intensive animal systems and aquaculture) were included as agricultural assets.

Risk ratings were allocated to each asset and threat scenario through an internal GSNRM review of each asset and the known impacts of environmental disasters for each species and asset using a risk matrix (Appendix 1). For some assets, impacts from disasters such as droughts, which lead to increased grazing pressures, were considered alongside cumulative threats from other factors influencing the response of assets to disasters. Given the significant data deficiencies for some species and assets, assumptions had to be made. These assumptions affect the reliability of the risk ratings as the precise impacts of disaster scenarios on various species and assets are not fully understood. Accumulated threats, such as habitat degradation, water use, and feral animals, also compound the risks, making it challenging to isolate the effects of individual disaster events. Thus, the risk matrix incorporates these uncertainties, highlighting the need for continued research and monitoring to refine risk assessments and resilience strategies.

Additionally, risk ratings will vary depending on the severity of the disaster. For example, the intensity of cyclones directly influences the extent of ecological damage with high gategory cyclones posing higher risks. Similarly, wildfire intensity will be variable across the landscape due to fluctuations in fuel loads and therefore risks would change depending on the location and environmental factors. These variations necessitate a dynamic approach to risk assessment, adjusting ratings based on real-time data and predictive models to better prepare for and mitigate disaster impacts on biodiversity and agricultural natural capital assets.

## 8. BIODIVERSITY ASSETS PREPAREDNESS AND RESPONSE TABLES

| Natural Disaster Risk Register for Biodiversity Assets - Drought | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Susceptibility | | | | Preparedness | | | Response | | | |
| **Asset** | **Emergency scenario** | **Risk description / reason susceptible** | **Likelihood** | **Consequence** | **Rating** | **Priority locations** | **Activities to build resilience** | **Action** | **Currently undertaken?** | **Activities during event** | **Action** | **Longer-term recovery actions** | **Action** |
| Golden-shouldered parrot (*Psephotus chrysopterygius*) | Drought | Reduction in quality and availability of water in the late dry season (OAC, 2022). Complete failure of a wet season is considered a factor that could cause Golden-shouldered parrots to decline. Duration and frequency of extreme droughts under an RCP48.5 emissions scenario between 2020-2039 show an increase in the frequency and duration of droughts in the Staaten National Park area (Appendix 2, Map 1 and Map 2 ) | Likely | Significant | Very high | Staaten River National Park | Establishment of automated weather station on Staaten River National Park and monitoring of temperature, rainfall and flood patterns. Assess the quality and availability of water in the late dry season. | QPWS, Traditional Owners | A remote weather station is not currently monitored to respond to conservation actions for the Golden-shouldered parrot in Staaten River National Park. | If the quality and availability of water in the late dry season is low provide alternative watering points where required and monitor the use of watering points. | QPWS, Traditional Owners | Post-drought population survey to determine resilience and plan conservation efforts accordingly. | QPWS, Traditional Owners, GSNRM |
| Freshwater sawfish (*Pristis pristis*) | Drought | Drought can cause pressure on sawfish populations, causing decreases in sawfish body condition/lower growth rates. Juvenile sawfish can also become trapped in receding waterholes and die in evaporating waterholes.<br><br>Drought predictions along the Gulf coastline show that the duration of extreme droughts will increase between 2020 and 2039, however, the frequency of extreme droughts is predicted to stay the same or decrease during this time frame. Susceptibility to droughts will only increase in years with extreme droughts (Appendix 2, Map 3 and Map 4). | Possible | Moderate | High | Coastal wetlands, Gulf of Carpentaria River Systems and tributaries (Normanton, Leichhardt, Staaten, Gilbert, Flinders and Albert Rivers). | Surveys and mapping of waterholes where juvenile sawfish may be stranded. | Sawfish and Rays Australia (SARA), Traditional Owner groups (Normanton Rangers), GSNRM | Limited surveys of waterholes have occurred to specifically identify the presence of sawfish at the end of the dry season or during drought. | Survey of waterholes identified to provide habitat for sawfish and removal of juvenile sawfish. Tag and release sawfish removed from waterholes. | SARA, Traditional Owner groups (Normanton Rangers) | Ad hoc post-drought monitoring of sawfish to track the survival of sawfish removed from drought-affected waterholes. | SARA, Traditional Owner groups (Normanton Rangers) |
| Gouldian finch (*Erythrura gouldiae*) | Drought | Droughts can affect Gouldian finch populations by disrupting food availability. Long-term shifts in rainfall patterns can lead to changes in grass species composition, potentially favouring grasses less palatable to finches. Furthermore, fluctuations in surface water availability during the dry season could impact the persistence of finch populations in certain regions (TSSC, 2016b).<br><br>Drought predictions with an 8.5 RCP scenario between 2020-39 for the grazing lands subregion predict a greater frequency and duration of extreme droughts in areas of *E. Gouldiae* distribution including the southeast of the region and areas around Georgetown and northeast of Mareeba, including Mt Molloy, Mt Carbine, Mt Mulligan and surrounding areas. Some areas within the finch's distribution are predicted to be less impacted by drought by 2039 (Appendix 2, Map 5 and Map 6). | Likely | Significant | Very high | Within the Gouldian finch distribution in the southeast of the region and properties around Georgetown and Mareeba Wetlands Reserve. Further spatial mapping of suitable land types will identify pastoral properties to engage with. | Develop and disseminate best practice grazing management guidelines, especially for preferred Gouldian finch wet season feeding habitat. | DAF, GSNRM | Specific guidelines to promote Gouldian finch wet season habitat have not been developed. | Remove livestock from paddocks identified as containing grasses favoured by the Gouldian finch during the dry season, e.g., annual spear grasses or native sorghum (Sarga species) (O'Malley, 2006). | Landholders | Conduct assessment of grass condition following the drought to determine actions required to improve habitat condition. Longer term monitoring to be undertaken where required. | Landowners, NRM's |
| | | | | | | | Implement sustainable grazing management programs that promote key grasses for the Gouldian finch, to build the resilience of the species habitat to drought events. This could include restricting livestock access to Gouldian finch wet-season foraging habitats during the wet season. | Landholders | Some pastoralists are currently using wet season spelling to manage their properties which could benefit *E. Gouldiae*. | | | | |
| | | | | | | | Promote the Gouldian finch as an indicator of sustainable cattle and fire management. | GSNRM, DAF | There are currently no campaigns promoting the Gouldian finch as an indicator species. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Koala (*Phascolarctos cinereus*) | Drought combined with heat waves | Drought can severely impact food (leaf fall and browning of foliage) reduction in foliar moisture causing dehydration and malnutrition of koalas. Survival of koalas during drought and heat wave events is more likely in higher-quality habitats closer to permanent water (Gordon et al., 1988; Seabrook et al., 2011).<br><br>The frequency and duration of extreme droughts in the Northern Gulf region are predicted to increase across the koala's distribution in the Northern Gulf region under an RCP 8.5 emissions scenario (Appendix 2, (Appendix 2, Map 7, Map 8 & Map 43).The susceptibility of koalas on the tablelands is likely to be lower than koalas in the grazing lands due to likely closer proximity to permanent water. | Likely | Moderate | High | The area between and surrounding Gilberton and Einasleigh, and the Cobbold Gorge population within the Grazing Lands (the koalas at Cobbold Gorge may be less likely impacted) and across the Tablelands.<br><br>Further areas to be informed by population monitoring. | Monitoring population dynamics to understand how koala populations respond to drought. | Research Institutions, Traditional Owners, GSNRM | Some surveys have been undertaken by ecological consultancies. James Cook University is currently completing a genetic analysis. DCEEW are funding a $10,000,000 program for national monitoring of koalas https://www.nkmp.org.au/populations.php | Conduct koala surveys in areas with known koala populations to determine habitat use and response of koalas during the drought event. | Research Institutions, Traditional Owners, GSNRM | Undertake monitoring to assess the health and recovery of koalas post-drought. | Research organisations e.g., Research Institutions, Traditional Owners, GSNRM |
| | | | | | | | Undertake population monitoring to increase knowledge of the distribution, abundance, population trends, and population health of koalas across the region to prioritise areas at a regional scale for conservation efforts. Incorporate Indigenous, community groups, and citizen science in monitoring. | Research Institutions, Traditional Owners, GSNRM | | | | | |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in perpetuity covenants, that promote the protection and maintenance of private lands with high-value habitat for the species. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | There are several nature refuges already gazetted across the koala's range in the Northern Gulf region. | Undertake an assessment of koala habitat including the availability of food, water resources, and tree health. | Research Institutions, Traditional Owners, GSNRM | Develop and implement habitat restoration plans tailored to the specific needs of koalas. | Govt Agencies, Research Institutions |
| | | | | | | | Improve the condition of existing Koala habitat on both private and public land through best-practice land management, including management of vegetation, fire, weeds, and introduced species. | Landholders, QRFS, QPWS, local councils, Gulf Savannah NRM | Some land managers undertake best practice land management which would promote and improve the condition of koala habitat in the region. | | | Conduct post-drought habitat restoration in areas identified as drought refugia. | Local tree planting groups, QPWS, GSNRM, Traditional Owners |
| | | | | | | | Raise awareness and educate landowners in best-practice land management for the conservation of the koala in the Northern Gulf region. | GSNRM | No specific education campaigns for koalas are being undertaken in the NG region. | Provision of water stations in easily accessible places to ensure koalas have access to water (e.g., Cobbold Gorge if koalas observed to be struggling in drought conditions). | local councils, Landowners | | |
| | | | | | | | Develop prioritisation at a regional scale for the long-term implementation of actions. These include threat risk assessment, prioritisation of habitat attributes for the protection and recovery of the Koala, local actions and land management planning (AG, 2022b). | Gvt Agencies, Research Institutions | Prioritisation of conservation actions has not been undertaken for the koala in north Queensland. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Greater glider (northern) (*Petauroides minor*) | Drought | Warmer climates and reduced rainfall impact the nutritional and water content of eucalyptus leaves, reducing food availability, which could cause reduced reproduction rates and population size (AG, 2022a; Wagner et al., 2020). The frequency and duration of extreme droughts are predicted to increase by 2030 in much of *P. minor* range in the region. Areas of refuge around Blackbraes National Park are evident with pockets of habitat where drought frequency and duration are not predicted to increase (Appendix 2, pages Map 9 and Map 10). | Possible | Minor | Moderate | Blackbraes National Park and surrounding properties, Werrington, Glenmore, Oak Park, Oak Valley, Gorge Creek Stations (verification of the distribution across these properties required). | Protect habitat considered to be climate change refuges for the Greater glider (northern). | QPWS, Landholders | Blackbraes National Park and Werrington Nature Refuge are currently protected for the conservation of *P. minor* habitat. | Undertake surveys to assess *P. minor* behaviour and diet during the drought event. Radio-collar several individuals to assess health and survival. | Research Institutions, QPWS, DESI | Conduct post-drought population surveys and telemetry studies to assess the impacts of the drought and monitor population recovery dynamics. | Research Institutions, QPWS, DESI |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in perpetuity covenants, that promote the protection and maintenance of private lands with high-value habitat for the species (AG, 2022a). | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | Currently, Werrington Station is gazetted as a nature refuge. | | | | |
| | | | | | | | Encourage landowners to avoid the use of barbed wire, and replace the top strand of existing barbed wire with single-strand wire in habitat known to be occupied by greater gliders. | GSNRM | Barbed wire replacement and tubing to cover barbed wire have been implemented in some key locations in Blackbraes National Park and Werrington Station (Werrington Nature Refuge). | Assess the availability of food resources in critical habitat areas to determine the impact of drought on food supply. | | Assess the post-drought recovery of food resources in critical habitat areas. | |
| Northern bettong (*Bettongia tropica*) | Drought | The availability of truffles, which is a primary food resource for the species, is strongly associated with rainfall, with truffle abundance decreasing with reduced rainfall. A decreased abundance of truffles during drought conditions has been likely associated with reductions in some populations. Small isolated subpopulations are particularly vulnerable to drought (Abell et al., 2006).<br><br>The Northern bettong exists in small restricted populations with a low density of individuals. The frequency and duration of extreme droughts are predicted to increase by 2030 across the Northern bettong's range (Appendix 2, Map 11 and Map 12). | Likely | Significant | Very high | The western edge of the Mount Carbine Tableland | Implement an appropriate fire management regime to maintain suitable habitat by thinning woody plants, restoring the grassy understorey (particularly by promoting the growth of cockatoo grass (*Alloteropsis semialata* R.Br.) and availability of truffles. Include monitoring of B. tropica around fire management activities and post-fire assessment of the regeneration of cockatoo grass and truffle species (Abell et al., 2006; TSSC, 2016a). | QPWS, AWC | QPWS have begun mechanical clearing of lantana at Mt Spurgeon to create access tracks for ongoing weed management, and to allow fire to penetrate the area once native grass cover has recovered. QPWS are adopting fire management at Mt Spurgeon with the specific aim of improving the habitat for northern bettong. | Undertake monitoring to assess the impacts of drought on the abundance and health of the population. | Research Institutions, DESI, AWC | Undertake post-drought population surveys to assess the impacts of the drought and monitor population recovery dynamics. | Research Institutions, DESI, AWC |
| | | | | | | | Trial and develop a method to use conservation detection dogs to sample truffle abundance and diversity. If successful, undertake monthly surveys to measure truffle seasonality and diversity. | Research Institutions, DESI | | | | Maintain and restore habitat conditions favourable for truffles (e.g., fire management, feral animal management). | QPWS, AWC |
| | | | | | | | Undertake weed management (e.g., lantana). | QPWS, Landowners | | If suitable undertake truffle surveys to assess the abundance and diversity of truffles. | Research Institutions, DESI | Quantify the post-drought abundance and diversity of truffles. | Research Institutions, DESI |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Mountain top nursery frog (*Cophixalus monticola*) | Drought | The conservation advice for the Mountain top nursery frog lists drought as a key threatening process as it impacts hydrology which can reduce food availability and breeding habitat (reduced soil and litter moisture can impact the suitability of breeding habitat for this species) (TSSC, 2019).<br><br>Australian microhylid frogs are terrestrial breeders, requiring high levels of soil and litter moisture to prevent their eggs from desiccating (Williams, 2007). Mountain top nursery frogs are known to breed in the apices of Mt Lewis walking stick palms, where decaying leaves and plant debris collects and provides a protective environment for eggs and froglets (Williams, 2007). Droughts, particularly those occurring after the onset of the breeding season, may have large negative impacts on the breeding success of the frogs if the leaf litter moisture level drops and eggs desiccate. Additionally, droughts and associated hydrological changes may affect food availability and susceptibility to disease (TSSC, 2019). Mountain top nursery frogs require high annual precipitation (2500-3500 mm) (Williams, 2007).<br><br>Drought frequency and duration are predicted to increase by 2030 under an RCP 8.5 scenario within the species distribution (Appendix 2, Map 13 and Map 14). | Likely | Significant | Very high | Mt Lewis National Park | Implement a program ensuring suitable habitat is maintained in areas currently supporting populations of the Mountain Top Nursery Frog and investigate options for enhancing the resilience of the species' current habitat to climate change (TSSC, 2019). | QPWS, Research Institutions, Terrain NRM, GSNRM | There are currently no actions being undertaken aimed at increasing drought resilience of mountain top nursery frog habitat. | Assess impacts of drought on soil moisture content and availability of shelter in core areas, as well as *Linospadix apetiolatus* palms which frogs use for breeding. | QPWS, Research Institutions, NRMs | Assess impacts on frogs and their habitat post-drought to better understand drought resilience of the species | QPWS, Research Institutions, NRMs |
| | | | | | | | Undertake targeted surveys in suitable habitats and potential habitats to locate any additional populations. | QPWS, Research Institutions | Researchers are planning surveys for possible new populations of mountain top nursery frogs to the north of Mt Lewis. | Not applicable as it is unlikely nursery frogs will be active/calling for undertaking surveys during drought. | QPWS, Research Institutions | Continue to survey for new populations and expand the known distribution of the species, particularly to the north of their current known range. | QPWS, Research Institutions |
| | | | | | | | Feral pig management to reduce habitat destruction by feral pigs (fencing and control) | QPWS, Research Institutions | Funding has been secured for Terrain NRM, GSNRM and JCU to trial exclusion fencing and pig control. | Increase feral pig control activities to reduce the impacts of pig disturbance when frogs are taking shelter under fallen logs and leaf litter. | QPWS, Research Institutions, NRMs | Continue to monitor feral pig numbers/disturbance in response to extreme events and management actions undertaken to inform best practice management. | QPWS, Research Institutions, NRMs |
| | | | | | | | Collect data to improve the understanding of how climate change impacts the species, This information can then be used to better prioritise disaster resilience and response. | QPWS, Research Institutions | Researchers are comparing current elevational limits for the species with historical survey data to identify how climate change may impact the species. | Assess impacts of drought on suspected important habitat variables such as soil moisture and health of Linospadix *apetiolatus* palm stands. | QPWS, Research Institutions | Continue to monitor the elevational limits of known populations and responses to drought (and other extreme) events. | QPWS, Research Institutions |
| | | | | | | | Investigate the establishment of additional self-sustaining populations to safeguard the species from extinction. | QPWS, Research Institutions | | | | Establish a captive breeding program to safeguard species from extinction due to climate change, for possible reintroduction at translocation sites. | QPWS, Zoos, Research Institutions, NRMs |
| Armoured mist frog (*Litoria lorica*) | Drought | Droughts can impact the hydrology of stream/river systems, which may reduce food availability and water quality. The armoured mist frog is likely to be susceptible to the effects of drought if it impacts river flow, water quality, and freshwater ecosystem health.<br><br>As armoured mist frogs are only currently known from a small number of sites (one main and two translocated sites), any impacts of drought in these river systems could have a large impact on the frog population.<br><br>Drought frequency and duration are predicted to increase by 2030 under an RCP 8.5 scenario within the species distribution (Appendix 2, Map 13 and Map 14). | Likely | Minor | Moderate | Mt Lewis National Park | Implement a program ensuring suitable habitat is maintained in areas currently supporting populations of the Armoured mist frog and investigate options for enhancing the resilience of the species' current habitat to climate change (TSSC, 2019). | QPWS, Research Institutions, Terrain NRM, GSNRM | There are currently no actions being undertaken aimed at increasing the drought resilience of armoured mist frog habitat. | Monitor the effect of drought on habitat at known sites for armoured mist frog, including water quality and possible changes in water flow. | QPWS, Research Institutions | Continue to survey historical sites and unsurveyed areas for surviving populations of *L. lorica*. | QPWS, Traditional Owner Ranger Groups, University Researchers |
| | | | | | | | Undertake targeted surveys in suitable habitats and potential habitats to locate any additional populations. | QPWS, Research Institutions | Researchers have continued to survey historical sites and employ eDNA analyses in an attempt to locate additional populations. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Armoured mist frog (*Litoria lorica*) | Drought | Cont. | Likely | Minor | Moderate | Mt Lewis National Park | Feral pig management to reduce habitat destruction by feral pigs (fencing and control) | QPWS, Research Institutions | QPWS control feral pigs in National Parks, but this has not been undertaken specifically to benefit armoured mist frog habitat | Increase feral pig control activities during drought when pig activtiy and disturbance will increase around permanent water such as the streams where armoured mist frogs live. | QPWS, NRMs | Implement coordinated integrated pig management to reduce the impacts of feral pigs on waterways. | QPWS, NRMs |
| | | | | | | | Collect data to improve the understanding of how climate change impacts the species, This information can then be used to better prioritise disaster resilience and response. | QPWS, Research Institutions | It is unknown if there is currently data being collected to improve understanding of how climate change impacts this species. | | | Continue to monitor source and translocated populations to study long-term population health and dynamics | QPWS, Research Institutions |
| | | | | | | | Investigate the establishment of additional self-sustaining populations to safeguard the species from extinction. | QPWS, Research Institutions | Armoured mist frogs were rediscovered at a single site, and JCU researchers and QPWS have translocated individuals to two additional locations to increase resilience. | | | | |
| King blue-grass (Dichanthium queenslandicum) | Drought | Grazing is considered a threat to King blue-grass in the conservation advice. Overgrazing of king blue-grass during drought events could indirectly impact populations in the region (TSSC, 2013).<br><br>*D. queenslandicum* has a limited distribution in the Northern Gulf region, found only in the southeastern portion of the region within Blackbraes National Park & Resource Reserve extending 25 kilometres to the north and east on Oak Park, Oak Valley and Lyndhurst Stations.<br><br>Drought frequency and duration is predicted to increase by 2030 under a RCP 8.5 scenario within the species distribution (Appendix 2, Map 15 and Map 16). Grazing of the national park during drought events has occurred in the past and therefore drought is considered a very high threat to the species in the region. | Likely | Significant | Very high | Blackbraes National Park and Resource Reserve, Oak Park, Oak Valley and Lyndhurst Stations. | Engage with private landholders and land managers responsible for the land on which populations occur and encourage these stakeholders to contribute to the implementation of conservation management actions. | GSNRM | Grazing extension have been consistently delivered in the region by Gulf Savannah NRM concerning drought-proofing properties, however, specific extension is not occurring currently for promoting the conservation of King blue-grass. | Remove stock from paddocks containing *D. queenslandicum.* | Landowners | Survey areas to assess the condition of King blue-grass and undertake re-seeding in key areas if necessary. | Qld Herbarium, QPWS |
| | | | | | | | Raise awareness of King blue-grass within the local community, for example, distributing fact sheets/ information/ brochures, or conducting field days in conjunction with known industry or community interest groups (TSSC, 2013). | GSNRM, QPWS, Qld Herbarium | There are no educational campaigns currently being delivered for this species in the Northern Gulf region. | | | | |
| | | | | | | | Investigate formal conservation arrangements or protected area (nature refuge status) on pastoral properties and educate landowners about the benefits of entering into a nature refuge agreement. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | The three pastoral properties are not currently gazetted as nature refuges. | Continue to monitor important populations of King blue-grass to assess the impacts of drought. | Qld Herbarium, Research Institutions | Manage grazing pressure, restocking paddocks when monitoring indicates King blue-grass has sufficiently recovered. | Landowners |
| | | | | | | | Monitoring of *D. queenslandicum* populations. | Qld herbarium, Research Institutions | There is currently no monitoring occurring of King blue-grass in the region. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Forty-mile Scrub National Park/ Undara semi-evergreen vine thicket | Drought combined with heat waves | Periods of above-average temperature in summer can affect vine thicket plants' ability to flower, set seed, and regenerate. Heatwaves and drought also increase this regional ecosystem's susceptibility to fire.<br><br>Predictions for 2020-39 indicate that under an RCP 8.5 scenario, heatwave frequency and hot days will increase by more than 20 days per year for Forty-mile Scrub and Undara National Parks. Drought frequency and duration are also predicted to increase in Undara and Forty-mile Scrub National Parks (Appendix 2, Map 17 and Map 18) | Likely | Minor | Moderate | Across both parks | Conduct yearly early season burning program to reduce risks of wildfire whilst promoting the biodiversity values and conservation of Forty Mile Scrub National Park | QPWS, Traditional Owners | Currently, Queensland Parks and Wildlife Service conducts early-season burning on both parks. | Conduct habitat monitoring to assess the condition of the vine thicket and determine any management actions required. | QPWS | Undertake post-drought habitat assessment to determine if habitat restoration is required. | QPWS, Traditional Owners |
| | | | | | | Kennedy Developmental Road, Forty-mile Scrub & Gulf Development Road, Undara National Park | Erect more signage prohibiting fires in the area. | QPWS, Traditional Owners, GSNRM, Etheridge Shire Council | Signs are currently located at Kalkani Crater and the day-use area at 40 Mile Scrub. These are the only easily accessible locations for free and independent visitation. | | | If habitat restoration is required, coordinate a habitat restoration group to restore damaged habitat. | QPWS, Etheridge Shire Council, Traditional Owners |
| | | | | | | Across both parks | Weed management, particularly focusing on weeds such as rubber vine, lantana and grader grass, which can act as wicking fuels, drawing late-season wildfire into fire-sheltered vine thickets. | QPWS, Traditional Owners | Weed management is currently undertaken in both parks to protect high-value areas. | Establish fire breaks to reduce risks of wildfire encroaching on the vine thicket during the drought. | QPWS, QRFS, Traditional Owners | Manage weeds and fire to ensure | QPWS |
| Broad leaf Tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland ecological community | Drought | *M. viridiflora* rapidly grows in seasonally wet environments, with elevated levels of seedling germination and survival, suckering and/or plant growth (Crowley et al., 2009). The ecological community relies on short periods of seasonal inundation during the wet season, as this supports an abundance of annual species in the ground layer. (AG, 2012) Drought could disrupt the recruitment and health of broad leaf tea-tree woodland communities (Crowley et al., 2009).<br><br>The frequency and duration of extreme droughts are predicted to increase under an 8.5 RCP scenario between 2020-2039 in areas where *M. viridiflora* is likely to occur (Appendix 2, Map 19 and Map 20). | Likely | Negligible | Minor | Verification of distribution is required. | Develop and disseminate best practice standards for the management of *M. viridiflora* on private and public lands. Encourage key stakeholders to contribute to the implementation of conservation management actions including weed, fire, and grazing management (e.g., fencing of stock to reduce weed incursions). | DAF, Qld Herbarium | There are currently no best practice standards for the management of *M. viridiflora* in north Queensland. | Conduct habitat condition assessments to determine any management actions required to improve the survival, suckering and/or plant growth during the drought. | Qld Herbarium, Research Institutions | Conduct post-drought surveys to assess post-drought habitat condition and recovery and identify any post-drought rehabilitation requirements. | Qld Herbarium, Research Institutions |
| | | | | | | | Undertake surveys across the range of 'likely habitat' to identify sites for management. | Qld Herbarium, Research Institutions | Specific surveys have not occurred for this ecological community in the region. | | | | |
| | | | | | | | Avoid any changes to hydrology that may result in changes to the natural hydrological regimes (TSSC, 2012) | Local Councils | It is unknown if this is a priority of landowners in ther region. | | | | |

| Natural Disaster Risk Register for Biodiversity Assets - Late-season wildfire | | | | | | | | | | | | | |
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| **Asset** | **Emergency scenario** | **Risk description / reason susceptible** | **Susceptibility** | | | **Priority locations** | **Preparedness** | | | **Response** | | | |
| | | | **Likelihood** | **Consequence** | **Rating** | | **Activities to build resilience** | **Action** | **Currently undertaken?** | **Activities during event** | **Action** | **Longer-term recovery actions** | **Action** |
| Gouldian finch (*Erythrura gouldiae*) | Late-season wildfire | Frequent intense fires can decrease the availability of both dry-season-feeding grasses (by burning ground seeds) and wet-season-feeding grasses (by lowering seed yields and plant survival). Fires, in conjunction with rainfall, lead to staggered grass seeding across the landscape, while regular extensive fires homogenize vegetation age, reducing the spatial-temporal complexity of seed availability relied upon by Gouldian finches. Additionally, frequent intense fires may diminish local hollow availability (TSSC, 2016b).<br><br>The conservation advice and recovery plan for this species lists inappropriate fire regimes as one of the main key threats. Large areas across the Gouldian finch range in the Northern Gulf grazing lands subregion have a history of frequent extensive late-season wildfires. Late-season wildfires have not occurred as frequently on the eastern part of the range on the Tablelands (Appendix 2, Map 21). | Possible | Significant | Very high | Across the species extent in the NG region. | Develop and disseminate best practice guidelines for fire management in preferred Gouldian finch habitat for pastoral properties across the distribution of the species in the Northern Gulf (TSSC, 2016b). | Firescape Science or Firesticks, GSNRM | Specific guidelines for fire management to enhance Gouldian finch habitat have not been developed. | Implement measures to protect Gouldian finch habitat from wildfire including creating fire breaks, using controlled burns, or employing other techniques to reduce the impact of the fire on | QRFS, Landowners | Remove cattle from impacted paddocks with identified high-value grasses for Gouldian finches to promote the regrowth of vegetation and remove grazing pressure from grasses/seeds that have survived/were not impacted by the fire. | Landowners |
| | | | | | | | Incorporate best practice guidelines for fire management for the conservation of gouldian finch habitat into community and property fire management plans as part of the Qld Fire and Biodiversity Program. | HLW, GSNRM, Landowners, QRFS, QPWS, Local Councils | Healthy Land and Water is currently delivering the Qld Fire and Biodiversity Program. Future collaborations are required to build conservation priorities for the Gouldian finch into fire management plans. | | | | |
| | | | | | | | Reduce the frequency, extent and intensity of fires across the distribution of the species to increase the overall extent of long-unburnt vegetation (TSSC, 2016b). | Landowners, QPWS, Local Councils, Traditional Owners | Many pastoralists aim to leave large areas of their country unburnt. | | | | |
| | | | | | | | Promote the Gouldian finch as an indicator of sustainable cattle and fire management. | GSNRM, DAF | There are currently no campaigns promoting the Gouldian finch as an indicator species. | | | | |
| | | | | | | | Conduct information sessions and fire management planning workshops that enhance awareness and capacity of private landholders and public land managers regarding the role of fire in enhancing gouldian finch habitat. | HLW, GSNRM | No targeted fire management workshop or information sessions are delivered specifically for integration of Gouldian finches into fire management planning. | | | | |
| Red goshawk (*Erythrotriorchis radiatus*) | Late-season wildfire | Extensive, hot fires late in the dry season have been known to cause nesting failures and destroy nest trees (QG, 2021). Fire management is especially important for managing the density of sapling regrowth under canopy trees and converting forest to woodland or grassland therefore reducing prey availability.<br><br>Fire management for this species is complex and varied fire history occurs throughout the species distribution in the Northern Gulf region. Threats of late-season wildfire would be largely dependent on known nesting and feeding areas. NAFI data shows that late-season wildfires occur infrequently in areas where red goshawk habitat is likely to occur (Appendix 2, Map 22). | Possible | Minor | Moderate | Within modelled species distribution. Landholder engagement informed by nest site data. | Identify and map important red goshawk habitat in the Northern Gulf region. Collate a list of known nest locations for red goshawks. | Birdlife Australia, CSIRO | Historical surveys occurred specifically for this species in north Queensland in 1999 (Czechura et al.. 2010).. | Protect any known nesting trees in the possible line of fire by creating fire breaks or back burning. | Landowners, QRFS | Assess damage to nesting sites following the wildfire. | Birdlife Australia, CSIRO |
| | | | | | | | Incorporate best practice guidelines for fire management for the conservation of red goshawk habitat into community and property fire management plans as part of the Qld Fire and Biodiversity Program. | HLW, GSNRM, Landowners, QRFS, QPWS, Local Councils | Healthy Land and Water is currently delivering the Qld Fire and Biodiversity Program. Future collaborations are required to build conservation priorities for the red goshawk into fire management plans. | | | | |
| | | | | | | | Conduct fire management planning workshops that enhance awareness and capacity of private landholders and public land managers regarding the role of fire in enhancing red goshawk habitat. | | No targeted fire management workshop or information sessions are delivered specifically for integration of red goshawks into fire management planning. | | | | |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in-perpetuity covenants, that reduce the effects of habitat fragmentation and degradation and promote the protection and maintenance of private lands with high-value habitat for the red goshawk. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | Prioritisation of properties for land management agreements requires updated survey data. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Koala (*Phascolarctos cinereus*) | Late-season wildfire | Late season wildfire can devastate koala food trees and cause direct physical harm to koalas.<br><br>Predicted forest fire susceptibility mapping indicates that the Northern Gulf region is predominantly at moderate to very high risk of wildfire that can impact koala habitat.<br><br>Predicted forest fire susceptibility mapping indicates that the Northern Tablelands subregion has a moderate to high risk of wildfire that can impact koala habitat. However, late-season wildfires have not occurred frequently across much of the koalas range in the region in the past (Appendix 2, Map 23).<br><br>Due to the niche suitability of koala food trees in the Northern Tablelands and Grazing lands, it is predicted that late-season wildfires pose a High risk to the Northern Gulf koala population (Shabani et al., 2023). | Possible | Moderate | High | Across the species extent in the NG region, and informed by further surveys and population monitoring. | Undertake population monitoring to increase knowledge of the distribution, abundance, population trends, and population health of koalas across the region to prioritise areas at a regional scale for conservation efforts. Incorporate Indigenous, community groups, and citizen science in monitoring. | Research organisations e.g., James Cook University, Traditional Owners, GSNRM | Some surveys have been undertaken by ecological consultancies. James Cook University is currently completing a genetic analysis. DCEEW is funding a $10,000,000 program for national monitoring of koalas https://www.nkmp.org.au/populations.php | Undertake continuous monitoring of the wildfire progression and its impact on koala habitat using the NAFI website and local knowledge/observations. Use information to guide decision-making. | GSNRM, DESI, QRFS | Undertake post-survey of koala habitat to determine damage and habitat restoration efforts required. | DESI, GSNRM |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in perpetuity covenants, that promote the protection and maintenance of private lands with high-value habitat for the species. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | There are several nature refuges already gazetted across the koala's range in the Northern Gulf region. | Protect valuable koala habitat from wildfire by back burning, creating fire breaks, and direct control of the fire. Prioritise the most valuable habitat with highest density of koalas for control. | QRFS, Landowners | Monitor koala populations in the affected areas to assess the impact of the wildfire on abundance and health. This can involve field surveys, camera trapping, and genetic monitoring to track population trends and identify areas where conservation efforts are needed. | DESI, GSNRM |
| | | | | | | | Improve the condition of existing Koala habitat on both private and public land through best-practice land management, including management of vegetation, fire, weeds, and introduced species. | Landholders, QRFS, QPWS, local councils, Gulf Savannah NRM | Some land managers undertake best practice land management which would promote and improve the condition of koala habitat in the region. | | | Undertake habitat restoration of high-value habitat such as replanting native vegetation that are important food resources for koalas. | Local community tree planting groups |
| | | | | | | | Raise awareness and educate landowners in best-practice land and fire management for the conservation of the koala in the Northern Gulf region. | HLW, GSNRM | There are currently no specific education campaigns for koalas in the NG region. | Coordinate the development of a post-fire monitoring and recovery team fostering collaboration and partnerships among government agencies, conservation organisations, researchers, Traditional Owners, and local community groups. | Govt Agencies, GSNRM, Wildlife rescue groups | Rescue any injured or displaced koalas and provide ongoing care and medical treatment as needed until the koalas are deemed fit for release. | Govt Agencies, Wildlife rescue groups, Local captive wildlife centres. |
| | | | | | | | Develop and implement community and property fire management plans that effectively secure and promote long-term, strategic and effective protection of known populations and suitable habitat (AG, 2022b). | HLW, GSNRM, Landowners, QRFS, QPWS, Local Councils | Fire management plans specifically for the protection of the koala and koala habitat in north Queensland do not currently occur. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Greater glider (northern) (*Petauroides minor*) | Late-season wildfire | Greater glider populations (southern and central) have been observed to suffer substantial decline as a direct result of wildfires in southern parts of its range. No known wildfire events have impacted *P. minor* populations; however, increased intensity and frequency of wildfires would likely impact populations.<br><br>Late-season fire frequency data from NAFI between 2000 and 2022 show a low fire frequency across much of the range of *P.minor* (Appendix 2, Map 24). | Possible | Significant | Very high | Across the species extent in the NG region. | Support the development of guidelines for fire management by assessing the impacts of fire management and different fire regimes (including frequency and intensity) on habitat, subpopulation size and hollow availability AG, 2022a). | Fire practitioners, GSNRM | There are currently no fire management guidelines aimed at protecting habitat for *P. minor* and little is known of the impacts of fire to the species in northern Queensland. | Undertake continuous monitoring of the wildfire progression and its impact on greater glider habitat using the NAFI website and local knowledge/observations. Use information to guide decision-making. | QPWS | Investigate the suitability of installation of fire retardant nestboxes to provide future refuge from fire. | Research Institutions, other research organisations |
| | | | | | | | Integrate guidelines for fire management to enhance and protect greater glider habitat into community and property fire management plans. | HLW, GSNRM, Landowners, QRFS, QPWS, Local Councils | This activity is currently not undertaken. | | | | |
| | | | | | | | Raise awareness and educate landowners in best-practice land and fire management for the conservation of the greater glider in the Northern Gulf region. | HLW, GSNRM | This activity is currently not undertaken. | Coordinate the development of a post-fire monitoring and recovery team fostering collaboration and partnerships among government agencies, conservation organisations, researchers, Traditional Owners, and local community groups. | Govt Agencies, QPWS, Research Institutions, GSNRM | Undertake post-fire assessment of habitat affected by the wildfire and determine if habitat restoration is required (prioritise work in Juntala - Blackbraes if damaged by fire). Undertake habitat restoration if required. | Post-fire monitoring and recovery team. |
| | | | | | | Blackbraes National Park and surrounding properties, Werrington, Glenmore, Oak Park, Oak Valley, Gorge Creek Stations (verification of the distribution across these properties required). | Encourage landowners to avoid the use of barbed wire, and replace top strand of existing barbed wire with single-strand wire in habitat known to be occupied by greater gliders. | GSNRM | Barbed wire replacement and tubing to cover barbed wire have been implemented in some key locations in Blackbraes National Park and Werrington Station (Werrington Nature Refuge). | Protect valuable greater glider habitat from wildfire by back burning, creating fire breaks, and direct control of the fire. Prioritise the most valuable habitat with the highest density of greater gliders for control. | Landowners, QPWS, QRFS, Traditional Owners | Undertake post-fire surveys of the greater glider population in fire affected habitat to determine the impact of the fire on population abundance and health. | QPWS, GSNRM |
| Northern quoll (*Dasyurus hallucatus*) | Late-season wildfire | Late-season wildfires can cause direct mortality of individuals. Indirect changes in habitat structure and floristics, and reduction in prey availability post-fire can facilitate post-fire population declines through increased predation risk and reduced reproductive output (Hill & Ward, 2010).<br><br>Some of the Northern quoll's range is impacted by frequent late-season fires (Appendix 2, Map 25). Although fires are identified in these areas, the fire would be required to occur during critical breeding times to have a large impact on a quoll population. Several scientific studies have documented population declines following a fire due to lowered recruitment. | Possible | Significant | Very high | Across the species extent in the NG region. | Integrate fire management practices aimed at conserving northern quoll habitat into community and property fire management planning to ensure a coordinated approach to planning and implementing early season fire management. Integrate traditional burning practices aimed to reduce fuel loads whilst keeping unburnt patches in identified high-value *D. hallucatus* habitat (e.g., woodlands adjoining rocky escarpments) (Andersen et al., 2005; Einoder et al., 2023; Thomas et al., 2021). | Landholders with support from QRFS, Traditional Owners, QPWS, HLW | In some locations, this is already underway. Greater adoption of best practice fire management is required across the region. | Protect valuable northern quoll habitat from wildfire by back burning, creating fire breaks, and direct control of the fire. | Landholders with support from QRFS, Traditional Owners, QPWS | Undertake post-fire population monitoring of Northern quoll populations in affected areas. | Research Institutions, Conservation organisation (AWC, Bush Heritage) |
| | | | | | | | Extension activities to build property manager awareness, skills and adoption of fire management aimed to reduce fuel loads and maintain long unburnt patches. | GSNRM, QRFS, Fire Sticks, FireScape, HLW | Gulf Savannah NRM currently undertakes fire workshops and capacity building in partnership with Firesticks. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Northern quoll (*Dasyurus hallucatus*) | Late-season wildfire | Cont. | Possible | Significant | Very high | Across the species extent in the NG region. | Increased participation of regional stakeholders (particularly property managers) in regional fire management meetings. Provision of community and property fire management plans to the Rural Fire Service. | QRFS | Landholders attend regional fire management meetings, however, increased participation would improve coordinated burning regimes. | | | Implement long-term monitoring and research programs to assess the resilience of Northern quolls to wildfires and understand their ecological requirements post-fire. | Research Institutions, Conservation organisation (AWC, Bush Heritage) |
| | | | | | | Prioritise control activities in open, topographically simple landscapes where quolls are more reliant on vegetation and woody debris (rather than rocks) for cover which will be reduced post-fire. | Management of feral predators. | Landholders, QPWS | There are currently no coordinated feral animal control activities occurring specifically for the protection of the northern quoll. Some sporadic feral animal control occurs. | | | Undertake post-fire feral animal management (Cats and wild dogs) (Cremona et al., 2017). | Landholders, QPWS |
| Mount surprise slider (*Lerista storri*) and Limbless fine-lined slider (*Lerista ameles*) | Late-season wildfire | Both these species are found in loose soil under logs and other debris, and it is assumed that both species feed on arthropods. Late-season wildfires can impact habitat quality for these species, exposing soil and burning habitat features that provide shelter (Amey et al., 2019; TSSC, 2013).<br><br>Late-season wildfires have occurred infrequently within both species distribution over the past 22 years according to NAFI data (Appendix 2, Map 26). | Possible | Significant | Very high | Whitewater, Springfield Stations and Undara National Park | Develop property fire management plans for Whitewater and Springfield Stations that include fire management strategies to protect habitat critical for both species. | HLW, Landowners, | There are currently no specific fire management plans for these species on either of the properties. | Protect known habitat from wildfire by back burning, creating fire breaks, and direct control of the fire. | Landowners, QRFS | Undertake a post-fire population survey to determine the impact of fire on both species. | DESI, GSNRM, Research Institutions |
| | | | | | | | Implement early-season burning to protect habitat critical for both species from late-season fires. | Landowners, QRFS | Fire management specifically for the protection of these species does not currently occur on either property. Planned burns occur in Undara National Park as part of regular park management. | | | | |
| Magnificent brood frog (*Pseudophryne covacevichae*) | Late-season wildfire | Late season wildfire can increase the sediment load into streams which reduces the quality of habitat (C. Starr Pers comm).<br><br>Late-season wildfires have occurred repetitively within the species distribution over the past 22 years according to NAFI data (Appendix 2, Map 27). | Likely | Minor | Moderate | Baldy Mountain Forest Reserve | Undertake prescribed burning to mitigate high fuel loads in areas of critical habitat. | QRFS, QPWS | Early-season burning is undertaken in some locations to protect key habitat for this species. | Coordinate efforts to contain and manage the wildfire, including establishing fire breaks, directly managing the fire, and conducting controlled burns to mitigate the spread of the fire into Magnificent brood frog habitat. | QRFS, MBFWG | Undertake post-fire surveys to assess the population status and any recovery actions required. Undertake follow-up monitoring if required. | DESI, MBFWG, Research Institutions |
| | | | | | | | Integrate fire management practices aimed at conserving magnificent brood frog habitat into the Baldy Mountain Forest Reserve Fire Management Plan. | HLW, QPWS, QRFS | It is unknown if fire management practices specifically for this species is integrated into the plan. | Coordinate a recovery and post-monitoring habitat assessment and monitoring team. | MBFWG | Undertake post-fire habitat assessment (including water quality assessment) to determine the damage to the Magnificent brood frog habitat and develop plans for habitat restoration and recovery. | DESI, MBFWG, Research Institutions |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Forty-mile Scrub National Park/ Undara semi-evergreen vine thicket | Late-season wildfire | Late-season wildfires can decimate semi-evergreen vine thickets. Obligate semi-evergreen vine thicket plant species (approximately 50% of all plant species in the vegetation) are fire-sensitive. Canopy species are particularly sensitive to fire, especially in the margins of the thickets. Some species are fire-tolerant are regenerate quickly after fire (TSSC, 2016a).<br><br>Both Forty Mile Scrub and Undara National Park have been prone to unplanned late-season wildfires. In 2019 a late-season wildfire caused extensive damage to the semi-evergreen vine thicket at Forty Mile Scrub. It is assumed that fires on both National Parks were unauthorised fires lit along the Kennedy Developmental Road and Gulf Developmental Road (QPWS, 2023a, 2023b) (Appendix 2, Map 28). | Likely | Severe | Severe | Across both parks | Conduct yearly early season burning program to reduce risks of wildfire whilst promoting the biodiversity values and conservation of Forty Mile Scrub National Park | QPWS, Traditional Owners | Currently, Queensland Parks and Wildlife Service conducts early-season burning on both parks. | Protect the vine thicket by back burning, creating fire breaks, and direct control of the fire. | QPWS, QRFS, Etheridge Shire Council, Traditional Owners | Undertake post-fire assessment of habitat affected by the wildfire and determine if habitat restoration is required. | QPWS, Traditional Owners |
| | | | | | | Kennedy Developmental Road, Forty-mile Scrub & Gulf Development Road, Undara National Park | Erect more signage prohibiting fires in the area. | QPWS, Traditional Owners, GSNRM, Etheridge Shire Council | Signs are currently located at Kalkani Crater and the day-use area at 40 Mile Scrub. These are the only easily accessible locations for free and independent visitation. | | | If habitat restoration is required, coordinate a habitat restoration group to revegetate areas of the parks impacted by the fire. | QPWS, Etheridge Shire Council |
| | | | | | | Across both parks | Weed management, particularly focusing on weeds such as rubber vine, lantana and grader grass, which can act as wicking fuels, drawing late-season wildfire into fire-sheltered vine thickets. | QPWS, Traditional Owners | Weed management is currently undertaken in both parks by QPWS. | | | Manage weeds and feral animals in burnt areas to promote regeneration of the vine thicket. | QPWS |
| Broad leaf Tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland ecological community | Late-season wildfire | Frequent and extensive late-season wildfires can impact the integrity of the ecological community. Fires can impact the recruitment of canopy species by affecting flower and seed production, reducing habitat diversity, and burning some taller tea-trees to ground level (TSSC, n.d.; Crowley et al., 2009).<br><br>Late-season fires have historically in some areas of land where *M. viridiflora* woodlands are likely to occur, primarily to the east of Sheoak Ridge and the North of Kuranda National Park (Appendix 2, Map 29). | Possible | Minor | Moderate | Verification of distribution is required. | Conduct strategic management of weeds focusing primarily on pasture grasses that can increase the vulnerability of this ecological community to fire. | Landowners, QPWS | Strategic management of weeds to protect M. viridiflora communities is currently not occurring. A coordinated approach is required following surveys to confirm the current distribution. | Undertake continuous monitoring of the wildfire progression and its impact on Broad leaf tea-tree habitat using the NAFI website and local knowledge/observations. Use information to guide decision-making. | QPWS, QRFS, Shire Councils, Traditional Owners | Undertake a post-fire assessment of habitat affected by the wildfire to evaluate the impact on vegetation composition and health. | Research Institutions, Qld Herbarium |
| | | | | | | | Develop and disseminate best practice standards for the management of *M. viridiflora* on private and public lands. Encourage key stakeholders to contribute to the implementation of conservation management actions including weed, fire, and grazing management (e.g., fencing of stock to reduce weed incursions). | DAF, Qld Herbarium | There are currently no best practice standards for the management of *M. viridiflora* in north Queensland. | | | If habitat restoration is required, coordinate a habitat restoration group to revegetate areas of the parks impacted by the fire. | Shire Councils, Tree planting Groups, GSNRM |
| | | | | | | | Undertake surveys across the range of 'likely habitat' to identify sites for management. | Qld Herbarium, Research Institutions | The distribution of the species within the Northern Gulf is not currently confirmed / ground truthed. | | | Remove cattle from burnt paddocks that contain Broad leaf tea-tree woodlands to promote regeneration of the woodlands and reduce the impacts of grazing and trampling on regrowth. | Landowners |
| | | | | | | | Raise public awareness about Broad lead tea-tree woodlands in high rainfall coastal north Queensland ecological community and fire management practices to protect the ecological community. | GSNRM, HLW | No education campaigns are currently occurring for this ecological community in the Northern Gulf region. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Broad leaf Tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland ecological community | Late-season wildfire | Cont. | Possible | Minor | Moderate | Verification of distribution is required. | Where appropriate, provide maps of known occurrences to local and state Rural Fire Services to seek inclusion of mitigative measures in bush fire risk management plan (s) risk register and/or operation maps. | Qld Herbarium, Research Institutions, GSNRM | No specific best practice standards for the management of *M. viridiflora* in the Northern Gulf region have been developed. | Coordinate efforts to contain and manage the wildfire, including establishing fire breaks, directly managing the fire, and conducting controlled burns to mitigate the spread of the fire into Broad leaf tea-tree habitat. | QPWS, QRFS, Shire Councils, Traditional Owners | Manage feral animals and weeds in burnt habitat to protect regeneration and sensitive habitats within the woodlands from further degradation. | Landowners, QPWS, Shire Councils |
| | | | | | | | Incorporate best practice guidelines for fire management for the conservation of *M. virififlora* woodlands into community and property fire management plans as part of the Qld Fire and Biodiversity Program. | HLW, GSNRM, QRFS, Landowners | This activity is currently not undertaken. | | | | |
| | | | | | | | Develop and implement best practice guidelines for fire management for the ecological community, which includes information for landowners on how to implement fire management actions. | Firescape Science or Firesticks, GSNRM, HLW | No specific fire management guidelines exist for this ecological community in the Northern Gulf region. | | | | |

| Natural Disaster Risk Register for Biodiversity Assets - Flood | | | | | | | | | | | | | |
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| | | | Susceptibility | | | | Preparedness | | | Response | | | |
| Asset | Emergency scenario | Risk description / reason susceptible | Likelihood | Consequence | Rating | Priority locations | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Green turtle (*Chelonia mydas*) | Flooding | Flooding can cause large movements of sediment downriver catchments blanketing seagrass feeding grounds, causing considerable loss of seagrass habitat due to light limitation. This will result in reduced food availability for green turtles and can in turn result in decreased turtle health, starvation, increased stranding and decreased. This can impact turtle health for several years following a flooding event (AG, 2017).<br><br>Gulf of Carpentaria green turtles are a distinct regional breeding population in Australia. The Gulf of Carpentaria rivers regularly flood and future extreme flooding events are predicted to increase which can exacerbate the mobilisation of sediment into the marine environment. Traditional Owners have observed turtles losing condition following flooding events in the Gulf region. Green turtles are highly mobile and have a varied diet, however, some susceptibility to loss of food resources is likely to occur. | Likely | Minor | Moderate | Seagrass communities around Karumba and extending north to the Staaten River | Undertake surveys of seagrass and reduction of identified threats to seagrass communities. | Research Institutions, CLCAC | CLCAC is currently partnering with Research Institutions to undertake seagrass surveys along the Gulf coasts. Extensive seagrass surveys have also been undertaken at the Port of Karumba. | Use satellite imagery and/or aerial photography to document flood plumes during the flood event. | Research Institutions, CLCAC | Undertake targeted post-flood seagrass surveys to assess the impact of the flood event on seagrass communities. | CLCAC, Research Institutions |
| | | | | | | | | | | | | Undertake monitoring of turtle health post-flood. Communicate with Traditional Owners on the mainland and Wellesley Islands to report any sick or emaciated turtles. | CLCAC, Research Institutions |
| Armoured mist frog (*Litoria lorica*) | Flooding | Increased rainfall can alter the hydrology and breeding frequency of stream-dwelling frogs, and make them vulnerable to being dislodged in high flows (TSSC, 2017a). Cyclones not only bring powerful destructive winds, but additionally can lead to heavy rainfall events which can negatively impact frog habitat.<br><br>Heavy rainfall events associated with cyclones could have large impacts on stream/river systems where *L. lorica* are known to persist, including causing erosion and sedimentation in the system, changing flows, damaging riparian vegetation, and negatively impacting water quality. Additionally, flash flooding associated with heavy rainfall events may dislodge adult frogs and tadpoles, causing mortality or sweeping them downstream.<br><br>SPI Wetness indices show a reduction in duration frequency and percent time in wetness (Appendix 2, pages Map 30). | Likely | Severe | Severe | Mt Lewis National Park | Implement a program ensuring suitable habitat is maintained in areas currently supporting populations of the armoured mist frog and investigate options for enhancing the resilience of the species' current habitat to climate change (TSSC, 2019). | QPWS, Research Institutions, GSNRM, Terrain NRM | The armoured mist frog is currently protected in Mt Lewis National Park. | No actions required. | N/A | Conduct post-flood habitat condition assessments to determine damage and habitat restoration activities required. | QPWS, Research Institutions, GSNRM, Terrain NRM |
| | | | | | | Mt Lewis National Park | Improve the management of stream flows, water quality and riparian environments throughout catchments, particularly upstream of existing and potential sites by monitoring erosion and clearing events and implementing rehabilitation of riparian vegetation. | | Unknown information regarding this activity. | | | | |
| | | | | | | Suitable habitat and potential habitat | Undertake targeted surveys in suitable habitats and potential habitats to locate any additional populations. | | Researchers have continued to survey historical sites and employ eDNA analyses to try and locate additional populations. | | | Continue to survey historical sites and unsurveyed areas for surviving populations of *L. lorica*. | |
| | | | | | | Mt Lewis National Park | Feral pig management to reduce habitat destruction by feral pigs (fencing and control) | QPWS | QPWS control feral pigs in National Parks, but this has not been undertaken specifically to benefit armoured mist frog habitat | | | Implement coordinated integrated pig management to reduce the impacts of feral pigs on waterways. | QPWS, Research Institutions, GSNRM, Terrain NRM |
| | | | | | | | Collect data to improve the understanding of how climate change will impact the species. This information can then be used to better prioritise disaster resilience and response. | Research Institutions, DESI | Unknown information regarding this activity. | | | Undertake post-flooding population monitoring to determine the pact of the flooding event on the *L. lorica* population | |
| | | | | | | Suitable habitat | Investigate the establishment of additional self-sustaining populations to safeguard both species from extinction. | | Armoured mist frogs were rediscovered at a single site, and JCU researchers and QPWS have translocated individuals to two additional locations to increase resilience. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Broad leaf Tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland ecological community | Flooding | *M. viridiflora* communities are particularly susceptible to changes in hydrological regimes, an increase in inundation due to flooding events can lead to a shift towards wetlands dominated by grasses, sedges and herbs (TSSC, 2012).<br><br>This ecological community is associated with drainage lines/watercourses and relies on seasonal inundation. Predictions for extreme participation events show a predicted decline in extended precipitation events and a decline in the duration of wetness between 2020 and 2039 under an RCP 8.5 scenario (Appendix 2, Map 31 and Map 32). | Likely | Moderate | High | Verification of distribution is required. | Develop and disseminate best practice standards for the management of *M. viridiflora* on private and public lands. Encourage key stakeholders to contribute to the implementation of conservation management actions including weed, fire, and grazing management (e.g., fencing of stock to reduce weed incursions). | DAF, Qld Herbarium | No specific best practice standards for the management of *M. viridiflora* in the Northern Gulf region have been developed. | Monitor the ecological community to determine the extent and impact of flooding. | Qld Herbarium, CSIRO, Research Institutions | Monitor the progress of recovery, through undertaking condition assessments. | Qld Herbarium, CSIRO, Research Institutions |
| | | | | | | | Undertake surveys across the range of 'likely habitat' to identify sites for management. | Qld Herbarium, Research Institutions | The distribution of the species within the Northern Gulf is not currently confirmed / ground truthed. | Remove cattle from flooded paddocks that contain Broad leaf tea-tree woodlands to promote regeneration of the woodlands and reduce the impacts of grazing and trampling on regrowth. | Landowners | Exclude cattle from flooded paddocks until habitat condition is restored. | Landowners |
| | | | | | | | Avoid any changes to hydrology that may result in changes to the natural hydrological regimes (TSSC, 2012) | Local Councils | Changes to hydrology are required to be assessed by local council. | | | Manage feral animals and weeds in flooded habitat to protect regeneration and sensitive habitats within the woodlands from further degradation. | Landowners, QPWS, Shire Councils |

## Natural Disaster Risk Register for Biodiversity Assets - Cyclone

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Golden-shouldered parrot (*Psephotus chrysopterygius*) | Cyclone | Reduction in food resources in response to high rainfall events associated with cyclones as rainfall buries and germinates seed (OAC, 2022). Cyclone predictions indicate maximum wind speeds of 90-120 km/hr within golden-shouldered parrot habitat (Appendix 2, Map 33).<br><br>The species has specific feeding grounds that are not currently well known in the Staaten River region due to the inaccessibility during the wet season to assess feeding grounds. It is presumed that feeding areas remain in good condition for this population. | Unlikely | Moderate | Moderate | Staaten River National Park | Establishment of automated weather station on Staaten River National Park and monitoring of temperature, rainfall and flood patterns. | QPWS, Traditional Owners | A remote weather station is not currently monitored to respond to conservation actions for the Golden-shouldered parrot in Staaten River National Park. | Coordinate a post-cyclone field team to undertake a rapid assessment of food resources following the cyclone. | QPWS, GSPRT GSNRM | Undertake a rapid survey of food resources. If food shortage is identified in accessible areas, implement a supplementary feeding regime. | QPWS, GSPRT GSNRM |
| Red goshawk (*Erythrotriorchis radiatus*) | Cyclone | Cyclones can damage nesting trees. Cyclone predictions indicate maximum wind speeds of 90-120 km/hr within red goshawk habitat, which could impact the availability of nesting trees (Appendix 2, Map 34). Nesting occurs from May to October in North Queensland, so it is unlikely to directly impact nesting birds. | Unlikely | Negligible | Minor | Dependent on nest mapping. | Identify and map important red goshawk habitat in the Northern Gulf region. Collate a list of known nest locations for red goshawks. | Birdlife Australia, CSIRO | Historical surveys occurred specifically for this species in north Queensland in 1999 (Czechura et al.. 2010). | No actions required. | N/A | Undertake post-cyclone survey of nesting habitat to determine any damage to nesting trees. | Birdlife Australia, CSIRO |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in-perpetuity covenants, that reduce the effects of habitat fragmentation and degradation and promote the protection and maintenance of private lands with high-value habitat for the red goshawk. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | Prioritisation of properties for land management agreements requires updated survey data. | | | | |
| Northern quoll (*Dasyurus hallucatus*) | Cyclone | Cyclones can cause a reduction in the availability of nest sites (hollows) in lower-elevation habitats and cause vegetation damage impacting foraging habitat and food resources (Thomas, 2020).<br><br>Den sites are impacted resulting in quolls being susceptible to exposure and predation. Cyclones can also impact recruitment into the population if a cyclone occurs during the young-in-den phase of the breeding period (November to December) (Thomas, 2020). Cyclone predictions indicate maximum wind speeds of 100-120 km/hr within quoll habitat, which could impact lower elevation habitat (Appendix 2, Map 35). On a population scale a susceptibility rating of moderate was given as quolls are relatively protected in higher-elevation rocky areas. | Possible | Minor | Moderate | Lower elevation areas where quoll populations would be susceptible to impacts from cyclones | Management of feral predators. | Landowners | Feral predators are not routinely managed across the Northern quoll's range. | Coordinate the development of a post-cyclone Northern quoll response team. | GSNRM | Undertake a post-cyclone assessment of habitat condition of areas impacted by the cyclone to determine if any management actions are required. | AWC, QPWS, GSNRM |
| | | | | | | | A coordinated approach to planning and implementing early season fire management (incorporating traditional burning practices) aimed to reduce fuel loads whilst keeping unburnt patches in identified high-value *D. hallucatus* habitat (e.g., woodlands adjoining rocky escarpments) (Andersen et al., 2005; Einoder et al., 2023; Thomas et al., 2021). | Landholders with support from QRFS, Traditional Owners, QPWS | In some locations, this is already underway. Greater adoption of best practice fire management is required across the region. | | | Undertake feral animal management to reduce the impacts of predation on displaced quolls. | Landowners, AWC, QPWS |
| | | | | | | | | | | | | Provide artificial hollows if habitat assessments indicate denning resources have been significantly impacted. | AWC, GSNRM |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Koala (*Phascolarctos cinereus*) | Cyclone | Cyclones can reduce habitat availability for koalas by causing defoliation and destruction of critical food trees. Strong winds and debris can also cause physical harm to koalas (AG, 2022b).<br><br>Koalas are only found in the eastern parts of the region. Tropical cyclone hazard assessments predict gusts of between 90-120 km/hr in habitat within the koala's estimated spatial distribution (Appendix 2, Map 36). | Possible | Minor | Moderate | Across the region | Undertake population monitoring to increase knowledge of the distribution, abundance, population trends, and population health of koalas across the region to prioritise areas at a regional scale for prioritisation of conservation efforts. Incorporate Indigenous, community groups, and citizen science in monitoring. | Research Institutions, Govt Agencies, GSNRM | Some surveys have been undertaken by ecological consultancies. James Cook University is currently completing a genetic analysis. DCEEW is funding a $10,000,000 program for national monitoring of koalas https://www.nkmp.org.au/populations.php | Monitor the path of the cyclone and determine if the cyclone passes over important koala habitat. | Govt Agencies | Undertake a post-cyclone assessment of the habitat impacted by the cyclone to determine the restoration efforts required. | DESI |
| | | | | | | | Develop prioritisation at a regional scale for the long-term implementation of actions. These include threat risk assessment, prioritisation of habitat attributes for the protection and recovery of the Koala, local actions and land management planning (AG, 2022b). | Govt Agencies, Research Institutions | Prioritisation of conservation actions has not been undertaken for the koala in north Queensland. | | | Undertake a post-cyclone survey of koalas to determine the impact of the cyclone on koala abundance and distribution. | DESI |
| Spectacled flying fox (*Pteropus conspicillatus*) | Cyclone | Cyclones can cause widespread damage to tree canopies resulting in the long-term loss of flower and fruit resources (TSSC, 2017c).<br><br>Tropical cyclone hazard assessments predict gusts of between 90-120 km/hr in habitat within the Spectacled flying fox estimated spatial distribution (Appendix 2, Map 37). | Possible | Moderate | High | Targeting camps in the Northern Tablelands region | Undertake telemetry studies to determine key foraging habitat in the Northern Tablelands region across an annual cycle. | CSIRO, Research Institutions | Insufficient information is known about this action. | Monitor the path of the cyclone and determine if the cyclone passes over important foraging grounds (if known) for the Spectacled flying fox. | Govt Agencies | Undertake a post-cyclone assessment of damage to foraging grounds. | Research Institutions, DESI |
| | | | | | | Across the species range in the Northern Gulf region | Identify opportunities to protect important foraging resources in native vegetation communities that are poorly represented within current reserves. | CSIRO, Research Institutions | Insufficient information is known about this action. | | | Assess the health of Spectacled flying fox camps to determine if supplementary feeding is required. If identified as a requirement, provide supplementary feeding. | Research Institutions, Tolga Bat Hospital, SFFRT |
| | | | | | | Informed by telemetry studies | Investigate formal conservation arrangements or protected area (nature refuge status) on properties containing important foraging resources and educate landowners about the benefits of entering into a nature refuge agreement | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | A number of nature refuges are gazetted within the spectacled flying fox distribution. | | | Undertake habitat restoration activities, such as revegetation, of important foraging grounds if required | Rainforest regeneration and recovery groups, local councils. |
| Armoured mist frog (*Litoria lorica*) | Cyclone | Please see the flood table as heavy rainfall as a result of a cyclone may impact this species habitat through flooding. | | | | | | | | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Mountain top nursery frog (*Cophixalus monticola*) | Cyclone | The mountain top nursery frog conservation advice lists cyclones as a key threatening process as they impact the species' habitat (TSSC, 2019).<br><br>The predicted maximum wind speeds of 100-120 km/hr for Mt Lewis contribute to the moderate susceptibility of these species' to cyclone scenarios (Appendix 2, Map 38). Any negative impacts of cyclone on the *L. apetiolatus* palms that *C. monticola* use for breeding may impact breeding success. | Likely | Minor | Moderate | Mt Lewis National Park | Implement a program ensuring suitable habitat is maintained in areas currently supporting populations of the Mountain Top Nursery Frog and investigate options for enhancing the resilience of the species' current habitat to climate change (TSSC, 2019). | QPWS, Research Institutions, GSNRM, Terrain NRM | There are currently no actions being undertaken aimed at increasing drought resilience of mountain top nursery frog habitat. | No actions required. | N/A | Conduct post-cyclone habitat condition assessments to determine damage and habitat restoration activities required. | QPWS, Research Institutions, GSNRM, Terrain NRM |
| | | | | | | Mt Lewis National Park | Improve the management of stream flows, water quality and riparian environments throughout catchments, particularly upstream of existing and potential sites by monitoring erosion and clearing events and implementing rehabilitation of riparian vegetation. | | There are currently no actions being undertaken aimed at increasing drought resilience of mountain top nursery frog habitat. | | | | |
| | | | | | | Suitable habitat and potential habitat | Undertake targeted surveys in suitable habitats and potential habitats to locate any additional populations. | | Researchers are planning surveys for possible new populations of mountain top nursery frogs to the north of Mt Lewis. | | | | |
| | | | | | | Mt Lewis National Park | Feral pig management to reduce habitat destruction by feral pigs (fencing and control) | QPWS | Funding has been secured for Terrain NRM, GSNRM and JCU to trial exclusion fencing and pig control. | | | Undertake post-flooding population monitoring to determine the impact of the cyclone event on the *C. monticola* population. | QPWS, Research Institutions, GSNRM, Terrain NRM |
| | | | | | | | Collect data to improve the understanding of how climate change will impact the species. This information can then be used to better prioritise disaster resilience and response. | Research Institutions, DESI | Researchers are comparing current elevational limits for the species with historical survey data to idenify how climate change may impact the species. | | | | |
| | | | | | | Suitable habitat | Investigate the establishment of additional self-sustaining populations to safeguard the species from extinction. | | | | | | |

## Natural Disaster Risk Register for Biodiversity Assets - Disease

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Green turtle (*Chelonia mydas*) | Disease | The recovery plan for marine turtles in Australia outlines diseases and pathogens as a risk to the health of turtles. Several diseases and infections have been found in marine turtles, considered to be caused by poor water quality including spirochiid parasites and bacterial infections. Fibropapillomatosis, a common disease presents as internal and external tumours (AG, 2017).<br><br>The current risk of disease and pathogens to the Gulf of Carpentaria green turtle populations is unknown (AG, 2017). | Unlikely | Minor | Moderate | Gulf of Carpentaria | Describe disease and pathogen prevalence and assess the implications for stock viability. Where necessary, identify causal factors and appropriate management responses (AG, 2017). | CLCAC, Research Institutions, DESI, CSIRO | The health status of Gulf of Carpentaria green turtles is currently being investigated by the Wellesley Islands Rangers. | Collect and report disease prevalence data. | CLCAC, DESI, Veterinarians | Undertake monitoring and health checks post-outbreak. | CLCAC, Research Institutions, DESI, CSIRO |
| | | | | | | | Undertake baseline water quality monitoring | CLCAC | Baseline water quality monitoring has been undertaken by the Normanton Rangers | Undertake repeat water quality monitoring. | CLCAC | | |
| Olive ridley (*Pacific ridley*) | Disease | The recovery plan for marine turtles in Australia outlines diseases and pathogens as a risk to the health of turtles. Several diseases and infections have been found in marine turtles, considered to be caused by poor water quality including spirochiid parasites and bacterial infections. Fibropapillomatosis, a common disease presents as internal and external tumours (AG, 2017).<br><br>The current risk of disease and pathogens to Olive ridley turtles is unknown (AG, 2017). | Unlikely | Minor | Moderate | Gulf of Carpentaria | Describe disease and pathogen prevalence and assess the implications for stock viability. Where necessary, identify causal factors and appropriate management responses (AG, 2017). | CLCAC, Research Institutions, DESI, CSIRO | The health status of Olive ridley turtles in the Gulf is currently unknown. | Collect and report disease prevalence data. | CLCAC, DESI, Veterinarians | Undertake monitoring and health checks post-outbreak. | CLCAC, Research Institutions, DESI, CSIRO |
| | | | | | | | Describe disease and pathogen prevalence and assess the implications for stock viability. Where necessary, identify causal factors and appropriate management responses (AG, 2017). | | The health status of Olive ridley turtles in the Gulf is currently unknown. | Undertake repeat water quality monitoring. | CLCAC | | |
| Golden-shouldered parrot (*Psephotus chrysopterygius*) | Disease | Psittacine Circoviral (beak and feather) Disease (PCD) is a disease that affects parrots and is often fatal to birds that contract it, and most species do not respond to treatment. The virus remains in the environment for many years and can result in long-term contamination of nesting sites (AG, 2005).<br><br>PCD has been recorded in Golden-shouldered parrots and the species is considered vulnerable to catastrophic epidemics of the disease (AG, 2021). | Possible | Severe | Very high | Staaten River National Park | Implement appropriate protocols needed to prevent disease occurrence. e.g., if research is being conducted on the Staaten River National Park population, implement hygiene protocols. | QPWS | Currently research is not being undertaken in Staaten River National Park. | Conduct thorough disease surveillance to assess the extent of the outbreak. Undertake field surveys, population monitoring and diagnostic testing to confirm cases of beak and feather disease in the Staaten River population of Golden-shouldered parrots. Report the occurrence of disease to the GSPRT. | QPWS, DESI, CSIRO, Veterinarians | Undertake monitoring and health checks post-outbreak to determine if the disease risk has lessened and to monitor the recovery of the population. | QPWS, DESI |
| | | | | | | | Assess the prevalence of beak and feather disease, and other diseases and genetic abnormalities that could affect survival and reproductive success. | QPWS, DESI, Research Institutions | This is currently not occurring for the Staaten River National Park population. | Implement appropriate protocols to avert disease spread | QPWS | Implement appropriate protocols needed to prevent disease reoccurrence. e.g., if research is being conducted on the Staaten River National Park population, implement hygiene protocols. | QPWS |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Spectacled flying fox (Pteropus conspicillatus) | Parasites | The spectacled flying fox has little resistance to the toxin of the paralysis tick. Animals can become paralysed and fall to the ground and may die from the effects of the venom. There appears to be a correlation between high rainfall events and tick numbers and there is an association between tick paralysis and the flying foxes feeding on wild tobacco (*Solanum mauritanium*). | Very likely | Significant | Severe | Atherton Tableland roosts | Manage Tobacco weed around roost sites. | Landowners, QPWS, Local councils | Tobacco weed is listed as a priority weed in the Tablelands Regional Council biosecurity as an environmental weed. | Undertake ground searches to rescue and rehabilitate spectacled flying foxes during tick season (October to December). | Tolga Bat Hospital, Volunteers | Strategically manage Tobacco weed around roost sites to reduce the incidence of tick incursion. | Local Council, Traditional Owners. |
| Mountain top nursery frog (*Cophixalus monticola*) | Disease | The mountain top nursery frog conservation advice lists Chytridiomycosis as a potential threat as it can cause mass population declines in frog populations (TSSC, 2019). The susceptibility of *C. monticola* is considered to be low due to the prevalence of Chytridiomycosis is extremely low in Australian mycrohylids, however monitoring for infection by novel, more severe strains are paramount.<br><br>*C. monticola* may be susceptible to infection by Ranavirus | Likely | Negligible | Minor | Mt Lewis National Park | Population monitoring with incorporated health checks. Implement suitable hygiene protocols as described in the Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis, and undertake surveillance for new and emerging strains of chytrid and Ranavirus that may pose a threat to the species. | QPWS, Research Institutions, GSNRM, Terrain NRM | Heath checks are undertaken during population monitoring. | Closely monitor the population to understand the threat the disease poses to the population, implementing suitable hygiene protocols to prevent further spread. | QPWS, Research Institutions, GSNRM, Terrain NRM | Continue to monitor the population and respond to disease outbreaks as required. | QPWS, Research Institutions, GSNRM, Terrain NRM |
| Armoured mist frog (*Litoria lorica*) | Disease | Chytridiomycosis is a key threat listed in the armoured mist frog conservation advice, as it has caused mass population declines in frog populations worldwide, and there is strong circumstantial evidence that it may have contributed the decline of upland forest stream-dwelling frogs in the Wet Tropics including L. lorica, which disappeared from all of its known sites during chytridiomycosis outbreaks in the 1980s and early 1990s (Laurance et al, 1996; Puschendorf et al., 2011; (TSSC, 2017a, 2019).<br><br>Following rapid declines between 1988 and 1994, the armoured mist frog was thought to be extinct until its rediscovery at a single low-elevation dry forest site in 2008 (Puschendorf et al., 2011). Adult frogs and tadpoles were both found to have high levels of infection by chytrid fungus, but no visible signs of disease, and it was hypothesised that the species can persist at the dry forest site due to the lower canopy cover, lower annual rainfall, and more defined dry season than in the rainforest, allowing the rocks in the river to warm up and slow the growth and reproduction of the fungal pathogen (Puschendorf et al., 2011). If this is the case, any climatic or environmental change that reduces the ability of the frogs to warm themselves on the rocks may reduce their ability to survive with chytrid infection. | Very likely | Severe | Severe | Mt Lewis National Park | Population monitoring with incorporated health checks. Implement suitable hygiene protocols as described in the Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis, and undertake surveillance for new and emerging strains of Chyrtid and Ranavirus that may pose a threat to the species. | QPWS, Research Institutions, GSNRM, Terrain NRM | The currently known populations of *L. lorica* are studied in a monitoring program. | Closely monitor population to understand the threat the disease poses to the population, implementing suitable hygeine protocols to prevent further spread. | QPWS, Research Institutions, GSNRM, Terrain NRM | Continue to monitor the population and respond to disease outbreak as required. | QPWS, Research Institutions, GSNRM, Terrain NRM |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Magnificent brood frog (*Pseudophryne covacevichae*) | Disease | The conservation advice for this species lists Chytridiomycosis as a key threat as it can cause mass population declines in frog populations. It is known to occur in other species in this genus, however, does not currently occur in *P. covacevichae* (TSSC, 2017b).<br><br>The species is not listed as a species under threat from the disease in the Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis (DEE, 2016). | Unlikely | Minor | Moderate | Baldy Mountain Forest Reserve | Population monitoring with incorporated health checks. Implement suitable hygiene protocols as described in the Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis (TSSC, 2017b; DEE, 2016) | Research Institutions, Magnificent brood frog working group | Generally, surveys are undertaken collecting counts of animal calls, animals are not handled during the surveys. No specific hygiene protocols are undertaken, however, volunteers on surveys are reminded to clean footwear before surveys. | Closely monitor the population if a disease outbreak is observed to understand the threat the disease poses to the population, implementing suitable hygiene protocols to prevent further spread. | Magnificent brood frog working group, GSNRM, Terrain NRM | Continue to monitor the population and respond to disease outbreaks as required. | Magnificent brood frog working group, GSNRM, Terrain NRM |
| | | | | | | | Include nature conservation, land management and landholder groups in conservation management activities. Conduct workshops to aid stakeholders in developing the skills and knowledge required to manage threats to this species while undertaking these activities. | Magnificent brood frog working group, GSNRM, Terrain NRM | No specific workshops have been undertaken to aid stakeholders in developing skills and knowledge to manage threats to this species. | | | | |
| Broad leaf Tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland ecological community | Disease | Myrtle rust is listed as a potential threat to *M. viridifora* communities in the conservation advice (TSSC, 2012). It is a fungal disease that infects plants in the Myrtaceae family, heavy infections can result in the death of soft plant material and plant death.<br><br>Myrtle rust is well-established along the east coast of Australia (Appendix 2, Map 31 and Map 32). The rust spores are very easily dispersed by wind, shoes, or by vehicles and gardening equipment making Broad leaf tea-tree communities especially vulnerable to disease outbreaks. Myrtle rust is currently not known to occur in Broad leaf tea-tree, however, a disease outbreak could be potentially catastrophic as it could inhibit the growth and reproduction of the dominant canopy species (TSSC, 2012). | Likely | Severe | Severe | Verification of distribution is required. | Undertake surveys across the range of 'likely habitat' to identify sites for management. | Qld Herbarium, Research Institutions | Specific surveys have not occurred for this ecological community in the region. | Encourage landowners, farmers, Traditional Owners and other community members within the known distribution to regularly monitor Broad leaf tea-tree stands for the signs of myrtle rust. Educate landowners about the disease and report suspected cases to Government agencies. | DAFF, Biosecurity Queensland, GSNRM | Scope locations for collection of plants and or seeds and rapidly collect geoplasm for storage enablement and germination research if not already undertaken (Mackinson et al., 2020). | Qld Herbarium, Research Institutions, DAFF |
| | | | | | | | Undertake surveys and monitoring of the ecological community and collect geoplasm for storage enablement and germination research (Mackinson et al., 2020). | Qld Herbarium, Research Institutions | This is currently not occurring in the region. | | | | |
| | | | | | | | Develop and implement suitable hygiene protocols to protect sites from potential outbreaks of myrtle rust (*Uredo rangelii*) (TSSC, 2012) | Biosecurity Qld, DAFF | Unknown information regarding this activity. | Undertake control of myrtle rust which may include chemical control or removal of severely infected plants | DAFF, Local Councils, GSNRM | Continue to undertake plant health surveys/monitoring of the ecological community to identify any new outbreaks of the disease to ensure prompt response for any future incursions. | Qld Herbarium, Landowners, Traditional Owners, DAFF |
| | | | | | | | Educate the local community about myrtle rust, signs, and protocols for reporting potential disease occurrence. | Biosecurity Qld, DAFF, GSNRM | There are no specific education campaigns in the region for Myrtle Rust. DAFF disseminate some information through Ranger programs. | | | | |

## Natural Disaster Risk Register for Biodiversity Assets - Heatwave

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Golden-shouldered parrot (*Psephotus chrysopterygius*) | Heatwave | It is currently unknown if heatwaves pose a threat, however, the draft recovery plan stipulates that determining if temperature stress during the breeding season is likely to become an issue should be a priority for managing the resilience of populations (OAC, 2022).<br><br>Potential for heat stress to cause mortality of nesting parrots, (March to June). The annual number of heatwave events is not predicted to increase between 2020 and 2039 in the Staaten River National Park area under an RCP 8.5 emissions scenario. The annual number of hot days is predicted to increase from 125 (1992-2022 data) to 175 days per year (Appendix 2, Map 39 and Map 40). | Unlikely | Minor | Moderate | Staaten River National Park | Establishment of automated weather station on Staaten River National Park and monitoring of temperature, rainfall and flood patterns. | QPWS, Traditional Owners | A remote weather station is not currently monitored to respond to conservation actions for the Golden-shouldered parrot in Staaten River National Park. | Monitor nesting site temperature and the health of parrots and their young to determine impacts of the heat wave on nesting animals. | QPWS, Research Institutions, Traditional Owners | Establish monitoring a monitoring assess the recovery of the golden-shouldered parrot Staaten population and nesting habitats following the heatwave event. Monitor nesting activity, breeding success, and population dynamics using standardised survey methods. | Research Institutions, QPWS, Traditional Owners |
| | | | | | | | | | | Provide water stations near to nesting sites if practical. | QPWS, Traditional Owners | Conduct research to better understand the long-term effects of heatwaves on golden-shouldered parrots and their nesting ecology, and use this information to inform management decisions. | Research Institutions, DESI |
| Greater glider (northern) (*Petauroides minor*) | Heatwave | The greater glider is particularly susceptible to high temperatures due to the species' unique physiology. Prolonged exposure to temperatures over 40°C is likely to lead to high mortality. Southern greater glider populations have declined in response to higher night-time temperatures. Warmer climates reduce the nutritional and water content of eucalyptus leaves, the primary diet of the species (AG, 2022a; Wagner et al., 2020).<br><br>The greater glider distribution follows the eastern boundary of the region and an isolated population is found within the lower SE portion of the region within Blackbraes National Park and surrounding properties. Climate predictions show that very hot days >35°C will increase between 1 and 37 days per year, between 2022 and 2039 under an RCP 8.5 emissions scenario. Heatwave events are predicted to increase across the greater gliders range in the Northern Gulf region between 1 and 4 events per year (Appendix 2, Map 41 and Map 42). | Possible | Severe | Very high | Blackbraes National Park and surrounding properties, Werrington, Glenmore, Oak Park, Oak Valley, Gorge Creek Stations (verification of the distribution across these properties required). | Protect habitat considered to be climate change refuges for the Greater glider (northern). | QPWS, Landholders | Blackbraes National Park and Werrington Nature Refuge are currently protected for the conservation of *P. minor* habitat. | Undertake monitoring of the population during the heatwave event to determine impacts on greater gliders. | QPWS | Following heatwave conduct on ground surveys to establish habitat and population impacts as a result of the event and to provide baseline for future population monitoring. Leverage post-disturbance monitoring at sites where surveys were undertaken prior to the event to assess population trends (AG, 2022a). | Research Institutions, QPWS |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in perpetuity covenants, that promote the protection and maintenance of private lands with high-value habitat for the species (AG, 2022a). | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | Currently, Werrington Station is gazetted as a nature refuge. | | | Instal 'Hi-Tech' insulated nesting boxes in areas likely to be impacted by heatwave events. | QPWS, WWF |
| | | | | | | | Encourage landowners to avoid the use of barbed wire, and replace top strange of existing barbed wire with single-strand wire in habitat known to be occupied by greater gliders. | GSNRM | Barbed wire replacement and tubing to cover barbed wire have been implemented in some key locations in Blackbraes National Park and Werrington Station (Werrington Nature Refuge). | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
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| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Koala (*Phascolarctos cinereus*) | Drought combined with heat waves | Drought can severely impact food (leaf fall and browning of foliage) reduction in foliar moisture causing dehydration and malnutrition of koalas. Survival of koalas during drought and heat wave events is more likely in higher-quality habitats closer to permanent water (Gordon et al., 1988; Seabrook et al., 2011).<br><br>The frequency and duration of extreme droughts in the Northern Gulf region are predicted to increase between Gilberton and Einasleigh (Grazing lands) and on the Tablelands north of Mareeba. Heatwaves are predicted to increase across the koala's distribution in the Northern Gulf region under an RCP 8.5 emissions scenario. Annual events are predicted to increase between 1 and 4 events annually across the range. The number of hot days per year is predicted to increase across the koala's range under the same emissions scenario (Appendix 2, Map 43 and Map 44). The susceptibility of koalas is likely to be lower than koalas in the grazing lands due to likely closer proximity to permanent water. | Likely | Moderate | High | The area between and surrounding Gilberton and Einasleigh, and the Cobbold Gorge population within the Grazing Lands (the koalas at Cobbold Gorge may be less likely impacted) and across the Tablelands.<br><br>Further areas are to be informed by population monitoring. | Monitoring population dynamics to understand how koala populations respond to drought. | Research Institutions, Traditional Owners, GSNRM | Some surveys have been undertaken by ecological consultancies. James Cook University is currently completing a genetic analysis. DCEEW is funding a $10,000,000 program for national monitoring of koalas https://www.nkmp.org.au/populations.php | Conduct koala surveys in areas with known koala populations to determine habitat use and response of koalas during the heatwave event. | Research Institutions, Traditional Owners, GSNRM | Undertake post-heatwave population monitoring to identify any impacts of heatwaves on koala abundance. | Research Institutions, Traditional Owners, GSNRM |
| | | | | | | | Undertake population monitoring to increase knowledge of the distribution, abundance, population trends, and population health of koalas across the region to prioritise areas at a regional scale for conservation efforts. Incorporate Indigenous, community groups, and citizen science in monitoring. | Research Institutions, Traditional Owners, GSNRM | | | | | |
| | | | | | | | Encourage landholders to enter land management agreements, particularly in perpetuity covenants, that promote the protection and maintenance of private lands with high-value habitat for the species. | Qld Gvt Private Protected Area Program partnered with Pastoralists, Support provided by GSNRM | There are several nature refuges already gazetted across the koala's range in the Northern Gulf region. | Provision of water stations in easily accessible places to ensure koalas have access to water (e.g., Cobbold Gorge if koalas are observed to be struggling in heatwave conditions). | Local councils, Landowners | Continue to undertake activities to improve the condition of koala habitat, focusing on high-importance habitat areas close to permanent water where heatwaves and droughts may impact food trees. | Landholders, QRFS, QPWS, local councils, Gulf Savannah NRM |
| | | | | | | | Improve the condition of existing Koala habitat on both private and public land through best-practice land management, including management of vegetation, fire, weeds, and introduced species. | Landholders, QRFS, QPWS, local councils, Gulf Savannah NRM | Landowners and government agencies undertake land management in the region, however, a more strategic approach, prioritising critical koala habitat should be undertaken. | | | | |
| | | | | | | | Raise awareness and educate landowners in best-practice land management for the conservation of the koala in the Northern Gulf region. | GSNRM | currently no specific education campaigns for koalas in the NG region. | | | | |
| | | | | | | | Develop prioritisation at a regional scale for the long-term implementation of actions. These include threat risk assessment, prioritisation of habitat attributes for the protection and recovery of the Koala, local actions and land management planning (AG, 2022). | Gvt Agencies, Research Institutions | This has not occurred for the region. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Spectacled flying fox (*Pteropus conspicillatus*) | Heatwave | Heat waves cause direct mortality to individuals when temperatures exceed 42 degrees Celsius and remain elevated for several consecutive days. Flying fox mortality is higher during heat wave events in camps that provide less shade.<br><br>Climate predictions show that the frequency of heatwave events will stay relatively the same across the Spectacled flying fox distribution in the Northern Gulf (Appendix 2, Map 45). | Possible | Severe | Very high | Identified roosts on the Tablelands | Undertake a complete census of Spectacled flying fox roosts within the Tablelands to determine roosts that may be susceptible to heatwave events. | WTMA, SFFRT | A complete census has been undertaken by the SFFRT and is currently under consultation. | Conduct regular monitoring and surveillance of spectacled flying fox colonies during heat wave events to assess the health and behaviour of the flying foxes and identify individuals that may be in distress. | Tolga Bat Hospital, Local Council, DESI | Conduct habitat improvement at flying fox camps impacted by heatwave events to improve canopy cover and shade. | DESI, Local Councils |
| | | | | | | | | | | Cool the flying fox camp down using sprinklers, misting systems or shallow water stations. | DESI | Install sprinklers and misting systems to provide cooling mechanisms during heatwave events. | DESI, Local Councils |
| | | | | | | | Use roost site records with mapping of past, current and future high-temperature models, to plan roost vegetation recovery actions. | WTMA, SFFRT | This is currently being completed by the SFFRT. | Rescue and rehabilitate heat-stressed or injured spectacled flying foxes. | Trained wildlife carers, volunteers, and veterinarians, DESI | | |
| Mountain top nursery frog (*Cophixalus monticola*) | Heatwave | Heat waves pose a threat to many elevation-restricted species, as they are often limited by thermal tolerances. The mountain top nursery frog is susceptible to heat waves as it requires temperatures 17-19 degrees Celsius.<br><br>Mountain top nursery frogs have a very small range, restricted to elevations above 1100m in Mt Lewis NP. Within this area they are patchily distributed, occupying approximately 1% of the available space (Williams 2007). It has been suggested that the availability of microhabitats influences *C. monticola* abundance (Shoo and Williams, 2004), as the species shows association with stands of Mt Lewis walking stick palms (*Linospadix apetiolatus*) which they use for breeding. The species requires cool temperatures (17-19 C) (Williams, 2007), making it susceptible to temperature increases during heat wave events and climate change as they have presumably limited dispersal ability and, cannot retreat to refugia at higher elevations (being already restricted to the summit area).<br><br>Heatwaves are predicted to marginally increase across the species distribution under an RCP 8.5 emissions scenario. Annual events are predicted to increase at most by 1 event annually. The number of hot days per year is predicted to also increase marginally (Appendix 2, Map 46 and Map 47). The species limited distribution, vulnerability to temperature change, and the comparatively modest heat wave projections for Mt Lewis contribute to a very high susceptibility of the species to heat waves. | Possible | Severe | Very high | Mt Lewis National Park | Reduce impacts of feral pigs to maintain sufficient leaf litter and woody debris is maintained at key sites to provide refuge for frogs during heatwave events. | QPWS, NRMs | Funding has been secured for Terrain NRM, GSNRM and JCU to trial exclusion fencing and pig control. Put this here? | Increase pig control during drought when sheltering frogs may be more susceptible to disturbance by feral pig rooting/foraging. | QPWS, NRMs | Implement coordinated integrated pig management to reduce impacts of feral pigs on high elevation rainforest. | QPWS, NRMs |
| | | | | | | | Deployment of artificial refugia may be an option to increase thermal buffering compared to available natural shelter. | QPWS, Research Institutions, NRMs | Researchers are currently studying the adoption of artificial refugia in Australian microhylid frogs. | Deploying artificial refugia may be an option if research indicates it is an effective method, but refugia would be more beneficial if deployed before heatwave onset. | QPWS, Research Institutions, NRMs | Undertake post-heatwave monitoring of known populations to establish potential impacts on the frog population. Close monitoring of the population is required as heat-stressed animals can be more susceptible to other threats such as disease. | QPWS, Research Institutions, NRMs |

| Natural Disaster Risk Register for Biodiversity Assets – Oil/Chemical Spill | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Asset** | **Emergency scenario** | **Risk description / reason susceptible** | **Susceptibility** | | | **Priority locations** | **Preparedness** | | | **Response** | | | |
| | | | **Likelihood** | **Consequence** | **Rating** | | **Activities to build resilience** | **Action** | **Currently undertaken?** | **Activities during event** | **Action** | **Longer-term recovery actions** | **Action** |
| Green turtle (*Chelonia mydas*) & Olive ridley (*Pacific ridley*) | Oil / Chemical Spill | Oil spills and pollutants can cause significant impacts to turtles through external contact, ingestion or inhalation resulting in breathing, sight or gastrointestinal injuries (AG, 2017). Oik can remain in the environment for many years and is highly toxic to eggs. Terrestrial runoff of nutrients and sediments from can impact water quality, causing changes in light and salinity over coral reefs and seagrass meadows. The long term effects of turtle exposure to chemical pollutants are not well understood (AG, 2017).<br><br>The Recovery plan for marine turtles (2017) sates that Gulf of Carpentaria Green turtles are threatened by potential oil and gas expansion, however no spills. | Possible | Significant | Very high | Karumba and high use fishing areas. | Educate local communities, fishermen, and industries about the importance of marine turtles and the impact of oil /chemical spills. Conduct awareness campaigns on how to prevent, and report oil /chemical spills and the importance of quick response. | GSNRM, Local councils, DAF | Currently there are no campaigns to deliver this information to industry, fishermen and the local community. | Deploy booms, skimmers, and other containment equipment to limit the spread of the contaminant. | Maritime Safety Queensland, DAF, Local Council | Undertake water quality monitoring to assess the long-term impacts of the oil / chemical spill. | Local Council, DAF, GSNRM |
| | | | | | | | Develop a response plan oil / chemical spill. | Local councils, DAF | There are currently no specific response plans for this in the Gulf of Carpentaria. | Begin clean up operations to remove oil / chemicals from the water and shorelines. | Maritime Safety Queensland DAF, Local Council, GSNRM | | |
| | | | | | | | | | | Conduct monitoring of the extent and movement of the oil spill using aerial surveys, or on-site observations. | Maritime Safety Queensland, Local Council, DAF, GSNRM | Release rehabilitated turtles back into the habitat where they were captured. | DESI, GSNRM |
| | | | | | | | | | | Catch and rehabilitate any turtles or other wildlife impacted by the spill. | Maritime Safety Queensland, DESI, GSNRM | | |

## 9. AGRICULTURAL NATURAL CAPITAL ASSETS, PREPAREDNESS AND RESPONSE TABLES

**Natural Disaster Risk Register for Natural Agricultural Capital Assets - Drought**

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| High value grazing soils | Drought | Drought conditions affect the production of soil organic matter and decreases soil particle cohesion. Drought conditions can lead to the loss of soil through erosion as plants can be selectively overgrazed or die due to a lack of water.<br><br>Projected more frequent and extended droughts will lead to greater pressure on riparian and alluvial areas from grazing animals. Current practices of grazing down grass cover to minimal levels near waterways during the late dry season, forming dense water access cattle pads cut into steep banks and early season wet season fire burning of remnant vegetation, all result in exposed and disturbed erodible soils at the beginning of the tropical monsoon rain season (Shellberg & Brooks, 2012).<br><br>The duration and frequency of droughts under an RCP 8.5 scenario are predicted to increase marginally in some areas of the region (Appendix 3, Map 48 and Map 49). | Very likely | Significant | Severe | Across the region with prioritisation of the Mitchell River catchment where Gully erosion is occurring at a rapid rate, coastal flood plains and properties around Georgetown with high-value grazing types. | Management of riparian vegetation (particularly native deep-rooted perennial grasses which are best for protecting and binding surface soils) to promote bank stability and prevent alluvial gully erosion into dispersible sodic soils (Shellberg & Brooks, 2012). | Landowners | Some landowners have adopted wet season spelling of riparian areas, however, this is not widely adopted. | Remove stock from paddocks along riparian areas and floodplains that are prone to erosion to reduce grazing impacts, and promote the growth of ground cover to stabilise soil. | Landowners | Fencing to exclude cattle from riparian zones, steep bank, and local catchment floodplain catchment areas around alluvial gullies to reduce chronic soil disturbance and cattle pad density and increase vegetative cover to protect soils from rainfall and reduce excess water runoff (Shellberg & Brooks, 2012). | Landowners |
| | | | | | | | Fencing of riparian areas to remove grazing impacts and reduce reduction in ground cover that can lead to erosion during flooding events (Greiner, 2009; Shellberg & Brooks, 2012). Locate fences/infrastructure outside flood zones if possible. | | Fencing of riparian areas is not particularly common practice due to the cost of fencing and its maintenance. | | | | |
| | | | | | | | Long-term safe stocking rates that maintain pasture resources in a desirable and productive condition (Tothill & Gillies, 1992) and therefore build the resilience of soil from the impacts of flooding and drought. Stocking rates to match pasture growth and spelling of pastures during the wet season (Bowen et al., 2019). | Landowners with facilitation from DAF | Some graziers drought-proof their properties, however, there is some resistance to best management practices across the extensive grazing landscapes. With the delivery of the Grazing Futures project uptake of GLM strategies has increased (Rolfe et al., 2021) | Monitor soil health and major gully scarps to determine retreat during the drought event. | CSIRO, GSNRM, DAF in partnership with Landowners | | |
| | | | | | | | Incorporate gully erosion management into Grazing Land Management Plans (GLMP's) which include management methods for addressing grazing pressure, weed management, fire regimes and infrastructure (Tait, 2015). | GSNRM, DAF in partnership with Landowners | Gully erosion management is considered a priority on smaller pastoral properties, however, on larger stations gully erosion management is not a priority for inclusion in GLMP's. | | | Undertake LiDAR assessments of catchment areas to determine priority areas for management. | CSIRO, Research institutions e.g., Griffith University |
| | | | | | | | Monitoring of major gully scarps to determine the rate of retreat and use the data to prioritise gully scarps for remediation. | CSIRO, Research institutions e.g., Griffith University | Very little monitoring of gully scarps is currently occurring. | Continue to undertake gully front stabilisation of priority gully scarps. | Landowners | Manage weeds round alluvial gullies to promote native vegetation regrowth. | Landowners |
| | | | | | | | Undertake gully front stabilisation of gully scarps which have been identified as having major retreat. | Landowners | This has occurred in some locations but more action required across the region. | | | | |
| | | | | | | | Development of erosion management guidelines for the Northern Gulf region, providing locally relevant examples and management techniques options suitable for effective intervention. | GSNRM | There are no erosion management guidelines for the region, GSNRM have included this as an activity in the NRM plan. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Agricultural soils | Drought | The soils of the Northern Tablelands are of low productivity, with the most agriculturally productive soils being the basaltic derived soils, however, the nutrient status is generally low due to leaching inducted by high rainfall.<br><br>Drought poses severe implications for soil and agricultural yield. Drought conditions affect the ability of soil organic matter and decrease soil particle cohesion. Drought also limits sufficient crop growth to produce effective residue cover and could lead to failure of intensive agricultural development due to the unreliability of rainfall.<br><br>Variability in stream flows due to drought could threaten irrigated agricultural production due to the unreliability of irrigation water (Petheram et al., 2013). Further, drought conditions can lead to the loss of soil through erosion.<br><br>Under a RCP 8.5 scenario the frequency of droughts is expected to increase marginally in the Mareeba Dimbulah Agricultural area (Appendix 3, Map 48 and Map 49). | Very likely | Moderate | Very high | All agricultural areas in the region. | Increase soil organic matter through practices such as cover cropping, crop rotation, and adding organic amendments like compost or manure. Higher organic matter content improves soil structure, water-holding capacity, and nutrient availability, making soils more resilient to drought. | Farmers | Increasing numbers of farmers are utilising cover cropping, crop rotation and compost/manure however, this practice is not widely adopted. | Monitor soil moisture levels using sensors or probes to inform irrigation scheduling and optimise water management practices. | Landowners, extension can be provided by GSNRM | Support the adoption of using drought resilient crops. | Farmers, FNQ Growers |
| | | | | | | | Apply mulches to the soil surface to reduce evaporation, suppress weed growth, and moderate soil temperatures. Mulching helps conserve soil moisture during dry periods and can improve soil health over time. | Farmers | Mulching is a common practice utilised by farmers in the region. | | | | |
| | | | | | | | Capture and store rainwater through techniques such as building swales, contour trenches, or constructing dams and reservoirs. Stored water can be used to supplement irrigation during dry periods. | Landowners, extension provided by GSNRM | There is minimal uptake of these techniques in the region. | Participate drought workshops, training programs, or support groups to access valuable resources and expertise. | GSNRM, Farmers, FNQ Growers | Conduct soil tests to assess nutrient levels, pH, and organic matter content to provide a basis for developing an appropriate soil management plan. | Farmers |
| | | | | | | | | | | Connect farmers, agricultural organisations, and community groups to share information, resources, and support during drought. | GSNRM | | |
| | | | | | | | Implement water-saving irrigation techniques such as drip irrigation or precision irrigation systems to optimise water use efficiency and minimise losses to evaporation and runoff. | Farmers, extension provided by GSNRM | Water-saving irrigation techniques are widely used in the region. | Use mulches or cover crops to conserve soil moisture and reduce evaporation from the soil surface. | Farmers | | |
| | | | | | | | Adopt reduced tillage or no-till practices to minimise soil disturbance and erosion, which can help preserve soil structure and organic matter. Reduced tillage also reduces moisture loss from the soil surface, enhancing drought resilience. | Farmers | There is minimal uptake of this practice across the region. | Explore options for financial assistance, subsidies, or insurance programs available for drought-affected farmers. | Farmers, GSNRM, FNQ Growers | Replant native vegetation or suitable cover crops to restore soil health and biodiversity. | Farmers |
| | | | | | | | Development of erosion management guidelines for the Northern Gulf region, providing locally relevant examples and management techniques options suitable for effective intervention. | GSNRM | There are no erosion management guidelines for the region, GSNRM have included this as an activity in the NRM plan. | Seek advice from agricultural extension services, farm advisors, or financial consultants to develop effective drought management strategies. | Farmers, GSNRM, DAF, FNQ Growers | Upgrade irrigation systems to incorporate newest water saving technologies. | Farmers, extension provided by GSNRM |
| | | | | | | | | | | Develop financial contingency plans to manage reduced income and increased expenses during drought. | Farmers, DAF, GSNRM | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Freshwater | Drought | Drought can cause changes in river/stream flow regimes toward a greater duration of low or no flow. Reduced baseflow inputs and reduced volumes of shallower refugial waterholes will result in greater late dry season degradation of water quality (higher temperatures, lower DO, higher salinity, and eutrophication).<br><br>Systems without groundwater/baseflow supplementation, and disconnected refugial waterholes need to have a sufficient volume and quality of water for biota to survive the dry season. Reduced rainfall presents threats to the viability of refugia (Waltham et al., 2014).<br><br>Less ground cover on scalded and drought-affected catchments can result in higher rates of soil erosion and elevated basin loads and exports of suspended and bed load sediment. The runoff will result in less infiltration and aquifer recharge (Tait, 2015).<br><br>Although significant increases in precipitation levels are projected for all Northern Gulf river basins under future climate scenarios (Gobius, 2015), these changes are predicted to be accompanied by increased seasonal variability that could see reduced precipitation in the driest quarters and also the occurrence of more extended dry seasons and failed wet seasons in some years (Moise, 2014). The Mitchell basin has been identified as being particularly vulnerable due to it being fed by shallow, local unconfined aquifers.<br><br>Additional water entitlements in Queensland river basins, including the Northern Gulf region (Close et al., 2012) increase the susceptibility of freshwater to drought risks (Tait, 2015). Further, drought will place greater demands on water resources for human/agricultural uses with impact to the residual water available for environmental allocations.<br><br>The duration and frequency of droughts under an RCP 8.5 scenario are predicted to increase marginally in some areas of the region (Appendix 3, Map 48, Map 49, Map 50 and Map 51). | Very likely | Significant | Severe | Across the grazing lands. | Reduce impacts of livestock on riparian areas by lowering stocking rates, fencing to remove cattle, and installing additional watering points away from watercourses and wet season paddock spelling to reduce erosion, sediment and nutrient input into waterways. | Landowners | Some landowners have adopted wet season spelling of riparian areas, however, this is not widely adopted. | Destock riparian areas and alluvial plains where damage from livestock could cause greater impacts to erosion and water quality. | Landowners | Conduct assessment of soil condition, ground cover and pasture regrowth to ensure restocking of paddocks occurs after adequate growth of ground cover. | Landowners |
| | | | | | | | | | | | | Conduct water quality monitoring post drought to determine impacts of the drought on water quality, particularly in the Cattle Creek area. | Landowners |
| | | | | | | Mareeba Dimbulah area. | Manage nutrient inputs into agricultural soils to reduce the pollution of water and resulting eutrophication. (e.g., applying fertilisers during suitable weather conditions and at the correct stage during crop growth in addition to using crop rotation, planting cover crops and ploughing in crop residues (Pau Vall & Vidal, 2015). | Farmers | This practice is more widely adopted due to the cost benefits to farmers and overall soil health. | Manage feral animals, such (e.g., pigs), and cattle that may cause additional damage to water bodies. | Landowners | Improve the uptake of Best Management Practices in regard to on farm water, nutrient and pesticide use. Engage primary producers in BMP trials and monitoring of ecosystem condition for direct participatory learning (Tait, 2015). | GSNRM, DAF, CSIRO |
| | | | | | | Across the region | Maintain native vegetation including deep-rooted perennial grasses along riparian zones and floodplains to promote bank and soil stability. | Landowners | Overgrazing of riparian areas is common across the region due to a lack of fencing infrastructure. | | | Educate Farmers and the regional community regarding the need for BMP adoption and communication of trial outcomes | GSNRM, DAF, CSIRO |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Native perennial pasture grasses | Drought | Extended dry period will put greater pressure on pastures (Crowley et al., 2015). Overgrazing of perennial pasture grasses during drought conditions can directly impact grass cover and reduce the amount of carbon entering the soil. Drought coupled with the a brief intense wet period could cause a decline in perennial pasture grasses and an increase in annuals.<br><br>Perennial grasses are an important forage resource for cattle and play a vital role in protecting and stabilising the soil, trapping and retaining litter, sediment and nutrients and providing habitat for native fauna. Drought conditions reduce the growth of perennial grasses and can lead to overgrazing. Repeated defoliation of plants reduces seed production and overgrazing can reduce the diversity and abundance of perennial grass species.<br><br>Although significant increases in precipitation levels are projected for all Northern Gulf river basins under future climate scenarios (Gobius, 2015), these changes are predicted to be accompanied by increased seasonal variability that could see reduced precipitation in the driest quarters and also the occurrence of more extended dry seasons and failed wet seasons in some years (Moise, 2014). Small increases in the frequency and duration of drought are predicted for the region under an RCP 8.5 scenario (Appendix 3, Map 50 and Map 51). | Very likely | Severe | Severe | Across the region | Increase the adoption of seasonal climate forecasts to facilitate pastoralists decisions to vary stocking rates (e.g., destocking in response to drought predictions) (Howden et al., 2008; Rolfe et al., 2014; Rolfe et al., 2021). | DAF to facilitate adoption by pastoralists, GSNRM promote action. | Seasonal climate forecasting is utilised by some Pastoralists. | Apply a logical decision-making framework to reassess drought planning and response strategy for each grazing enterprise and modify as required for the individual drought circumstance (Bowen et al., 2019). | Landowners in collaboration with DAF, extension supported by GSNRM | Conduct monitoring of pasture resources to inform the restocking process (Bowen et al., 2019). | Landowners in collaboration with DAF, extension supported by GSNRM |
| | | | | | | | Long-term safe stocking rates that maintain pasture resources in a desirable and productive condition (Tothill & Gillies, 1992). Stocking rates to match pasture growth and spelling of pastures during the wet season (Bowen et al., 2019). | Landowners | Some pastoralists manage their enterprises using safe stocking rates. | | | | |
| | | | | | | | Wet season spelling of paddocks for the first 6-8 weeks of the wet season and utilisation of 50% of the pasture thereafter (Ash et al., n.d.; Bowen et al., 2019). | | Wet season spelling is used by some pastoralists, greater adoption across the region is required. | Further destocking of country in response to drought length and severity. | Landowners | | |
| | | | | | | | Fence paddocks according to land types so that grazing management can be aligned with best practice management for each land type. | | Some pastoralists have established fencing and watering points however this is not common practice due to the cost of infrastructure. | | | | |
| | | | | | | | Provision of Grazing Land Management (GLM) extension including the Grazing Futures Livestock Business Resilience Program to pastoralists to continue to promote practice change, development of planning frameworks to respond to drought and managing livestock for seasonal variability (Bowen et al., 2019). | DAF partnering with GSNRM | Both DAF and GSNRM provide extension to landowners promoting best practice GLM and practice change to manage livestock for seasonal variability (e.g., through the Grazing Futures Livestock Business Resilience Program). | As a last resort provide supplement feeding for remaining cattle. | Landowners | Delay restocking as long as possible, and when re-stocking utilise conservative stocking rates and wet season spelling to aid in the recovery of perennial pasture species. | |
| | | | | | | | Improve the uptake of breeder herd management (e.g., herd segregation on foetal aging, rapidly reducing numbers by culling Preg-tested Empty (PTE) cows) to provide greater opportunities to reduce grazing pressure where required rapidly (Bowen et al., 2019). | DAF partnering with GSNRM | Breeder herd management is becoming more often utilised in the region however, this practice is still not widely adopted. | | | | |
| Beef cattle | | Beef production is highly dependent on seasonal conditions, droughts lead to a loss of forage and if pastoralists do not destock in response to these conditions cattle may die.<br><br>The Northern Gulf region has a long history of drought impacting the northern beef herd. Historically the herd has been impacted in 1965-66, through much of the 1980's, the early 2000's and 2013-14 (Crowley & Waller, 2016). Small increases in the frequency and duration of drought are predicted for the region under an RCP 8.5 scenario (Appendix 3, Map 50 and Map 51). | Very likely | Significant | Severe | Across the region | Increase the adoption of seasonal climate forecasts to facilitate pastoralists decisions to vary stocking rates (e.g., destocking in response to drought predictions) (Howden et al., 2008; Rolfe et al., 2014; Rolfe et al., 2021) | DAF to facilitate adoption by Landowners, GSNRM | Seasonal climate forecasting is utilised by some Pastoralists. | As a last resort provide supplement feeding for remaining cattle. | Landowners | Conduct monitoring of pasture resources to inform the restocking process (Bowen et al., 2019). | Landowners in collaboration with DAF, extension supported by GSNRM |
| | | | | | | | Increase adoption of proven technologies, GLM and delivery of GFLBRP that improve decision making capacity for drought preparedness of livestock production systems. Particularly farm-management economics approaches to assess the relative value of alternative destocking and restocking decision during drought response and recovery (Bowen & Chudleigh, 2021). | DAF to facilitate adoption by Landowners, MLA GSNRM | Some landowners are using farm management economics approaches to enhance decision making and increase the viability of their businesses. | Destocking and herd management. | Landowners | Delay restocking as long as possible, and when re-stocking utilise conservative stocking rates. | |

## Natural Disaster Risk Register for Agricultural National Capital Assets - Late-season wildfire

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| High value grazing soils | Late-season wildfire | Late-season wildfire can cause potential degradation of topsoil, which could be exacerbated if followed by heavy rainfall and grazing<br><br>Late-season fires have occurred most frequently in the northwest of the region along the Mitchell and Staaten River catchments (Appendix 3, Map 53). Other areas Late-season wildfires are predicted to increase in the Northern Gulf region and combined with predicted heavy rainfall and flood events, the susceptibility of soils to late season wildfire is severe. | Likely | Severe | Severe | Across the region, Mitchell and Staaten River catchments. | Conduct prescribed mosaic burning during cooler, wetter months to reduce the build-up of dry vegetation and minimise the risk of late-season wildfire. Conduct storm burning to manage weeds. | Landowners, Traditional Owner, QRFS, QPWS | This activity is not widely adopted in the region. | Coordinate the development of fire management teams to upgrade or install fire breaks and conduct backburns overnight or when conditions cool, winds drop and humidity increases to prevent wildfire damaging riparian vegetation (NGRMG, 2013). | QRFS, Local Councils, Landowners | Monitor ground cover and pasture condition to ensure restocking of paddocks occurs after adequate growth of ground cover. | Landowners, DAF, Traditional Owners, GSNRM |
| | | | | | | | Undertake wet season spelling. | | Wet season spelling is used by some pastoralists, greater adoption across the region is required. | | | | |
| | | | | | | | Manage weeds in sensitive riparian areas to reduce wildfire risk and increase bank stability by promoting the growth of native vegetation and grasses. | | Farmers have a legal obligation to undertake weed management on their properties. | | | | |
| Agricultural soils | Late-season wildfire | High frequency or intensity of wildfires may reduce soil organic matter in intensive agricultural systems (Malcolm et al., 1999).<br><br>The majority of the areas used for extensive and intensive agriculture in the Northern Gulf region have not experienced frequent late-season wildfires, except for some small areas along the Gilbert River (Appendix 3, Map 52). | Possible | Moderate | High | The Gilbert River Agricultural Area | Implement controlled burns during cooler, wetter periods to reduce fuel loads. | Farmers, QRFS | Some farmers undertake cool season burns, however, this is not widely adopted using a strategic approach between landholders. | Coordinate the development of fire management teams to upgrade or install fire breaks and conduct backburns overnight or when conditions cool, winds drop and humidity increase (NGRMG, 2013). | QRFS, Farmers | Conduct soil tests to evaluate nutrient levels, pH, and organic matter content, and adjust post-fire soil management practices accordingly. | Farmers. |
| | | | | | | | Ensure fire fighting equipment, including pumps, hoses, and water tanks are readily accessible and in good working order. Implement and maintain fire breaks around the property. | Farmers | Management of fire breaks are a relatively common practice in the region. | | | Implement erosion control measures such as mulching, revegetation, and soil stabilisation to prevent soil erosion and promote recovery. | Farmers. |
| | | | | | | | Foster collaboration and communication among stakeholders to develop fire management plans, share resources and coordinate response efforts. Landowners, QPWS and other stakeholders encouraged to attend fire management group meetings. | Farmers, QRFS, QPWS | Several Rural Fire Services in the region are currently non-functioning due to lack of membership. | Coordinate firefighting efforts with local fire agencies, emergency services, and neighbouring landowners to optimise fire fighting efforts and resources. | QRFS, SES, Farmers | | |
| Freshwater | Late-season wildfire | Freshwater ecosystems are threatened by late-season wildfire including wetland associated regional ecosystems. Wildfires can increase the exposure of catchment areas to soil erosion at the beginning of the wet season, increasing destabilisation of stream bank areas, open overstorey canopies promoting weed invasion and contributing to increasing instream temperatures. Burnt areas can also be further impacted by increased grazing pressure (Tait, 2015). Increased rates of runoff from burnt catchments can result in reduced recharge of groundwater aquifers (Tait, 2015). | Likely | Moderate | High | Across the region, Mitchell and Staaten River catchments. | Conduct prescribed mosaic burning during cooler, wetter months to reduce the build-up of dry vegetation and minimise the risk of late-season wildfire whilst leaving some grazing pasture for livestock. Burn different areas in different years. | Farmers, QRFS, QPWS | This activity is not widely adopted in the region. | Coordinate the development of fire management teams to upgrade or install fire breaks and conduct backburns overnight or when conditions cool, winds drop and humidity increase (NGRMG, 2013). | QRFS, Landowners/Farmers | Conduct assessment of soil condition, ground cover and pasture regrowth to ensure restocking of paddocks occurs after adequate growth of ground cover. | Landowners |
| | | | | | | | | | | | | Conduct post fire water quality monitoring to determine impacts of the fire on water quality. | Landowners |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Freshwater | Late-season wildfire | Late-season fires have occurred most frequently in the northwest of the region along the Mitchell and Staaten River catchments (Appendix 3, Map 53). Late-season wildfires are predicted to increase in the Northern Gulf region and combined with predicted heavy rainfall, flooding and droughts, the susceptibility of freshwater ecosystems is considered High. | Likely | Moderate | High | Across the region, Mitchell and Staaten River catchments. | Manage weeds in riparian zones, particularly introduced grasses and weeds that create high fuel loads. | Farmers | Farmers have a legal obligation to undertake weed management for some on their properties. Some areas are poorly managed for weeds that are not of national significance. | Coordinate firefighting efforts with local fire agencies, emergency services, and neighbouring landowners to optimise firefighting efforts and resources. | | Improve the uptake of Best Management Practices regarding on-farm water, nutrient and pesticide use. Engage primary producers in BMP trials and monitoring of ecosystem condition for direct participatory learning (Tait, 2015). | GSNRM, DAF, CSIRO |
| | | | | | | | | | | | | Educate Farmers and the regional community regarding the need for BMP adoption and communication of trial outcomes | GSNRM, DAF, CSIRO |
| Native perennial grasses | Late-season wildfire | The response of pastures to repeated wildfires will depend on the conditions during and after the fires. High-intensity fires followed by dry conditions can promote the recruitment of some woody species, especially wattles, however some high intensity burns can reduce wattles (Service, 2013). These woody species would compete with perennial pasture grasses.<br><br>NAFI data shows that some areas in the Gulf have experienced frequent late-season wildfires and wildfires have impacted large areas of the Northern Gulf region (Appendix 3, Map 53). Late-season wildfires between September - December 2021 burnt approximately 5,565,737 hectares, affecting 216 properties and 81,000 breeding cattle. 49 properties had more than 50% of their pasture burnt out. High-intensity wildfires are predicted to occur more frequently in the Northern Gulf grazing lands as a result of climate change (Crowley & Waller, 2016). | Likely | Significant | Very high | Across the region | Conduct prescribed mosaic burning during cooler, wetter months to reduce the build-up of dry vegetation and minimise the risk of late-season wildfire whilst leaving some grasses left for cattle forage. Burn different areas each year. | Landowners, QRFS, Traditional Owners | This activity is not widely adopted in the region. | Coordinate the development of fire management teams to upgrade or install fire breaks and conduct backburns overnight or when conditions cool, winds drop and humidity increase (NGRMG, 2013). | QRFS, Local Councils, Landowners | Assess the impact of wildfire on d other vegetation, soil erosion, seed bank depletion and plant mortality. | Landowners, DAF, GSNRM |
| | | | | | | | Strategically create and manage fire breaks to prevent wildfire entering the property. | Landowners, QRFS, QPWS | Management of fire breaks are a relatively common practice in the region. | | | Conduct weed management in burnt areas to prevent competition between weeds and native grasses. | Landowners |
| | | | | | | | Manage weeds to reduce wildfire risk, with priority for weeds that create high fuel loads. | Landowners, Traditional Owners | Farmers have a legal obligation to undertake weed management for some on their properties. Some areas are poorly managed for weeds that are not of national significance. | Pastoralists and response teams to stay informed of the latest information about wildfire using the NAFI website. | Landowners and response teams | Monitor regrowth of perennial grasses to inform when it is safe to reintroduce cattle into pastures affected by the fire. | Landowners |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Beef cattle | Late-season wildfire | Extensive late-season wildfires can have large impacts on cattle management in the region. Wildfires can destroy pasture resources and cause direct mortality to cattle (NGRMG, 2013).<br><br>Historically wildfires have impacted large areas of the Northern Gulf region (Appendix 3, Map 53). Late-season wildfires between September - December 2021 burnt approximately 5,565,737 hectares, affecting 216 properties and 81,000 breeding cattle. 49 properties had more than 50% of their pasture burnt out. 2,500 cows and calves were humanely destroyed (NGRMG, 2013). High-intensity wildfires are predicted to occur more frequently in the Northern Gulf grazing lands as a result of climate change (Crowley & Waller, 2016). | Likely | Severe | Severe | Across the region | Disseminate fire information to landholders to help prepare for the upcoming fire season(s), to raise awareness about adopting best practice fire management. | QRFS, GSNRM | GSNRM currently disseminate information through a preparedness checklist and also through delivery of fire workshops. | Muster cattle out of fire-prone paddocks or areas within the predicted path of the fire if possible. | Landowners | Broker agistment arrangements with neighbouring parks to move cattle to areas unaffected by wildfire. | Local councils, DAF, GSNRM |
| | | | | | | | Conduct prescribed burning during cooler, wetter months to reduce the build-up of dry vegetation and minimise the risk of late-season wildfire. | Landowners, QRFS | This activity is not widely adopted in the region. | Coordinate the development of fire management teams to upgrade or install fire breaks and conduct backburns overnight or when conditions cool, winds drop and humidity increase (NGRMG, 2013). | QRFS, Local Councils, Landowners | Map the extent of fire damage and establish risk to animal welfare to prioritise properties for assistance. | |
| | | | | | | | Strategically create and manage fire breaks to prevent wildfire entering the property. | Landowners, QRFS | Management of fire breaks are a relatively common practice in the region. | | | | |
| | | | | | | | Increase participation of landowners in fire management group meetings to maximise a coordinated approach to regional fire management. | QRFS | Insufficient knowledge regarding this activity. | Pastoralists and response teams to stay informed of the latest information about wildfire using the NAFI website. | Landowners and response teams | Coordinate assistance to properties for veterinary care, and supplementary feed for cattle | |
| | | | | | | | Review and refine the Northern Gulf regional wildfire mitigation strategy through ongoing discussions with local landholders and Traditional Owners. | GSNRM, Firescape Science | The wildfire mitigation strategy has not been updated since it was initially drafted. | | | | |
| | | | | | | | Include fire information in relevant workshops on field days. | GSNRM, QRFS | GSNRM currently disseminate information through a preparedness checklist and also through delivery of fire workshops. | | | | |
| | | | | | | | Develop property level fire management and response plans. | Landowners | Very minimal number of properties with a written fire management plan, most properties have considered response actions. | | | | |
| Horticultural crops and tropical fruit | Late-season wildfire | Fires can potentially cause crop damage. The majority of the areas used for extensive and intensive agriculture in the Northern Gulf region have not experienced frequent late-season wildfires, with the exception of some small areas along the Gilbert River (Appendix 3, Map 52). | Possible | Significant | High | The Gilbert River and Mareeba Dimbulah Agricultural areas | On property fire-fighting equipment and fire management plan in place. | Farmers | Insufficient knowledge regarding this activity. | Activate fire fighting protocols. Seek assistance with fighting the fire if required. | Farmers, QRFS | Assess damage, replant / replace crops. | Farmers. |

## Natural Disaster Risk Register for Agricultural Natural Capital Assets - Flood

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| High value grazing soils | Flood | Major flooding can cause erosion to riparian soils. Erosion risk is likely to be exacerbated if increasing rainfall intensity occurs in conjunction with declines in mean rainfall or following drought conditions (S. M. Howden et al., 2008). Erosion risk is also exacerbated where areas are overgrazed, cleared or impacted by weeds (e.g., rubber vine). Flooding can also damage fence lines that protect riparian areas from grazing.<br><br>In 2019 flooding impacted large areas of the Northern Gulf region, severe river and creek erosion, floodplain erosion, including gullying, and extensive sheet erosion occurred (Hall et al., 2020) Flood mapping can be found in Appendix 3, Map 56). | Very likely | Significant | Severe | High-value grazing land management types within flood zones particularly along the western coastline extending inland. | Management of riparian vegetation (particularly native deep-rooted perennial grasses which are best for protecting and binding surface soils) to promote bank stability and prevent alluvial gully erosion into dispersible sodic soils (Shellberg & Brooks, 2012). | Landowners | Some landowners have adopted wet season spelling of riparian areas, however, this is not widely adopted. | Remove stock from paddocks containing riparian zones and flood plains. | Landowners | Assess the extent of soil erosion and damage caused by the flood, including sediment deposition and loss of soil fertility. Consider aerial surveys to assess large scale impacts. | Landowners Traditional Owners, GSNRM |
| | | | | | | | Fencing of riparian areas to remove grazing impacts and reduce reduction in ground cover that can lead to erosion during flooding events (Greiner, 2009; Shellberg & Brooks, 2012). Locate fences/infrastructure outside flood zones if possible. | | Fencing of riparian areas is not particularly common practice due to the cost of fencing and its maintenance. | | | Assess ground cover and pasture condition to ensure restocking of paddocks occurs after adequate growth of ground cover. | Landowners, DAF, Traditional Owners, GSNRM |
| | | | | | | | Long-term safe stocking rates that maintain pasture resources in a desirable and productive condition (Tothill & Gillies, 1992) and therefore build the resilience of soil from the impacts of flooding and drought. Stocking rates to match pasture growth and spelling of pastures during the wet season (Bowen et al., 2019). | Landowners with facilitation from DAF | Some graziers drought-proof their properties, however, there is some resistance to best management practices across the extensive grazing landscapes. With the delivery of the Grazing Futures project uptake of GLM strategies has increased (Rolfe et al., 2021) | | | Undertake immediate monitoring of major gully scarps to assess retreat from the flood and prioritise scarps for remediation. | Landowners, Traditional Owners GSNRM |
| | | | | | | | Incorporate gully erosion management into Grazing Land Management Plans (GLMP's) which include management methods for addressing grazing pressure, weed management, fire regimes and infrastructure (Tait, 2015). | DAF in partnership with Landowners | Very little monitoring of gully scarps is currently occurring. | | | Stabilise priority gully scarps . | Landowners, Traditional Owners |
| | | | | | | | Monitoring of major gully scarps to determine the rate of retreat and use the data to prioritise gully scarps for remediation. | CSIRO, DAF in partnership with Landowners | This has occurred in some locations but more action is required across the region. | | | Manage weed regrowth immediately following the flood and promote the growth of native ground cover. | |
| | | | | | | | Undertake gully front stabilisation of gully scarps which have been identified as having major retreat. | Landowners | There are no erosion management guidelines for the region, GSNRM has included this as an activity in the NRM plan. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Agricultural soils | Flood | Major flooding and intense rainfall associated with cyclonic activity can cause erosion of topsoil if exposed (Mines, N.D.). Water logging of some soils can impact on agricultural productivity through leaching of nutrients or rising saline groundwaters (Mines, N.D.; Petheram et al., 2013). Increased nutrient leaching of soils can reduce nutrient and therefore low agricultural productivity (Malcolm et al., 1999).<br><br>The Northern Gulf region has extensive In 2019 flooding impacted large areas of the Northern Gulf region, severe river and creek erosion, floodplain erosion, including gullying, and extensive sheet erosion occurred (Hall et al., 2020) Flood mapping can be found in Appendix 3, Map 54). | Likely | Significant | Very high | Low-lying riparian areas along the Walsh and Gilbert and Rivers and tributaries. | Identify flood-prone areas on the farm and plant crops and plantations above the flood zone. | Farmers | Most plantations and croplands are located above the flood zones. | Implement temporary drainage measures such as adjusting irrigation infrastructure to manage excess soil and prevent waterlogging. | Farmers | Assess the impact of the flooding on soils to identify soil erosion, sediment deposition and nutrient loss. | Farmers |
| | | | | | | | Maintain native vegetation including deep-rooted perennial grasses along riparian zones and floodplains to promote bank and soil stability. | Farmers | This practice is minimally undertaken in the region. | Monitor soil erosion and sediment transport during the flooding event and take immediate action to mitigate erosion hotspots using erosion control measures such as mulching. | Farmers | Adjust cropping schedules and crop selection based on flood damage and soil conditions, consider cover crops to mitigate erosion and restore soil health. | Farmers |
| | | | | | | | | | | | | Implement soil stabilisation measures such as revegetation, mulching and erosion control. | Farmers |
| Freshwater | Flood | Hydrologic conditions in rivers and streams are impacted by large river flows during flooding events as these events exacerbate erosion problems. This subsequently results in the build-up of sediment into rivers and streams reducing water quality, and the availability of dry-season water and pool habitat (Brooks et al., 2008).<br><br>In addition, the quality of surface water runoff is lower than ground-derived water as it can contain contaminants such as sediments, excessive nutrients, petroleum products etc, derived from the soil surface (Burrows, 2000). Animal manure and urine introduce excess nutrients, promoting the overgrowth of problematic plants and algae like toxic blue-green algae. This disrupts aquatic ecosystems by causing significant fluctuations in oxygen and pH levels. Animal waste can also pose health risks to both animals and humans, increasing water treatment costs for human consumption downstream (Burrows, 2000).<br><br>Under future climate scenarios, significant increases in precipitation levels are projected for all Northern Gulf river basins (Gobius, 2015) Flood mapping can be found in (Appendix 3, Map 56). | Very likley | Moderate | Very high | Across the grazing lands. | Reduce impacts of livestock on riparian areas by lowering stocking rates, fencing to remove cattle, installing additional watering points away from watercourses and wet season paddock spelling to reduce erosion, sediment and nutrient input into waterways. | Landowners | Some landowners have adopted wet season spelling of riparian areas, however, this is not widely adopted. | Destock riparian areas and alluvial plains where damage from livestock could cause greater impacts to erosion and water quality. | Landowners | Undertake post-flood water quality monitoring to assess the level of contamination and pollution levels. | Landowners, Farmers, GSNRM |
| | | | | | | Mareeba Dimbulah area. | Manage nutrient inputs into agricultural soils to reduce the pollution of water and resulting eutrophication. (e.g., applying fertilisers during suitable weather conditions and at the correct stage during crop growth in addition to using crop rotation, planting cover crops and ploughing in crop residues (Pau Vall & Vidal, 2015). | Farmers | This practice is more widely adopted due to the cost benefits to farmers and overall soil health. | | | Conduct regular water quality monitoring to detect changes in nutrient levels, sedimentations, and pollutants, and take corrective actions as needed to protect ecosystem health. | Landowners, Farmers, GSNRM |
| | | | | | | Across the region | Maintain native vegetation including deep-rooted perennial grasses along riparian zones and floodplains to promote bank and soil stability. | Landowners | Overgrazing of riparian areas is common across the region due to lack of fencing infrastructure. Riparian areas are also used for agriculture due to high-quality soils located in these areas. | Engage with landowners, industry, agricultural stakeholders, and local communities to coordinate flood response and recovery efforts. | GSNRM, DAF, Landowners, FNQ Growers | Monitor the regrowth of pasture grasses and other vegetation to inform a suitable time to restock riparian areas and alluvial plains. | Landowners |
| | | | | | | | | | | | | Assess flood damage to agricultural land, infrastructure, and prioritise clean up and recovery actions. | Landowners, Farmers |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Native perennial pasture grasses | Flood | Sustained inundation of floodplains results in reduced ground cover (during recovery period) and impacts the resilience and carrying capacity of associated vegetation communities (Tait, 2015). The impacts depend on the degree of flooding, pasture species present and depth and duration of flood (Peck & Jones, 2022). In 2019 extensive flooding caused widespread destruction of pasture plants through soil erosion, and the covering of pasture plants with silt (Hall et al., 2020). Weed establishment following flood events can severely compete with recovering pastures, limiting the recovery.<br><br>Flooding can have severe impacts on pasture condition. The impacts depend on the degree of flooding, pasture species present and depth and duration of flood. Pasture grasses vary in their tolerance to flooding, however, complete inundation for 2 days or more will result in some plant deaths. In 2019 extensive flooding killed the tops of grass tussocks of all P3 species on flooded areas on the Gulf Plains (Hall et al., 2020). Signs of new growth were seen within three to four weeks post-flooding. Flooding in 1974 caused the spread of asbestos grass (*P. basedowii*) and the flooding in 2019 caused the movement of this grassy weed further across the landscape (Hall et al., 2020).<br><br>Under future climate scenarios, significant increases in precipitation levels are projected for all Northern Gulf river basins (Gobius, 2015) Flood mapping can be found in (Appendix 3, Map 56). | Very likely | Moderate | Very high | High value grazing land management types within flood zones particularly along the western coastline extending inland. | Removal of all stock from paddocks close to watercourses or on floodplains during the wet season to protect high grazing land types from overgrazing before the event of flooding. This will facilitate recovery in land condition and pasture grasses in the event of a flood (Shepherd, 2023). | Landowners | Cattle are often moved from these areas up into sand ridge country, as the lower floodplains get too wet for cattle. | Constantly assess flood levels and move all stock to higher ground where required. | Landowners | Monitor the recovery of pastures closely for 2-3 weeks following flooding and then monthly thereafter to determine recovery actions required (Hall et al., 2020; Peck & Jones, 2022). | Landowners, DAF, GSNRM |
| | | | | | | | | | | | | Spell pastures that were impacted by flooding and defer re-stocking as long as possible (Hall et al., 2020). | Landowners |
| | | | | | | | | | | | | Undertake hay drops to cattle stranded due to the flooding and monitor for weeds following hay drops. | Landowners, Local Councils, DAF, GSNRM |
| | | | | | | | | | | | | Reseed pasture if required. | Landowners |
| | | | | | | | | | | | | Manage weeds in bare areas after flooding. | Landowners |
| | | | | | | | | | | | | Severely degraded areas, identified as D condition, could be rehabilitated with mechanical treatments such as ripping, chisel ploughing, discing or crocodile seeding. However, a reliable nature pasture, grass or legume, seed industry to supply significant seed supplies is not an option (Hall et al., 2020). | Landowners |
| | | | | | | | | | | | | Take photographs post-flooding to assess the pasture damage and recovery (using Normalised Difference Vegetation Index (NDVI) (Hall et al., 2020). | DAF, GSNRM |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Beef cattle | Flood and cyclone | Flooding events can cause direct mortality to cattle, particularly when the flooding occurs early wet season when pasture growth has not allowed for the cattle to build up condition before flooding commences. Poor-condition cattle cannot withstand cold, wet conditions and can die through exposure, bogging and being swept away by flood waters (Hall et al., 2020).<br><br>The Gulf region has a history of flooding. The 2019 flood event caused the death of approximately half a million cattle due to exposure. Predictions of greater rainfall and flooding events resulted in a susceptibility rating of severe Flood mapping can be found in (Appendix 3, Map 56 and Map 58) | Very likley | Significant | Severe | The extensive coastal floodplains and 200km upstream areas along river systems (flood hazard area). | Maintain safe stocking rates, and destock at the end of the dry season if cattle lose condition. Cull Preg-tested Empty cows. As a last resort, late dry season feeding of grass hay and other supplementary feeds such as cottonseed, and cattle licks to ensure the condition of cattle is reasonable entering the wet season. | Landowners | This is undertaken by some pastoralists in the region. | Purchase emergency fodder supplies. | Landowners | Undertake survey of stranded/dead animals after the event. Determine animal welfare issues and relay information to industry, disaster authorities. Culling and disposal of stock may be required. | DAF, Local Councils, GSNRM |
| | | | | | | | Construction of flood refuge mounds to provide refuge to cattle during flood events (Shepherd, 2023). | | There is minimal uptake of this activity across the region. | Where possible relocate stock to safer locations outside the flood impact area using helicopters or boats. This needs to happen while animals are still in reasonable condition to move. | Landowners | | |
| | | | | | | | Rearrangement fencing to provide cattle with access to existing high ground not previously in paddocks exposed to flooding (Shepherd, 2023). | | There is minimal uptake of this activity across the region. | Monitor the movement of low-pressure systems in the Gulf of Carpentaria to provide early indications of the flood event. | Landowners | Where possible arrange relocation / transportation of stock to a safer location. If this is not possible organise fodder drop/supply to stranded cattle. | Farmers |
| | | | | | | | Strategically stock paddocks prone to flooding between December to March with classes of cattle least likely to impact on the enterprise if the paddock floods (e.g., steers, heifers, empty cows. (Shepherd, 2023). Maintain appropriate stocking rates and undertake wet season spelling. | | This is undertaken by some pastoralists in the region, however greater uptake required. | | | | |
| Horticultural crops and tropical fruit | Flood and cyclone | Flooding can cause fruit and crop loss, can uproot trees and cause plant rollover. Further, flooding can also increase the potential for plant disease/pest outbreaks causing crop loss (Bananas, mangoes, avocado, papaya, lychee/longan, citrus).<br><br>Inundation from flooding events can cause crop loss for tropical vegetable crops and sugarcane. In some cases of prolonged inundation, it can cause crop death. Flood mapping can be found in (Appendix 3, Map 54 and Map 57). | Possible | Moderate | High | Low-lying riparian areas along the Walsh and Gilbert and Rivers and tributaries. | Maintain on farm disease / pest management and quarantine protocols. | Farmer | Farmers have a legal obligation to follow disease and pest management protocols. | Follow disease/pest management best practice and report any incidences of disease to Biosecurity Queensland. | Farmers, BQ | Monitor for disease and pest outbreaks. Respond and report to DAF and BQ required. | Farmers |
| | | | | | | | Locate plantations above the floodplain. | | Most plantations are planted above floodplains | Undertake a damage assessment, clean up crop areas, salvage fruit if possible, and replant as required. | | Monitor for disease and pest outbreaks. Respond and report to DAF and BQ required. | Farmers |
| Aquaculture | Flood | Flooding can cause breaches in bunded walls at aquaculture facilities, spilling fish into natural waterways. Diseases can then be transferred from aquaculture stock to wild fish. Extended power outages from flooding may cause stock losses.<br><br>A number of aquaculture facilities in the region are located within or close to flood hazard areas. Flood mapping can be found in (Appendix 3, Map 55). | Likely | Significant | Very high | Aquaculture facilities located within the vicinity of Mt Molloy and Dimbulah | Facilities built to a Q100 event and to industry standards | Farmer | Facilities would be built to industry standards at the time of build. | Repair infrastructure. | Farmers | Rebuild infrastructure to current industry standards. | Farmers |

| Natural Disaster Risk Register for Natural Agricultural Capital Assets - Cyclone | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| High value grazing soils | Cyclone | Extended or intense rainfall events associated with cyclones lead to surface runoff. As water accumulates along narrow pathways between grass tussocks or animal trails, its velocity increases, deepening soil erosion, particularly if the subsoil is prone to dispersion or slaking. This erosion process perpetuates with subsequent rainfall, gradually deepening and widening gullies, which significantly contributes to soil loss and poses threats to sustainability in various agricultural production systems.<br><br>Erosion and soil loss are already major existing problems in the Northern Gulf region and are expected to increase with the predicted increase in rainfall events. The sodic, silty soils which dominate floodplain areas are dispersive and particularly prone to erosion (Tait, 2015). The Mitchell catchment is particularly susceptible to gully erosion and naturally prone to structural breakdown (Brooks et al., 2009). Predicted areas of cyclonic activity including maximum wind speeds can be found in (Appendix 3, Map 58). | Possible | Significant | Very high | High value grazing land management types within flood zones. | Management of riparian vegetation (particularly native deep-rooted perennial grasses which are best for protecting and binding surface soils) to promote bank stability and prevent alluvial gully erosion into dispersible sodic soils (Shellberg & Brooks, 2012). | Landowners | Some landowners have adopted wet season spelling of riparian areas, however, this is not widely adopted. | Remove stock from paddocks containing riparian zones and flood plains. | Landowners | Assess the extent of soil erosion and damage caused by the flood, including sediment deposition and loss of soil fertility. Consider aerial surveys to assess large scale impacts. | Landowners Traditional Owners, GSNRM |
| | | | | | | | Fencing of riparian areas to remove grazing impacts and reduce reduction in ground cover that can lead to erosion during flooding events (Greiner, 2009; Shellberg & Brooks, 2012). Locate fences/infrastructure outside flood zones if possible. | | Fencing of riparian areas is not particularly common practice due to the cost of fencing and its maintenance. | | | Assess ground cover and pasture regrowth to ensure restocking of paddocks occurs after adequate growth of ground cover. | Landowners, DAF, Traditional Owners, GSNRM |
| | | | | | | | Long-term safe stocking rates that maintain pasture resources in a desirable and productive condition (Tothill & Gillies, 1992) and therefore build the resilience of soil from the impacts of flooding and drought. Stocking rates to match pasture growth and spelling of pastures during the wet season (Bowen et al., 2019). | Landowners with facilitation from DAF | Some graziers drought-proof their properties, however, there is some resistance to best management practices across the extensive grazing landscapes. With the delivery of the GrazingFutures project uptake of GLM strategies have increased (Rolfe et al., 2021) | | | Undertaken immediate monitoring of major gully scarps to assess retreat from the flood and prioritise scarps for remediation. | Landowners, Traditional Owners GSNRM |
| | | | | | | | Incorporate gully erosion management into Grazing Land Management Plans (GLMP's) which include management methods for addressing grazing pressure, weed management, fire regimes and infrastructure (Tait, 2015). | DAF in partnership with Landowners | Very little monitoring of gully scarps is currently occurring. | | | Stabilise priority gully scarps . | Landowners, Traditional Owners |
| | | | | | | | Monitoring of major gully scarps to determine the rate of retreat and use the data to prioritise gully scarps for remediation. | CSIRO, DAF in partnership with Landowners | This has occurred in some locations but more action required across the region. | | | Manage weed regrowth immediately following the flood and promote the growth of native ground cover. | |
| | | | | | | | Undertake gully front stabilisation of gully scarps which have been identified as having major retreat. | Landowners | There are no erosion management guidelines for the region, GSNRM have included this as an activity in the NRM plan. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Agricultural soils | Flood | Major flooding and intense rainfall associated with cyclonic activity can cause erosion of topsoil if exposed (Mines, N.D.). Water logging of some soils can impact on agricultural productivity through leaching of nutrients or rising saline groundwaters (Mines, N.D.; Petheram et al., 2013). Increased nutrient leaching of soils can reduce nutrient and therefore low agricultural productivity (Malcolm et al., 1999).<br><br>In 2019 flooding impacted large areas of the Northern Gulf region, causing severe river and creek erosion, floodplain erosion, including gullying, and extensive sheet erosion (Hall et al., 2020). Predicted areas of cyclonic activity including maximum wind speeds can be found in (Appendix 3, Map 54) | Possible | Moderate | High | All agricultural areas in the region. | Identify flood-prone areas on the farm and plant crops and plantations above the flood zone. | Farmers | Most plantations and croplands are located above the flood zones. | Implement temporary drainage measures such as adjusting irrigation infrastructure to manage excess soil and prevent waterlogging. | Farmers | Assess the impact of the flooding on soils to identify soil erosion, sediment deposition and nutrient loss. | Farmers |
| | | | | | | | Maintain native vegetation including deep-rooted perennial grasses along riparian zones and floodplains to promote bank and soil stability. | Farmers | Overgrazing of riparian areas is common across the region due to a lack of fencing infrastructure. Riparian areas are also used for agriculture due to high-quality soils located in these areas. | Monitor soil erosion and sediment transport during the flooding event and take immediate action to mitigate erosion hotspots using erosion control measures such as mulching. | Farmers | Adjust cropping schedules and crop selection based on flood damage and soil conditions, consider cover crops to mitigate erosion and restore soil health. | Farmers |
| | | | | | | | | | | | | Implement soil stabilisation measures such as revegetation, mulching and erosion control. | Farmers |
| Beef cattle | Cyclone | Cyclones can impact on cattle production by increasing fire risk due to the large amount of woody vegetation that falls and creates additional fuel loads. Cattle can die as a direct result of the cyclone and trees can fall and damage fencing.<br><br>Cyclones in the past have caused extensive damage to trees creating woody debris and fuel loads. It is possible this scenario will reoccur into the future. Predicted areas of cyclonic activity including maximum wind speeds can be found in (Appendix 3, Map 58) | Possible | Minor | High | Across the region. | Maintain safe stocking rates, and destock at the end of the dry season if cattle lose condition. Cull Preg-tested Empty cows. As a last resort, late dry season feeding of grass hay and other supplementary feeds such as cottonseed, and cattle licks to ensure the condition of cattle is reasonable entering the wet season. | Landowners | This is undertaken by some pastoralists in the region. | Move cattle into paddocks away from the predicted path of the cyclone. | Landowners | Contact property owners to determine the extent of damage to properties and evaluate assistance required to inform response strategy. | Local Councils, GSNRM |
| | | | | | | | Construction of flood refuge mounds to provide refuge for cattle during flood events (Shepherd, 2023). | | There is minimal uptake of this activity across the region. | | | | |
| | | | | | | | Rearrangement of fencing to provide cattle with access to existing high ground not previously in paddocks exposed to flooding (Shepherd, 2023). | | There is minimal uptake of this activity across the region. | | | Monitor livestock health and welfare. | Landowners |
| | | | | | | | | | | | | Develop a cyclone response strategy as required. | Local Councils, GSNRM |
| | | | | | | | Strategically stock paddocks prone to flooding between December to March with classes of cattle least likely to impact on the enterprise if the paddock floods (e.g., steers, heifers, empty cows. (Shepherd, 2023). Maintain appropriate stocking rates and undertake wet season spelling. | | This is undertaken by some pastoralists in the region, however greater uptake required. | | | If the cyclone has caused extensive vegetation damage and fallen timber, develop a wildfire mitigation strategy to provide a framework for fire management and ongoing hazard reduction in cyclone-affected areas. | Firescape Science |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Horticultural crops and tropical fruit | Cyclone | Flooding and cyclones can cause fruit and crop loss, can uproot trees and cause plant roll over. Further, flooding can also increase the potential for plant disease / pest outbreak causing crop loss (Bananas, mangoes, avocado, papaya, lychee / longan, citrus).<br><br>Inundation from flooding events can cause crop loss for tropical vegetable crops and sugarcane. In some cases of prolonged inundation it can cause crop death. Predicted areas of cyclonic activity including maximum wind speeds can be found in Appendix 3, Map 57). | Possible | Severe | Very high | Across the Mareeba / Dimbulah areas | Undertake emergency canopy removal of trees and/or harvesting and storage of fruit where possible. | Farmer | Farmers harvest fruit prior to cyclone occurrence. | Undertake a damage assessment, clean up crop areas, salvage fruit if possible, and replant as required. | Farmers | Monitor industry recovery | DAF |
| | | | | | | | Maintain on farm disease / pest management protocols | Farmer | Farmers have a legal obligation to follow disease and pest management protocols. | Follow disease / pest management best practice. | Farmers | Monitor for disease and pest outbreaks. Respond and report to DAF and BQ required. | Farmers |
| Aquaculture | Cyclone | Flooding from cyclones can cause breaches in bunded walls at aquaculture facilities, spilling fish into natural waterways. Diseases can then be transferred from aquaculture stock to wild fish. Predicted areas of cyclonic activity including maximum wind speeds can be found in Appendix 3, Map 57). | Likely | Significant | Very high | Aquaculture facilities located within the vicinity of Mt Molloy and Dimbulah | Facilities built to a Q100 event and to industry standards | Farmer | Facilities would be built to industry standards at the time of build. | Repair infrastructure. | Farmers | Rebuild infrastructure to current industry standards. | Farmers |

# Natural Disaster Risk Register for Agricultural Natural Capital Assets - Disease

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Beef cattle, Intensive livestock systems (chicken) | Disease | Climate change may affect the host environment, the vector, the pest or disease itself and the epidemiology. Heavier rainfall and flooding events are likely to contribute to expanding the range of some pests and diseases and contraction of the distribution of other species (Black et al, 2008; McKeon, et al., 2009; Henry et al. 2012). | Possible | Severe | Very high | Across the region | Ensure animals are vaccinated (Black et al., 2008). | Landowners | Insufficient knowledge regarding this activity. | Report any signs of unusual disease or pest outbreaks in their livestock to Biosecurity Queensland. This includes both suspected and confirmed cases. | Landowners | Continue monitoring for any signs of recurrence and immediately reporting any new cases to Biosecurity Queensland. | Landowners |
| | | | | | | | Maintain appropriate stocking rates that keep cattle in good condition, to ensure they are better equipped to deal with disease | | This is undertaken by some pastoralists in the region. | | | | |
| | | | | | | | Select disease and climate-adapted beef cattle breeds to build the resilience of the herd to diseases and parasites (Black et al., 2008). | | The selection of climate-adapted beef cattle breeds are widely used in the region. | Adhere to movement restrictions imposed by Biosecurity Queensland, including restrictions on moving animals, animal products, and potentially contaminated materials. | | Thoroughly clean and disinfect affected areas, equipment, and facilities to ensure the disease or pest is eradicated. | |
| | | | | | | | Establish conditions for managing a disease outbreak and financial compensation for stock losses to provide incentives to report disease outbreaks (Black et al., 2008). | Govt Agencies, BQ, GSNRM | There are already established procedures for managing disease outbreaks through BQ and DAFF. | Implement quarantine measures to prevent the spread of diseases or pest, e.g., isolating infected animals or areas. | | Ensure decontamination protocols are followed for personnel, vehicles, and any items that may have come into contact with infected animals or areas. | |
| | | | | | | | | | | Follow directives from Biosecurity Queensland regarding treatment and control measures, including vaccination, culling of affected animals and applying pest control measures. | Landowners, BQ | Adhere to required follow-up measures or monitoring programs set by Biosecurity Queensland to ensure the long-term eradication of the disease or pest. | |
| | | | | | | | Quarantine new animals. | Landowners | Insufficient knowledge regarding this activity. | Maintain detailed records of the outbreak, including dates of occurrence, number of affected animals, treatment measures undertaken, and outcomes. | Landowners, BQ | Follow guidelines for repopulating livestock if culling was necessary e.g., ensuring new animals are disease-free and implementing strict quarantine measures for new animals. | |
| | | | | | | | Constantly monitor animals for signs of diseases. | | This activity is relatively well adopted, however, monitoring animals on larger pastoral holdings is more challenging due to animals dispursed over wider areas. | Enhance biosecurity practices on the property to reduce the risk of spread, including disinfecting equipment, controlling the movement of people and vehicles, and implementing biosecurity zones. | Landowners | Review and update biosecurity plans to address any weaknesses identified during the outbreak. | Landowners, support provided by BQ, GSNRM |
| | | | | | | | Develop an on-farm biosecurity management plan and maintain on farm biosecurity practices | | This activity is widely adopted. | | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Beef cattle, Intensive livestock systems (chicken) | Disease | Cont. | Possible | Severe | Very high | Across the region | Distribute educational materials and resources on best practice livestock health and biosecurity. Run workshops and training sessions on disease prevention, identification, and biosecurity measures. | GSNRM, BQ | BQ and DAFF currently disseminate this information widely. | Alert and provide information about the emerging disease to the community to build knowledge about the disease symptoms and protocols for reporting notifiable diseases. | BQ, DAF, GSNRM | Work with government bodies to advocate for policies and funding that support disease prevention and management in the livestock industry. | GSNRM, Govt bodies. |
| | | | | | | | Development of new technologies for disease diagnostics to increase the ability of disease detection and control diseases (Black et al., 2008). | Research institutions, CSIRO, DAF, BQ | Insufficient knowledge regarding this activity. | | | Facilitate access to financial aid, grants, and compensation schemes for affected farmers. | GSNRM |
| Horticultural crops and tropical fruit | Disease | Environmental conditions affect disease severity in agricultural settings. Increased temperatures can create conditions that are favourable for plant pathogens such as black sigatoka in bananas and fungal infections in sugar cane (QG, n.d.). Altered rainfall patterns can weaken plants and make them more susceptible to disease.<br><br>Warmer temperatures and extreme weather events can expand the range of pest and disease vectors , spread spores and other infectious agents over larger areas. | Possible | Severe | Very high | Across the region | Diversify crops and use crop rotation to break potential disease cycles. | Farmers | This practice is becoming more widely adopted in broadacre cropping. | Report any signs of notifiable disease or pest outbreaks in their crops to Biosecurity Queensland. This includes both suspected and confirmed cases | Farmers | Continue monitoring for any signs of recurrence and immediately reporting any new cases to Biosecurity Queensland. | Landowners |
| | | | | | | | | | | Utilise beneficial microorganisms or natural predators to combat the diseases. | | Thoroughly clean and disinfect affected areas, equipment, and facilities to ensure the disease or pest is eradicated. | |
| | | | | | | | | | | Isolate infected plants or areas to prevent the spread of pathogens. | | Ensure decontamination protocols are followed for personnel, vehicles, and any items that may have come into contact with infected animals or areas. | |
| | | | | | | | Plant disease and pest resistant or tolerant crop varieties. | Farmers | This activity is widely adopted. | Apply treatments recommended for the specific disease. | | Adhere to required follow-up measures or monitoring programs set by Biosecurity Queensland to ensure the long-term eradication of the disease or pest. | |
| | | | | | | | Conduct regular monitoring or crops for signs of disease or pest infestations. Use disease forecasting models to assist with detecting and managing diseases early. | Farmers | The monitoring of crops for signs of diseases and pest infestations is currently occuring widely in the region. Disease forecasting models are not widely used. | Maintain detailed records of the outbreak, including dates of occurrence, number of affected plants, treatment measures undertaken, and outcomes. | | Consider replanting with disease and pest resistant or tolerant crop varieties. | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Horticultural crops and tropical fruit | Disease | Cont. | Possible | Severe | Very high | Across the region | Education and extension services to provide farmers with the latest information on diseases management strategies and climate adaption techniques. | DAF, CSIRO, GSNRM | DAF currently disseminate information and deliver extension to farmers on disease management strategies and climate adaption techniques. | Enhance biosecurity practices on the property to reduce the risk of spread, including disinfecting equipment, controlling the movement of people and vehicles, and implementing biosecurity zones. | | Review and update biosecurity plans to address any weaknesses identified during the outbreak. | Landowners, with support provided by BQ, GSNRM |
| | | | | | | | | | | Deploy emergency response teams to affected areas to help contain and manage outbreaks and implement quarantine measures. | BQ, Government Agencies | Facilitate access to financial aid, grants, and compensation schemes for affected farmers. | GSNRM |
| | | | | | | | | | | Alert and disseminate information about the emerging disease to the community to build knowledge about the disease symptoms and protocols for reporting notifiable diseases. | BQ, DAF, GSNRM | Work with government bodies to advocate for policies and funding that support disease prevention and management in the agricultural sector. | GSNRM |
| Aquaculture | Diseases | Increase in temperatures, heat wave events and cyclones and heavy rainfall can create favourable conditions for pathogens and parasites. There is an increasing risk of significant aquatic animal diseases emerging and spreading in aquaculture systems (DAWR, 2016). | Possible | Severe | Very high | Aquaculture facilities located within the vicinity of Mt Molloy and Dimbulah | Develop on farm biosecurity plan to prevent the introduction and spread of disease and allow for early disease detection so that impacts can be reduced (DAWR, 2016). | Farmers | Farm biosecurity plans are widely adopted. | Isolate infected stock and implement quarantine measures to prevent the spread of disease. | Farmers | Continue monitoring for any signs of recurrence and immediately reporting any new cases to Biosecurity Queensland. | Farmers |
| | | | | | | | Diversify the species farmed to reduce the risk of disease outbreak (FAOUN, 2024). | | Insufficient knowledge regarding this activity. | Administer appropriate treatments and medications. | | Thoroughly clean and disinfect affected areas, equipment, and facilities to ensure the disease or pest is eradicated. | |
| | | | | | | | Undertake regular health monitoring of stock, control the movement of animals and equipment, and use disease-free broodstock (FAOUN, 2024). | | Regular health monitoring of stock is used by aquaculture facilities. | Promptly report disease outbreaks to Biosecurity Queensland. | | Ensure decontamination protocols are followed for personnel, vehicles, and any items that may have come into contact with infected animals or areas. | |
| | | | | | | | Research to develop diseases-resistant strains and improve vaccines and treatments for common aquaculture diseases. | Research institutions, CSIRO, DAF, BQ | Insufficient knowledge regarding this activity. | Alert other farmers about any disease outbreaks, coordinate efforts and share information on best practices and treatments. | GSNRM, DAFF, BQ | Adhere to required follow-up measures or monitoring programs set by Biosecurity Queensland to ensure the long-term eradication of the disease or pest. | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Aquaculture | Diseases | Cont. | Possible | Severe | Very high | Aquaculture facilities located within the vicinity of Mt Molloy and Dimbulah | Disseminate the latest research outcomes to improve farmer knowledge and uptake of newest information and technologies. | GSNRM, DAF | Insufficient knowledge regarding this activity. | | | Review and update biosecurity plans to address any weaknesses identified during the outbreak. | |

## Natural Disaster Risk Register for Agricultural Natural Capital Assets - Heatwave

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Freshwater | Heatwave | Higher temperatures, including more hot days can impact water quality such as reduced dissolved oxygen, carrying capacity, enhanced mobilisation of nutrients from sediments, increased solubility of metals and generation of favourable conditions for blue-green algae.<br><br>Water quality in refugial waterholes can naturally approach or surpass physiological limits for the maintenance of some aquatic biota (e.g., fish) due to high temperatures and low dissolved oxygen. Successive days of high temperatures are likely to cause additional stresses on waterholes (Tait, 2015).<br><br>Heatwave conditions under an RCP 8.5 scenario are predicted to increase across the region between 1 and 4 events annually. Heatwaves are particularly evident in the west of the region in the Norman and Gilbert River catchments (Appendix 3, Map 59 and Map 61). | Very likely | Moderate | Very high | Across the region, particularly in the Norman and Gilbert Rivers. | Improve shading of freshwater environments by promoting growth of vegetation along riparian areas and wetlands. | Landowners, Traditional Owners | Significant stands of trees still occur along most riparian areas, with exception of some areas damaged by rubbervine or cleared for agriculture. | Monitor water temperature and flow conditions to determine heatwave impacts on the freshwater ecosystem | Landowners, Traditional Owners, GSNRM | Undertake post-heatwave monitoring of water temperature, dissolved oxygen, pH, invertebrate sampling and other water quality parameters to asses recovery and direct future management actions. | Landowners, Traditional Owners, GSNRM |
| | | | | | | | Monitor water quality parameters such as temperature, dissolved oxygen, pH, and nutrient levels regularly to establish baseline conditions and detect changes. | Landowners, CSIRO, Traditional Owners | The Normanton Rangers are currently undertaking water quality monitoring in the Norman River and surrounding areas. | | | | |
| | | | | | | | Develop and implement climate adaption plans for freshwater ecosystems, incorporating measures to mitigate heatwave impacts and promote ecosystem resilience. | CSIRO,GSNRM | A climate adaption plan has not been developed. | | | | |
| | | | | | | | Undertake management of weeds such as rubber vine that smother native riparian vegetation. | Landowners, Traditional Owners | Management of weeds is undertaken in the region and is an obligation of landowners. | | | | |
| Beef cattle | Heatwave | Animal thermal stress is expected to increase as temperature and humidity levels increase (S. Howden et al., 2008). This can reduce animal production, and reproductive performance and increased mortality. Increases of 1.5°C and above may exceed limits for normal thermoregulation of cattle and could result in persistent heat stress (Thornton et al., 2021). Water demand by livestock is strongly related to temperature and is likely to increase as temperatures rise in the future (S. Howden et al., 2008).<br><br>Heatwave conditions under an RCP 8.5 scenario are predicted to increase across the region between 1 and 4 events annually. Heatwaves are particularly evident across Strathmore, Abingdon Downs, and surrounding properties (Appendix 3, Map 59 and Map 61). | Very likely | Significant | Severe | Across the region, Strathmore, Abingdon Downs, Coralie, Claraville and surrounding properties. | Further selection of livestock lines with effective thermoregulatory control may help with herd resilience to heat stress (Howden et al., 2008). | Landowners | Some farmers have been heat testing the fertility of bulls and shade shelters in paddocks for cows to calve. Pastoralists currently utilise climate-resilient beef breeds, however, there is large variation within breeds. | Monitor cattle behaviour and signs of heat stress, such as excessive panting and drooling. | Landowners | Conduct a post-event review of impacts and response measures to identify areas for improvement. | Landowners |
| | | | | | | | | | | Ensure cattle are located in paddocks with adequate shade and water. | | | |
| | | | | | | | Increase the number of watering points to reduce the distance livestock have to travel to water (Howden et al., 2008) and ensure adequate shade in paddocks or holdings where native vegetation is not present. | Landowners | Insufficient knowledge available regarding the utilisation of watering points. | Monitor water troughs to ensure they remain clean, accessible, and free from contamination. | | | |
| **Asset** | **Emergency scenario** | **Risk description / reason susceptible** | **Susceptibility** | | | **Priority locations** | **Preparedness** | | | **Response** | | | |

| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Horticultural crops and tropical fruit | Heatwave | Heat waves and increases in hot days can cause reduced yields in some crops on some soil types (Mines, N.D.) and can cause a loss of land productivity (Thomas & Squires, 1991).<br><br>Heatwave conditions under an RCP 8.5 scenario are predicted to slightly increase across the agricultural areas (0-1 events annually) (Appendix 3, Map 59 and Map 61). | Possible | Moderate | High | Mareeba / Arriga area and Gilbert River. | Install efficient irrigation systems such as drip irrigation to deliver water directly to plant roots to minimise evaporative loss. | Farmers, extension can be provided by DAF and GSNRM | Irrigation projects have been implemented by GSNRM whereby some farmers have installed efficient irrigation systems. Greater uptake is required in the region. | Increase irrigation frequency and duration during heatwave events to ensure adequate soil moisture levels for crop survival and growth. | Farmers | Assess crop damage and plant health status following heatwave events to determine the extent of heat stress and potential yield losses. | Farmers |
| | | | | | | | Improve soil health and water retention capacity through practices such as applying organic matter, mulching and cover cropping. | Farmers | Increasing numbers of farmers are utilising cover cropping, and applying organic matter, however, this practice is not widely adopted. | Use mulch to reduce soil temperature and maintain root zone moisture. | | | |
| | | | | | | | Choose heat tolerant crop varieties and species adapted to local growing conditions and temperature extremes. | | This activity is relatively widely adopted. | Provide temporary shading or cooling measures for sensitive fruit plantations, such as overhead sprinklers or misting systems to prevent fruit damage. | | Implement soil moisture management practices such as deep watering or soil conditioning to promote root development and enhance soil resilience. | |
| Aquaculture | Heatwave | Temperature controls and limits fish development and physiology. Extreme temperature can limit fish growth, and impact hemato-physiology, metabolism, immune and molecular stress responses. Extended periods of increased water temperature can reduce aquaculture performance, development, reproduction, growth and survival of fish, whilst also increasing disease susceptibility (Islam et al., 2022).<br><br>Heat wave events are predicted to slightly increase in areas where aquaculture facilities are located within the region (Appendix 3, Map 60). | Possible | Significant | Very high | Aquaculture facilities located within the vicinity of Mt Molloy and Julatten. | Increase aquaculture pond depth (Islam et al., 2022). | Farmers | Insufficient knowledge available regarding this activity. | Adjust feeding rates and schedules to minimise metabolic heat production and reduce stress. | Farmers | Evaluate the impact of the heatwave on the aquaculture operation, including water quality, fish health, and reproductive performance. | Farmers |
| | | | | | | | Apply pond coverings such as shade cloth to reduce water temperature, direct sunlight exposure and prevent heating (Islam et al., 2022). | | Insufficient knowledge available regarding this activity. | Monitor and manage water quality parameters such as temperature, dissolved oxygen, pH and nutrient levels. | | | |
| | | | | | | | Cultivate heat-tolerant aquatic species adapted to the local climate conditions and temperature extremes. | | Insufficient knowledge available regarding this activity. | Use aerators, water circulation pumps, or evaporative cooling systems to lower water temperatures and enhance oxygenation during heatwaves. | | Implement corrective measures such as water quality treatments, pond or tank flushing, and stock management adjustments to facilitate recovery and minimise losses. | |
| | | | | | | | Explore the options of food additives, essential oils, and endocrine therapy to build the resilience of aquaculture fish to heat waves (Islam et al., 2022). | CSIRO, DAF | Insufficient knowledge available regarding this activity. | Increase water exchange rates or replenishment frequency to flush out heat-affected water and maintain cooler temperatures. | | | |

| Asset | Emergency scenario | Risk description / reason susceptible | Susceptibility | | | Priority locations | Preparedness | | | Response | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Rating | | Activities to build resilience | Action | Currently undertaken? | Activities during event | Action | Longer-term recovery actions | Action |
| Intensive livestock systems (chicken) | Heatwave | Animal thermal stress is expected to increase as temperature and humidity levels increase (S. Howden et al., 2008). This can reduce animal production, and reproductive performance and increased mortality. Broiler chickens above 31 days of age are highly succeptible to mortality during heat wave events.<br><br>Heat wave events are not predicted to increase in areas where poultry farms are located within the region (Appendix 3, Map 60). | Possible | Severe | Very high | All poultry facilities in the region. | Avoid overcrowding poultry houses (Kapetanov et al., 2015). | Farmers | This activity is widely adopted. | Monitor animal behaviour and signs of heat stress, such as increased respiration rate and heavy panting. | Farmers | Conduct a post-event review of impacts and response measures to identify areas for improvement. | Farmers |
| | | | | | | | Install ventilation systems, and cooling systems for confined intensive livestock systems (Thornton et al., 2021). | | This activity is widely adopted. | Utilise cooling systems. | | | |
| | | | | | | | Genetic selection of animals that may be less susceptible to thermal stress (e.g., naked necks) (Pawar et al., 2016). | | Insufficient knowledge available regarding this activity. | Provision of cool water and additional waterers during the heat wave event. Insulated water tanks can be used to ensure water stays cool (Kapetanov et al., 2015). | | | |
| | | | | | | | Installation of alarm systems that activate when ventilation systems fail to function (Kapetanov et al., 2015). | | This activity is widely adopted. | | | | |

# 10. COMMUNITY/STAKEHOLDER ENGAGEMENT

Gulf Savannah NRM (GSNRM) acknowledges the vital role of effective communication in disseminating this disaster preparedness and resilience plan to stakeholders. To achieve this, GSNRM will adopt a multi-faceted approach, leveraging platforms like newsletters, workshops, and community forums to provide detailed information on the plan's objectives, strategies, and implementation. Additionally, the organisation actively engages stakeholders through targeted outreach efforts such as one-on-one meetings and presentations, ensuring their involvement in ongoing planning processes. Regular updates and progress reports are shared to foster transparency and accountability, allowing for continuous feedback and refinement of the plan as necessary.

Moreover, GSNRM is dedicated to integrating the disaster preparedness and resilience plan into government efforts at Commonwealth, state, and territory levels. This will involve ongoing close collaboration with relevant government agencies, participation in working groups and consultations, and advocating for the inclusion of identified gaps in preparedness actions in government policies. By working closely with government partners, GSNRM aims to enhance the resilience of biodiversity and agricultural natural capital assets in the Northern Gulf Region, contributing to more effective emergency response management.

Furthermore, GSNRM recognises the indispensable role of community and stakeholder engagement in disaster management and resilience-building efforts. Engaging communities and stakeholders not only taps into local knowledge and expertise but also fosters collaboration, strengthens social cohesion, and builds community resilience. By raising awareness about the importance of biodiversity and agricultural natural capital assets, GSNRM aims to promote sustainable land management practices and conservation efforts, ultimately contributing to long-term environmental sustainability.

## 10.1 Selecting Key Stakeholders/Communities for Engagement in Disaster Management

During the development of this plan, numerous opportunities for collaboration and partnerships with communities, government agencies, and stakeholders were identified. These collaborations aim to strengthen resilience and mitigate the environmental impacts of extreme natural disasters. Ongoing consultations will gather additional valuable input and feedback from these stakeholders to review and refine the actions outlined in the plan, ensuring efficient emergency preparedness and response management.

Through stakeholder engagement, clear actions, and stakeholder roles and responsibilities will be solidified to ensure a clear guide to what is achievable and the role of each stakeholder in disaster scenarios. This will ensure all stakeholders are aware and supportive of their identified roles and responsibilities outlined in the plan.

## 10.2 Education and Training

Through the development of this plan, various education and training initiatives have been identified to enhance the knowledge and skills of stakeholders in delivering activities aimed at building the resilience of biodiversity and agricultural natural capital assets. These initiatives focus on building landholder knowledge and skills to implement best practices in land management for asset conservation, essential for the long-term sustainability of these assets. These initiatives focus on:

- Implementing best practices in land and fire management for asset conservation.

- Providing education on habitat management tailored to specific species, such as koalas, Gouldian finches, and red goshawks.
- Offering workshops and sessions to build capacity in agricultural management, including hygiene protocols and technology integration.
- Providing education and training during disaster events to ensure effective response and recovery, along with promoting best practices in livestock health and biosecurity management.

By identifying training and capacity-building requirements, GSNRM can prioritise securing funding to implement these initiatives, thereby advancing plan outcomes.

## 11. LEGAL FRAMEWORK

Gulf Savannah NRM will adhere to various legislative frameworks to ensure that disaster preparedness, response, and recovery actions are conducted legally, responsibly and sustainably. Compliance with these laws is crucial for protecting natural resources, minimising biosecurity risks, and ensuring the safety and well-being of local communities. Adhering to these legislations helps coordinate efforts between different levels of government and local stakeholders, fostering a cohesive and effective approach to disaster management. This not only supports immediate response efforts but also ensures long-term environmental and community resilience.

Ensuring that landowners and stakeholders are informed about their legal obligations is essential for maintaining compliance and safeguarding the environment during disaster operations. Understanding and following these laws will help prevent activities that could exacerbate the impact of disasters, such as improper land clearing or the spread of invasive species. By promoting awareness and adherence to these regulations, Gulf Savannah NRM will enhance the effectiveness of disaster management efforts and support sustainable development practices.

A list of the key legislations relevant to this plan is provided below:

- **Disaster Management Act 2003**: Establishes the framework for managing disasters in Queensland.
- **Biosecurity Act 2014**: Prevents the spread of pests and diseases during recovery operations.
- **Local Government Act 1989**: Defines the roles of local councils in disaster management.
- **Environment Protection and Biodiversity Conservation (EPBC) Act 1999**: Protects significant biodiversity and habitats.
- **Nature Conservation Act 1992**: Safeguards native flora and fauna.
- **Vegetation Management Act 2006**: Regulates land clearing to prevent soil erosion and protect vegetation.
- **Coastal Protection and Management Act 1995:** Addresses coastal erosion and habitat conservation.
- **Water Act 2000 (Qld):** Manages water resources in Queensland, ensuring sustainable water use and protection of water ecosystems.
- **Waste Reduction and Recycling Act 2011 (Qld):** Promotes waste management and recycling, critical during disaster debris clearance and waste management.
- **Environment Protection Act 1994:** Controls pollution and protects the environment.
- **Wet Tropics World Heritage Protection and Management Act 1993**: Ensures conservation within the Wet Tropics World Heritage Area.
- **Fisheries Act 1994 (Qld):** Manages and protects fish habitats and fisheries resources, relevant during recovery efforts affecting aquatic environments.
- **Aboriginal Cultural Heritage Act 2003 (Qld**): Protects Indigenous cultural heritage, requiring consideration of cultural sites during disaster response and recovery.

## 12. RISK MANAGEMENT INCLUDING MITIGATION STRATEGIES

Risk management involves systematically identifying and understanding risks and the controls in place to manage them. According to AS/NZS/ISO 31000:2009, a risk is defined as the “effect of uncertainty on objectives.” The goal of risk management is not to avoid risks entirely but to manage them effectively to maximise opportunities and minimise adverse impacts.

Through the delivery of this plan identified risks will be analysed and treated individually, with assessments made regarding their consequences and likelihood, resulting in specific risk ratings. During an emergency, the level of risk may vary based on the event's scale and size. The risk

management process follows the seven-step approach outlined in AS/NZS/ISO 31000:2009 (Figure 1 below).

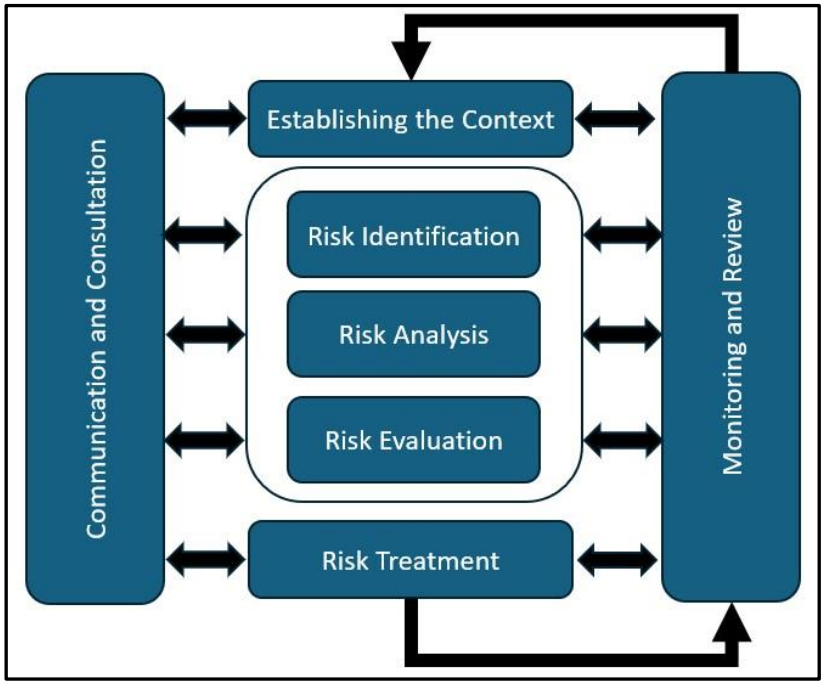


Figure 1. AS/NZS/ISO 31000:2009 7-step risk process.

The AS/NZS/ISO 31000:2009 framework outlines a seven-step process for risk management, which is particularly useful in disaster scenarios. Gulf Savannah NRM will undertake a comprehensive risk analysis at the onset of each natural disaster. This will involve establishing the context by defining the scope and objectives of the risk management activities. Risks will then be identified, and a thorough risk assessment involving examination of the identified risks to understand their potential impact and likelihood. In the risk evaluation step, risks will then be prioritised based on their analysis, enabling GSNRM to focus on the most significant threats.

Once risks are evaluated, the risk treatment step involves selecting and implementing measures to mitigate, transfer, accept, or avoid risks. Continuous monitoring and review ensures that the risk management process remains dynamic and responsive to new threats and changing circumstances. Lastly, communication and consultation are integral throughout the process, ensuring that all stakeholders are informed and involved in managing risks. By adhering to the AS/NZS/ISO 31000:2009 standards, GSNRM can develop a robust risk management plan for each unique disaster event that addresses immediate disaster-related risks and enhances their overall resilience and preparedness for future emergencies.

## 12.1 Safety and Human Health Risks

For each unique natural disaster encountered an onset risk assessment process will be undertaken for safety and human health. This will involve identifying potential hazards that could impact individuals and communities. This includes evaluating the likelihood and severity of risks like hazardous material exposure, infrastructure collapse, disease outbreaks, and limited medical access. By prioritising these risks, the process will inform targeted mitigation strategies, resource allocation, and emergency responses. Continuous monitoring throughout the disaster situation will ensure that response activities stay effective, aiming to protect lives and minimise health impacts during the disaster.

## 12.2 Ecosystem/Asset Damage

An assessment of the risks for ecosystem and asset damage while undertaking resilience and response activities for each unique disaster will be conducted. This will involve identifying potential threats to natural habitats, biodiversity, and agricultural assets through the delivery of actions. This assessment will include an analysis of the likelihood and severity of impacts such as habitat

destruction, species displacement, spread of weeds and pathogens, water contamination, and soil erosion. Evaluating the potential damage to agricultural lands, water resources, and conservation areas helps prioritise protective measures and recovery strategies for each event. By understanding the interconnectedness of ecosystems and human activities, each risk assessment will inform the development of targeted interventions to preserve biodiversity, maintain ecosystem services, and protect natural assets, ensuring long-term resilience and sustainability.

## 12.3 Resource Availability

For each natural disaster, an evaluation of current resource availability will be undertaken to ensure resource availability to effectively mitigate and respond to identified risks. This will involve GSNRM completing a comprehensive inventorying and analysis of the resources necessary for disaster response, such as personnel, equipment, funding, and technical expertise. Assessing resource availability ensures adequate means to implement protective measures, conduct monitoring, and rehabilitation actions to restore damaged ecosystems by identifying gaps in current resources at the time of the event, and planning for the allocation or procurement of additional support where needed. By integrating resource availability into the risk assessment process, GSNRM can develop unique, realistic and actionable plans, ensuring that they are equipped to address ecological and asset damage efficiently and effectively. This comprehensive approach enhances overall resilience, ensuring that both human and natural systems can recover and thrive post-disaster.

## 12.4 Public Communication

Effective public communication is vital in the context of risk assessment and resource availability for ecosystem and asset damage during disasters. GSNRM will deliver clear, timely, and transparent communication to ensure that communities are well informed about potential risks, preparedness measures, and available resources. GSNRM will disseminate information through various channels such as social media, community meetings, local news outlets, and educational workshops to reach diverse audiences. Public communication will also include updates on risk assessments, resource mobilisation efforts, and protective actions being taken. By maintaining open lines of communication, authorities can build trust, enhance public understanding, and encourage proactive participation in disaster preparedness and response efforts, ultimately leading to more resilient communities and ecosystems.

## 12.5 Maintaining Communication with Emergency Services

Gulf Savannah NRM will establish effective channels of communication, to enable disaster responders to swiftly exchange critical information, enabling proactive measures to minimise risks. Timely updates will allow for the deployment of resources to vulnerable areas, facilitating rapid interventions to protect ecosystems and agricultural resources from potential harm. This proactive approach will reduce the likelihood and severity of damage caused by the disaster, preserving essential natural capital assets vital for ecological balance and sustainable agriculture. Thus, robust communication systems will play a pivotal role in enhancing resilience and reducing the overall impact of disasters on biodiversity and agricultural landscapes.

A comprehensive list and contact details for stakeholders are provided in ‘12. Key Contacts’ will be reviewed at the onset of a natural disaster to enable a prompt communication plan to be developed to ensure communication is strategic and best placed for the unique situation. UHF repeater station maps have been provided in Appendix 4, for use in emergencies for the Local Government areas of Croydon, Etheridge, and Carpentaria.

## 12.6 Disaster Management Code of Practice

Gulf Savannah NRM will endeavour to adhere to the Far North Queensland Regional Organisation of Councils Disaster Management Natural Assets Code of Practice (Dryden & Doak, 2021). GSNRM will build requirements under the Code of Practice into activity planning and risk management processes. The Code of Practice provides a decision framework to prevent the spread of priority biosecurity risks and mitigate impacts on natural assets and significant environmental areas during disaster response

and recovery operations. Local governments, in collaboration with regional partners like Gulf Savannah NRM, play a crucial role in identifying priority biosecurity risks, natural assets, and significant environmental areas that may be impacted during disasters. Clear identification of these areas allows for safeguarding against unnecessary impacts and ensures appropriate actions are taken for their recovery. While natural areas may not always be the priority during disaster situations, Councils and Disaster Management Teams need to be aware of and follow processes that mitigate negative impacts during their operations. GSNRM's participation in LDMG Environmental Sub-committees can benefit the delivery of the Code of Practice by providing specialised knowledge and ensuring that environmental considerations are integrated into disaster response plans. This involvement helps to effectively reduce biosecurity risks and protect natural resources during disaster operations.

## 13. MONITORING AND DATA

During the development of this plan, Gulf Savannah NRM has pinpointed a multitude of data and knowledge gaps, as well as information that could be gathered to enhance resilience and response efforts. This proved especially crucial for biodiversity assets, where significant data deficiencies exist for the majority of species outlined in the plan. Baseline data is lacking for many of these species, and inaccuracies persist in the modelled distributions due to limited biodiversity survey efforts in the region. Additionally, there is a lack of understanding regarding the impact of disasters on these species and their habitats, leading to many risk assessments and responses being based on assumptions. Consequently, the plan integrates monitoring and research initiatives to guide future endeavours, ensuring that disaster responses yield optimal outcomes for the ecological sustainability of the region. Fortunately for the grazing lands, extensive land condition data has been collected for the past 20 years and some gully erosion data has been collected which can be used to inform grazing land management and impacts of severe weather events on soil assets.

Throughout the delivery of this disaster preparedness and resilience plan, Gulf Savannah NRM will also continually refine its approach to data collection to effectively track the progress of implementation and evaluate the effectiveness of actions. At the onset of a natural disaster key performance indicators (KPIs) and metrics to measure the success of various preparedness and response actions will be developed to track the delivery of the plan in response to the natural disaster.

Gulf Savannah NRM will establish data collection protocols and mechanisms to capture relevant information on the implementation of the plan, including the status of asset preparedness, response activities undertaken, and outcomes achieved. Additionally, the organisation will define methodologies for data analysis to assess the impact and effectiveness of actions in mitigating risks and enhancing resilience. Regular monitoring and evaluation of data will enable Gulf Savannah NRM to identify areas for improvement, adjust strategies as needed, and ensure that the plan remains responsive to evolving challenges and priorities. By integrating data-driven decision-making into the planning process, Gulf Savannah NRM aims to enhance the adaptive capacity and overall effectiveness of disaster management efforts in the Northern Gulf Region.

## 14. KEY CONTACTS

| Organisation / Entity | Contact Details |
|---|---|
| Australian Wildlife Conservancy | Cairns Office<br>21 Balfe Street,<br>Parramatta Park, QLD 4870<br>Email: Cairns.Office@australianwildlife.org |
| Biosecurity Queensland | Biosecurity Queensland Cairns<br>21-23 Redden Street, Portsmith, Qld 4870<br>Phone: (07) 4241 7800<br>Email: cairns.bq@daf.qld.gov.au<br>General enquiries: 13 25 23 |
| Commonwealth Scientific and Industrial Research Organisation | CSIRO head office in Canberra<br>Phone: (02) 6276 6000<br>Email: info@csiro.au |
| Carpentaria Shire Council | Normanton Office<br>29-33 Haig St, Normanton Qld 4890<br>Phone: (07) 4745 2200<br><br>Karumba Office<br>Phone: (07) 4747 7555<br>Email: council@carpentaria.qld.gov.au |
| Croydon Shire Council | 63 Samwell Street, Croydon, Qld 4871<br>Phone: (07) 4748 7100<br>Email: admin@croydon.qld.gov.au |
| Department of Agriculture and Fisheries' | Mareeba Research Facility<br>28 Peters Street, Mareeba, Qld 4880<br>Phone: (07) 4017 0700<br>Email: info@daf.qld.gov.au<br>General enquiries: 13 25 23 |
| Department of Environment, Science and Innovation | Atherton Office<br>28 Mabel Street, Atherton, Qld 4883<br>Phone: (07) 4091 8170<br>Fax: (07) 4091 3578 |
| Etheridge Shire Council | 53 Luff Street, Georgetown, Qld 4871<br>Phone: (07) 4062 1487<br>Email: council@etheridge.qld.gov.au |
| James Cook University | James Cook University – Cairns Campus<br>14-88 McGregor Road, Smithfield, Qld 4878<br>Phone: (07) 4232 1111<br>Email: enquiries@jcu.edu.au |
| Mareeba Shire Council | 65 Rankin Street, Mareeba, Qld 4880<br>Phone: (07) 4086 4500<br>General enquiries: 1300 308 461<br>Email: info@msc.qld.gov.au |
| Meat and Livestock Australia | Brisbane office<br>8/2 Upper Dairy Hall<br>45 King St, Bowen Hills QLD 4006<br>Phone: 1800 023 100<br>Email: info@mla.com.au |
| Queensland Rural Fire Service | Far North Region Headquarters<br>Level 8 William McCormack Place II<br>5b Sheridan Street, Cairns, Qld 4870<br>Phone: (07) 4032 8759<br>Email: qfesfnr.regadmin@qfes.qld.gov.au<br><br>Western Command<br>17 Vernon Street Atherton, Qld, 4883<br>Phone: (07) 4089 6820 |
| Tablelands Regional Council | 45 Mabel Street, Atherton, Qld 4883 |

| | |
|---|---|
| | Phone: 1300 362 242<br>Email: info@trc.qld.gov.au |

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## APPENDIX 1: RISK MATRIX

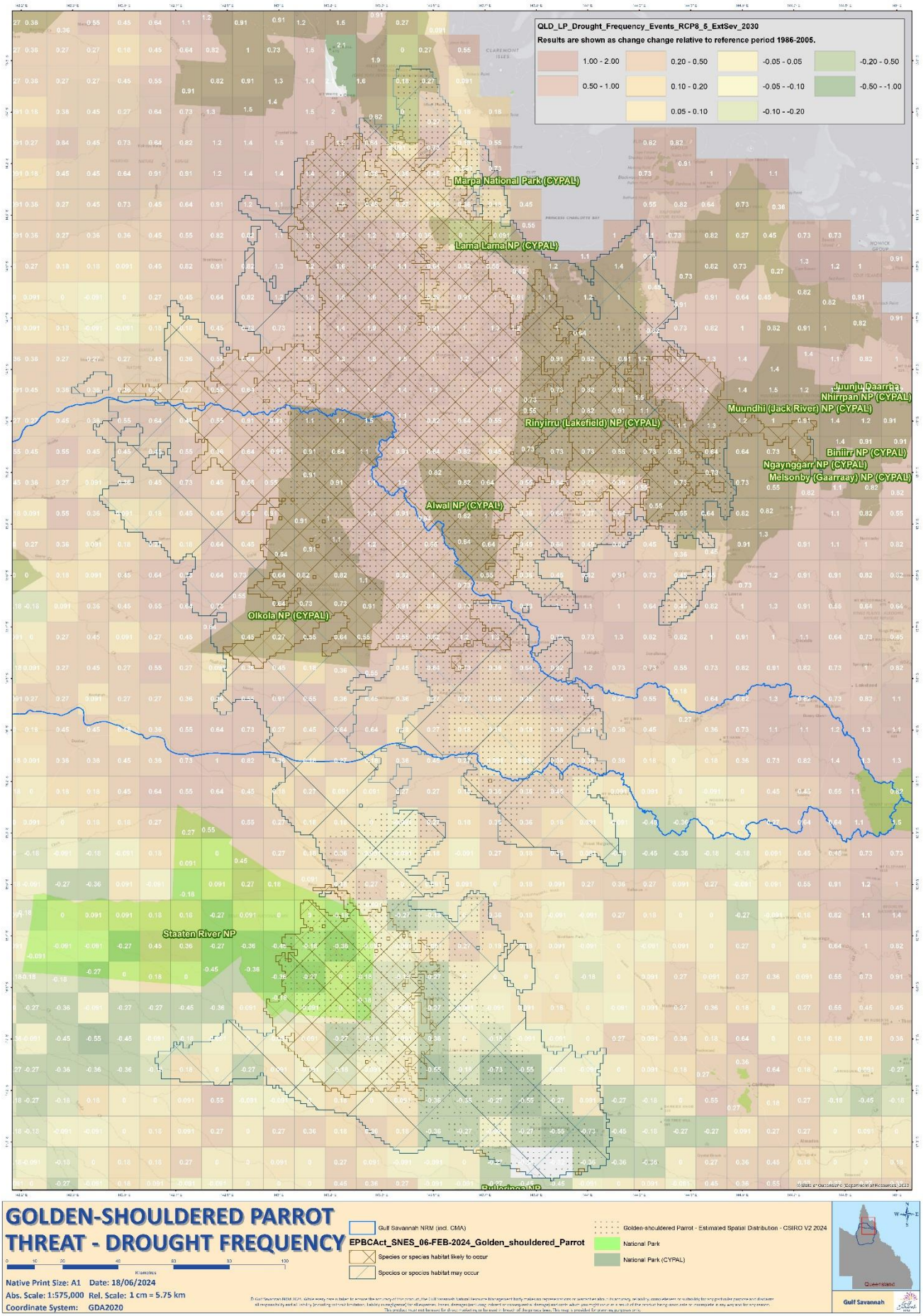
| Likelihood | Consequences | | | | |
|---|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Significant** | **Severe** |
| **Very likely** | Moderate | High | Very high | Severe | Severe |
| **Likely** | Minor | Moderate | High | Very high | Severe |
| **Possible** | Minor | Moderate | High | Very high | Very high |
| **Unlikely** | Minor | Moderate | Moderate | High | Very high |
| **Unknown** | Minor | Minor | Moderate | High | High |

Risk matrix legend / Risk rating

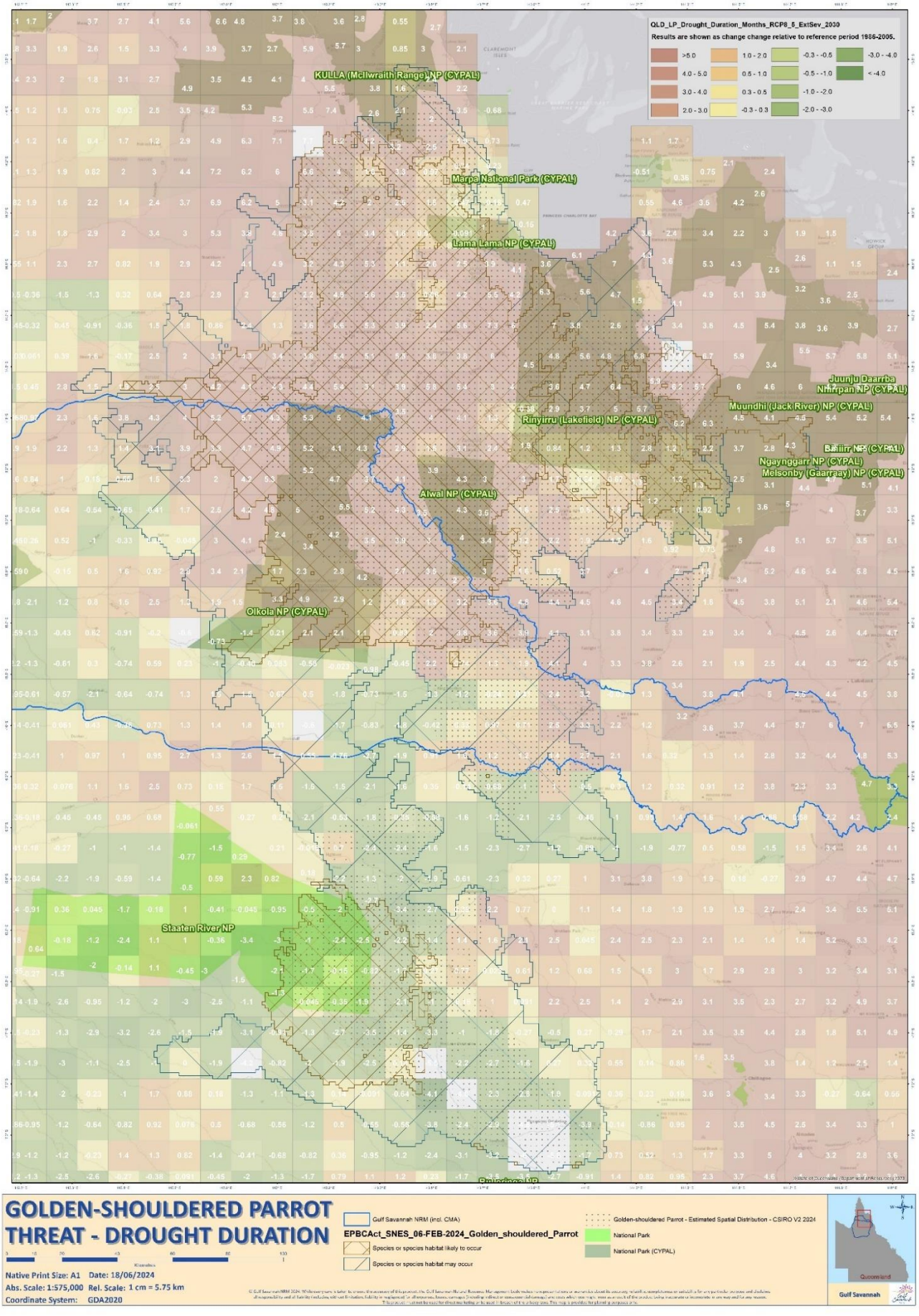
| | | | | |
|---|---|---|---|---|
| Minor | Moderate | High | Very high | Severe |

## APPENDIX 2: BIODIVERSITY ASSET AND THREAT SPATIAL MAPPING

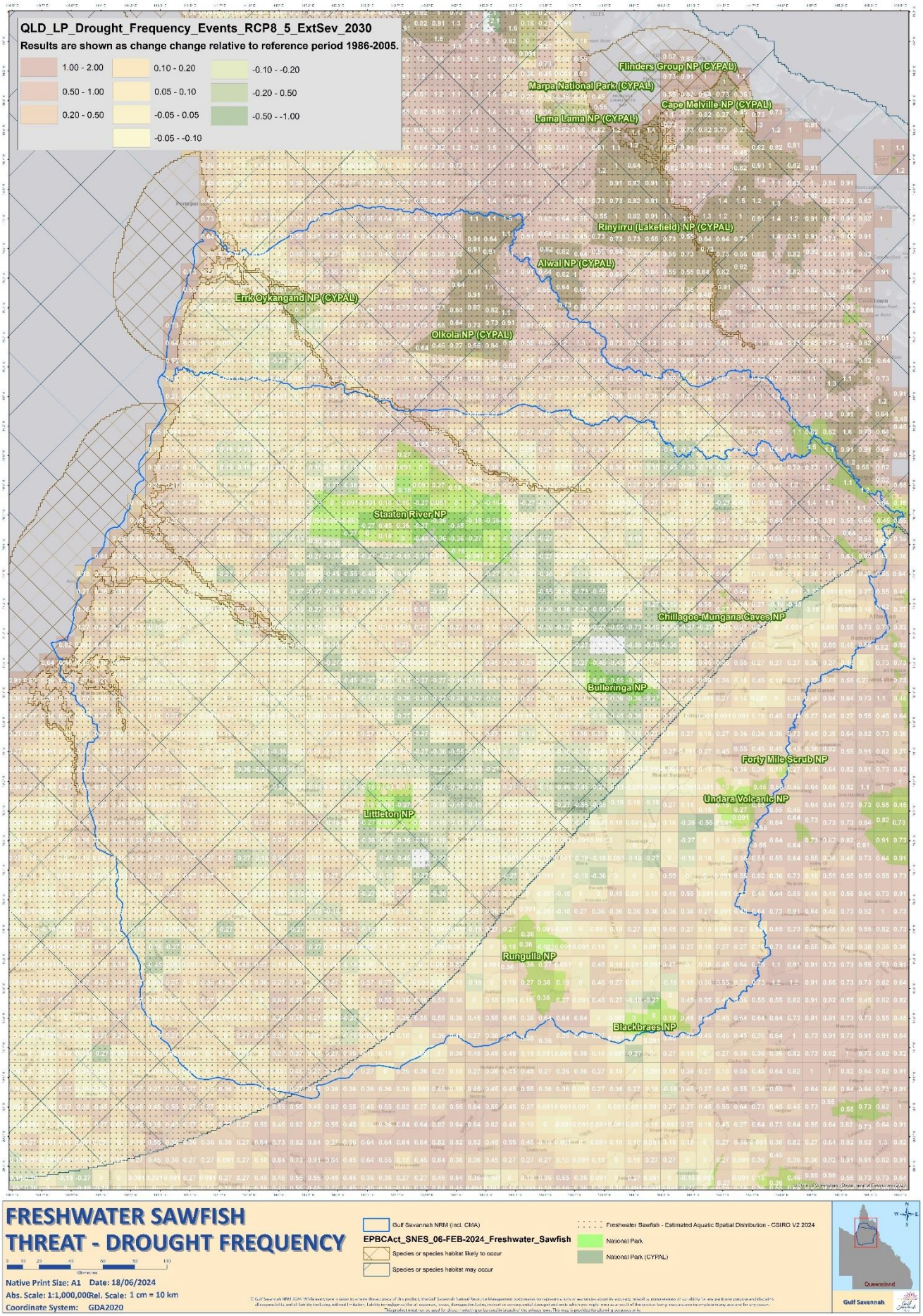
## Map 1 – Golden Shouldered Parrot – Threat – Drought Frequency



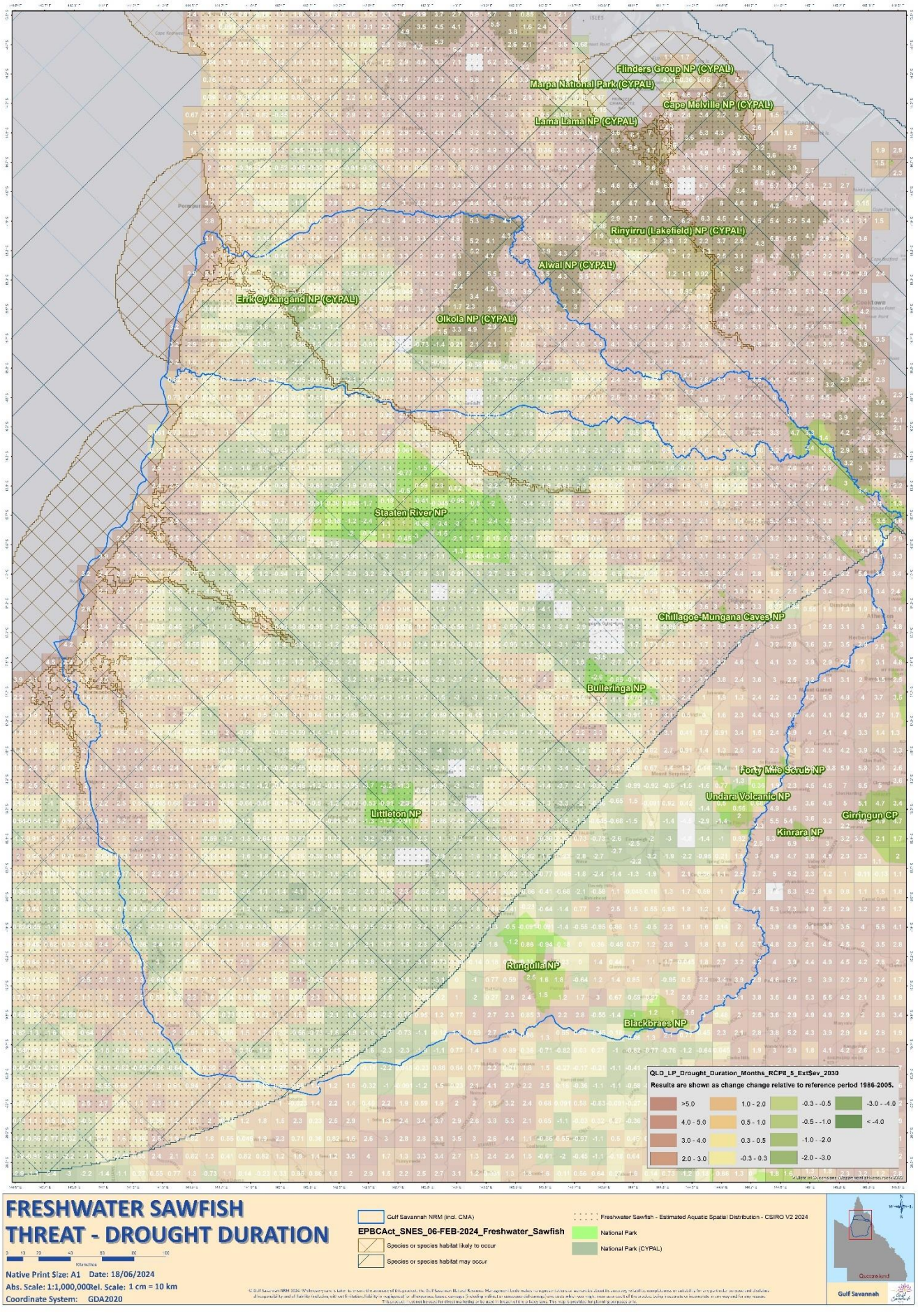
## Map 2 – Golden Shouldered Parrot – Threat – Drought Duration



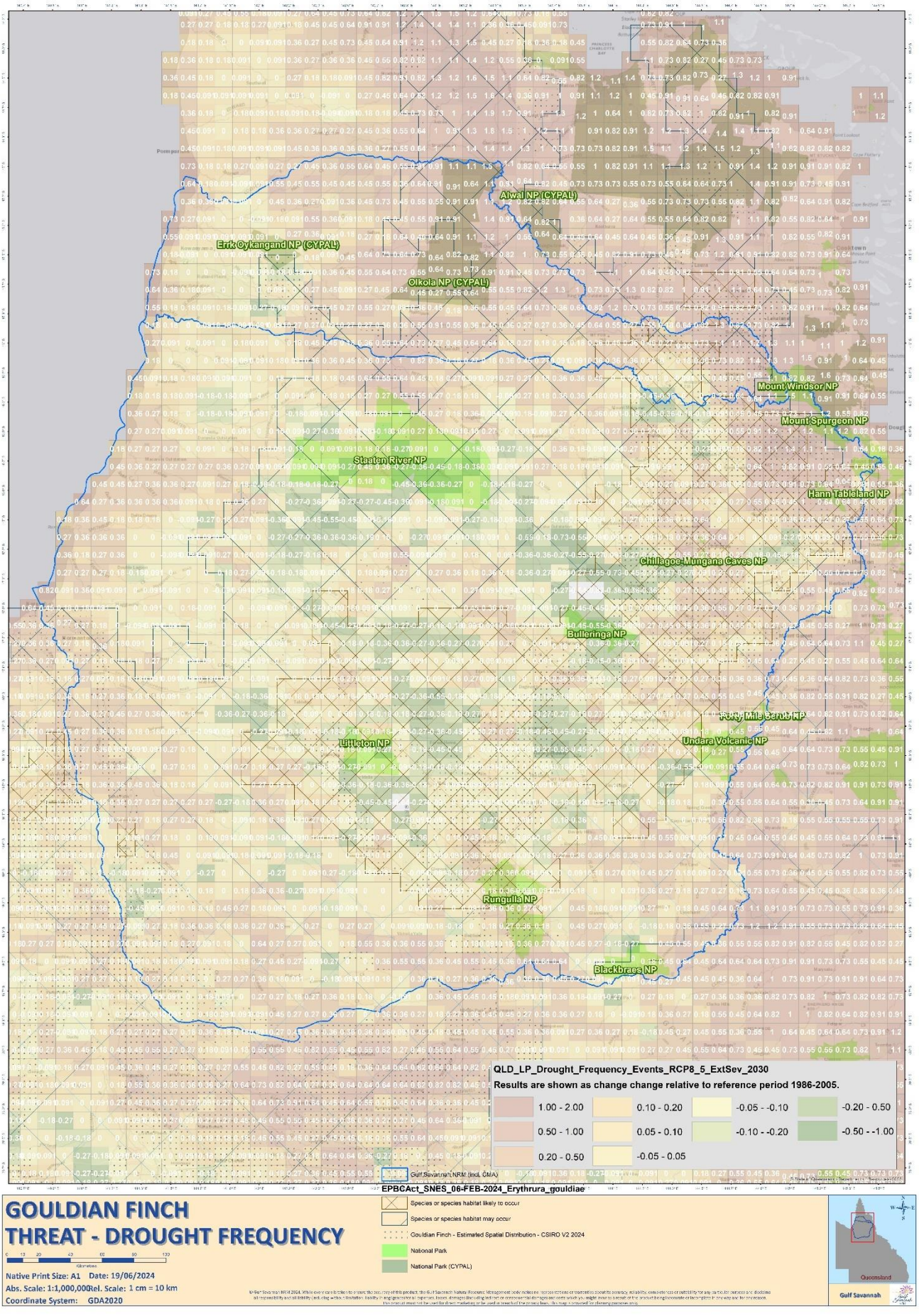
## Map 3 – Freshwater Sawfish – Threat – Drought Frequency



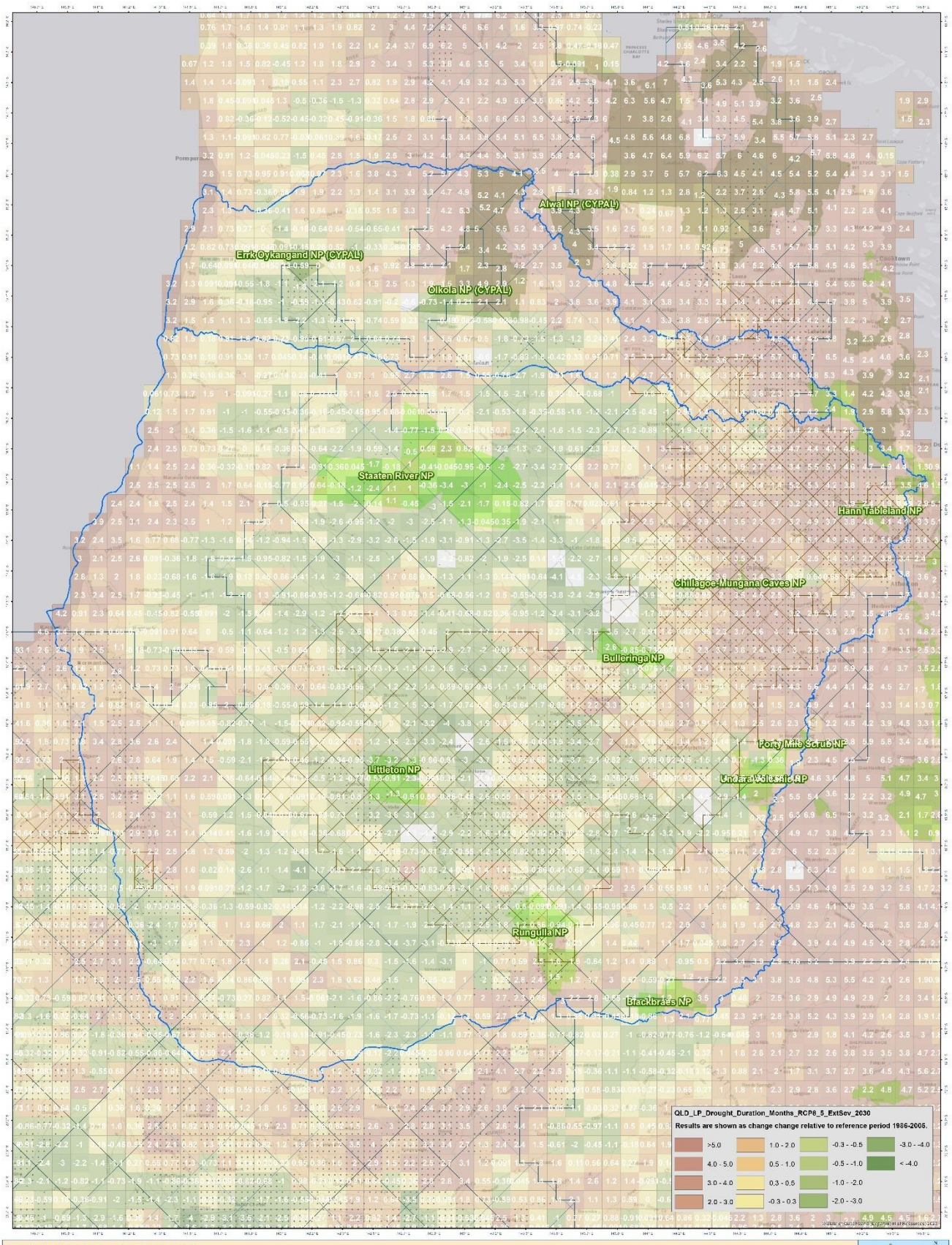
## Map 4 – Freshwater Sawfish – Threat – Drought Duration



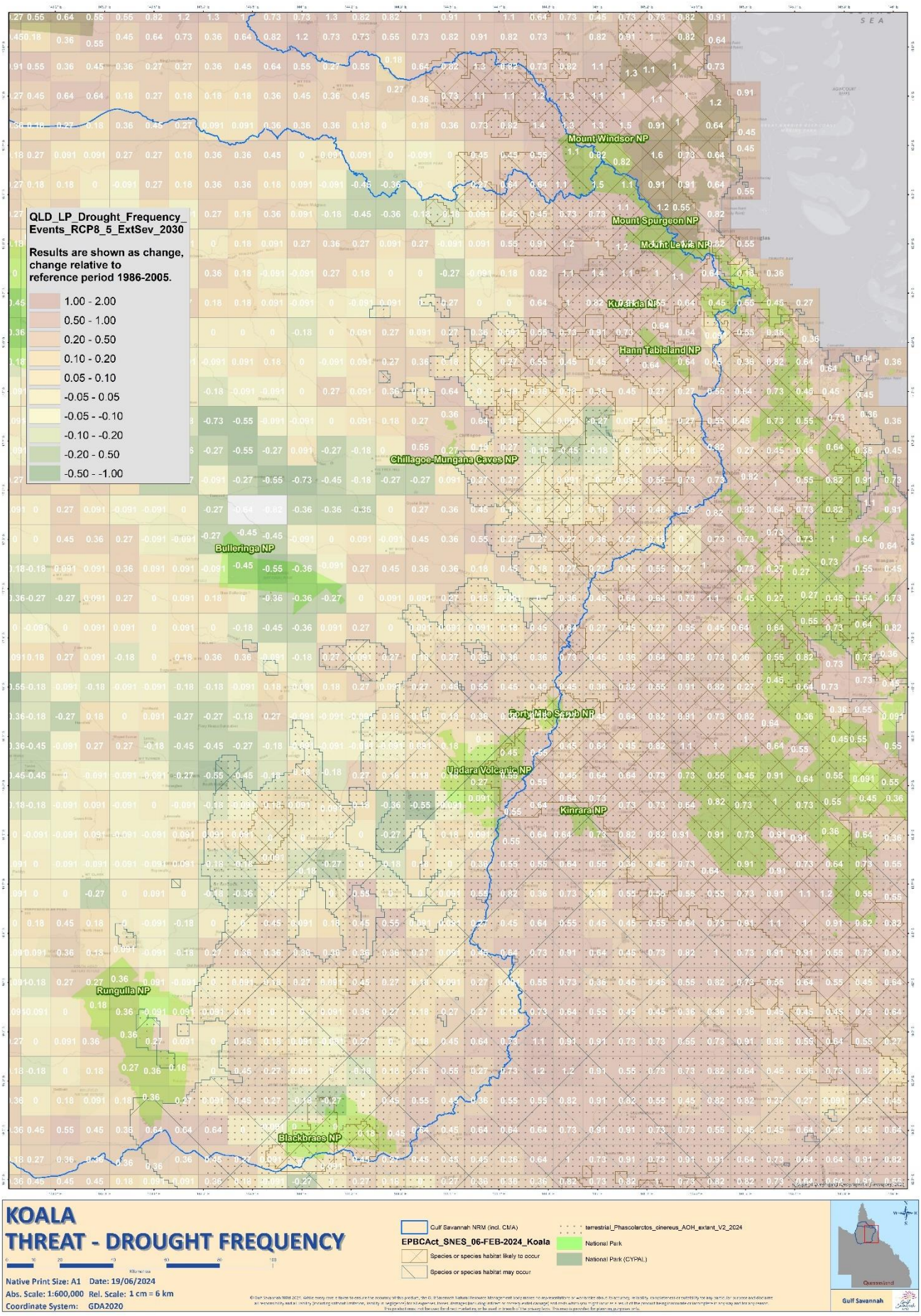
## Map 5 – Gouldian Finch – Threat – Drought Frequency



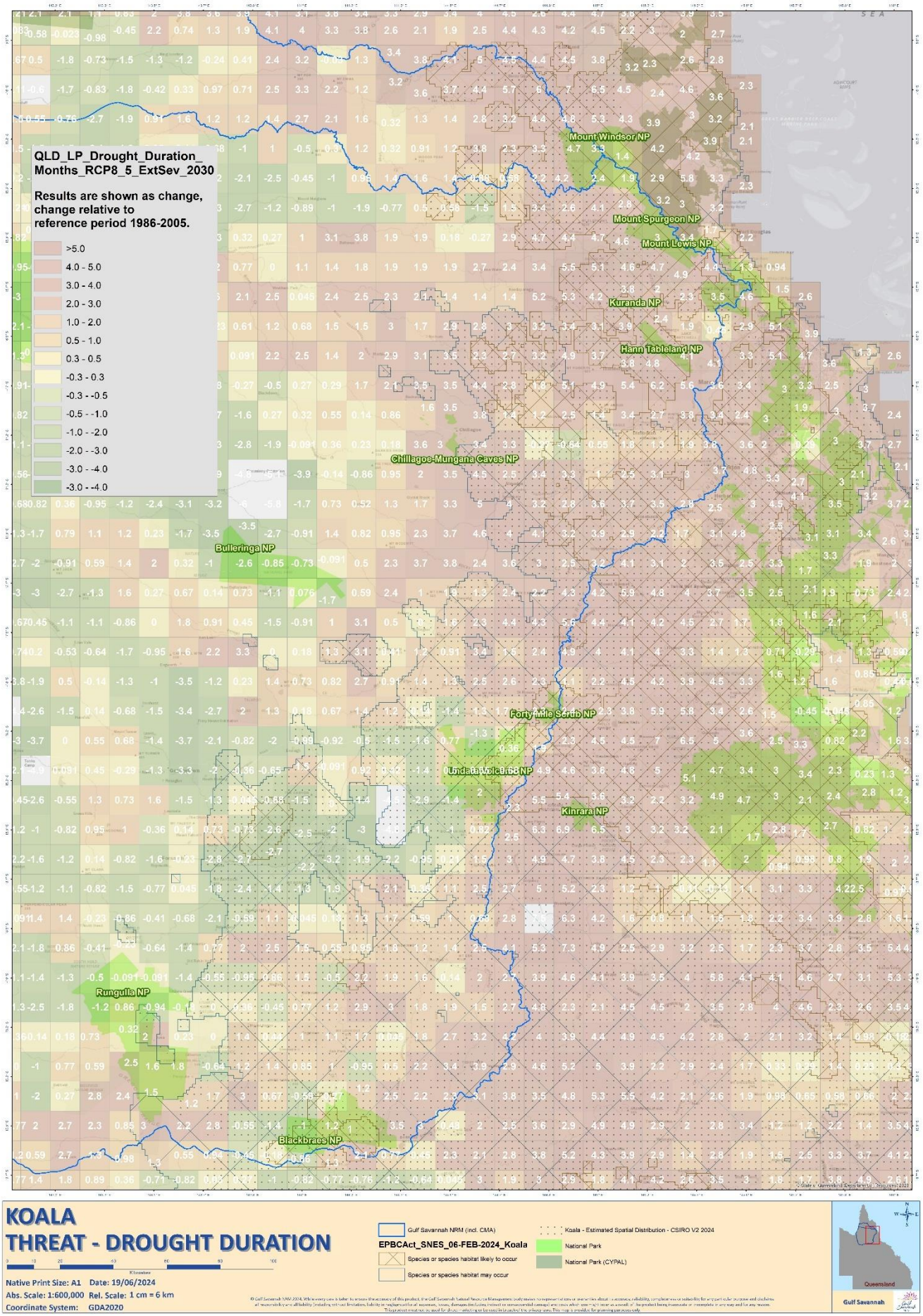
## Map 6 – Gouldian Finch – Threat – Drought Duration



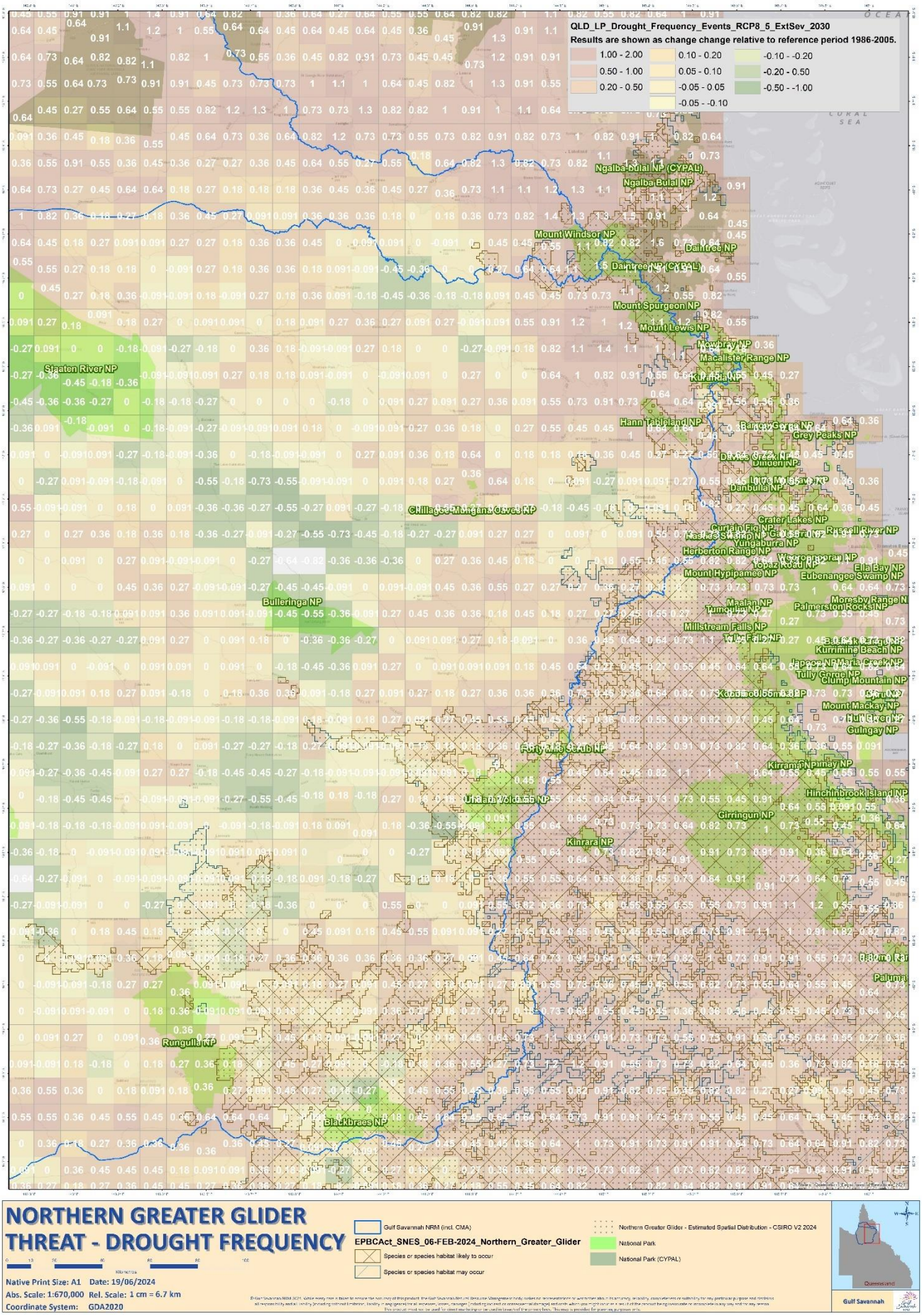
## Map 7 – Koala – Threat – Drought Frequency



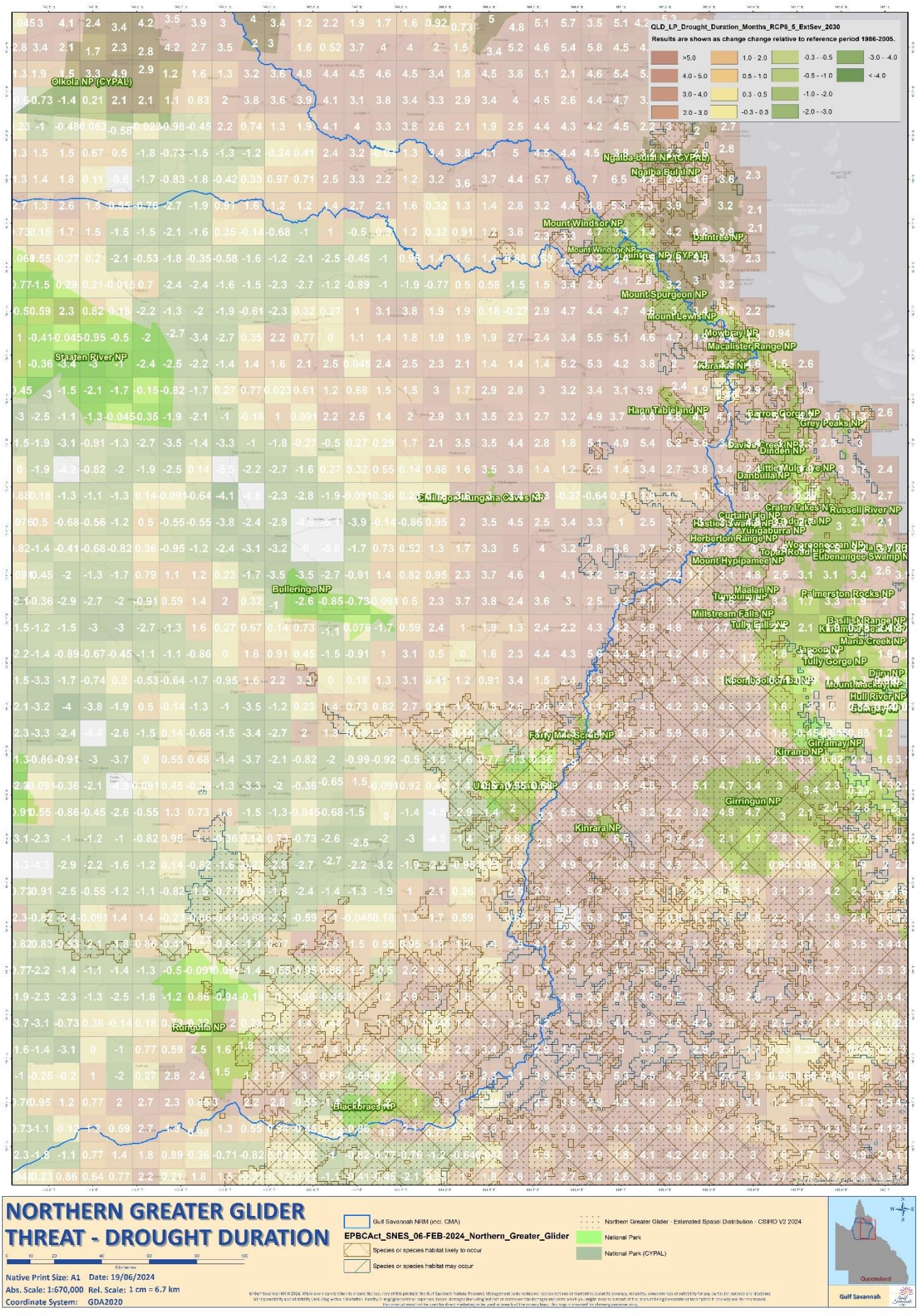
## Map 8 – Koala – Threat – Drought Duration



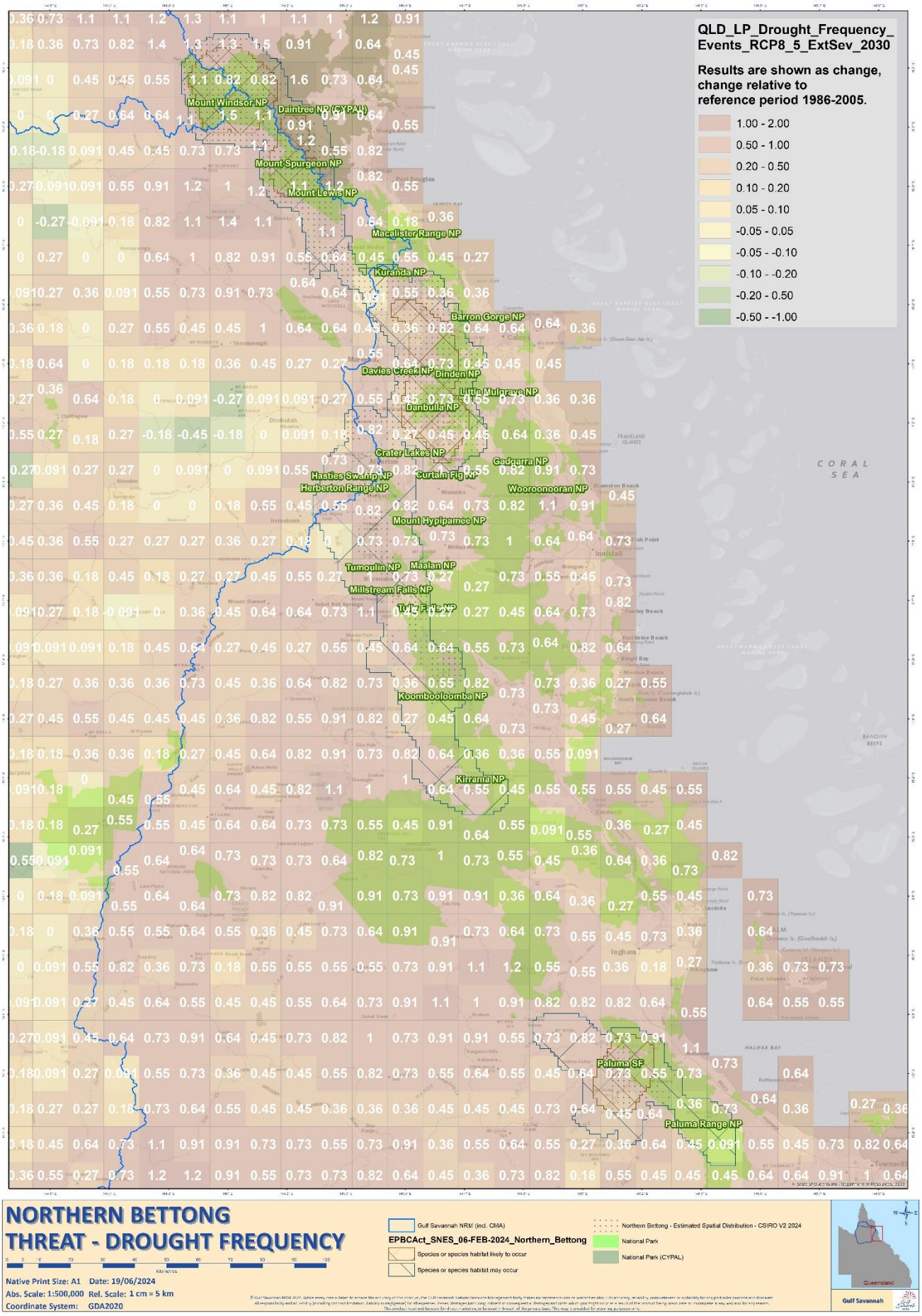
## Map 9 – Northern Greater Glider – Threat – Drought Frequency



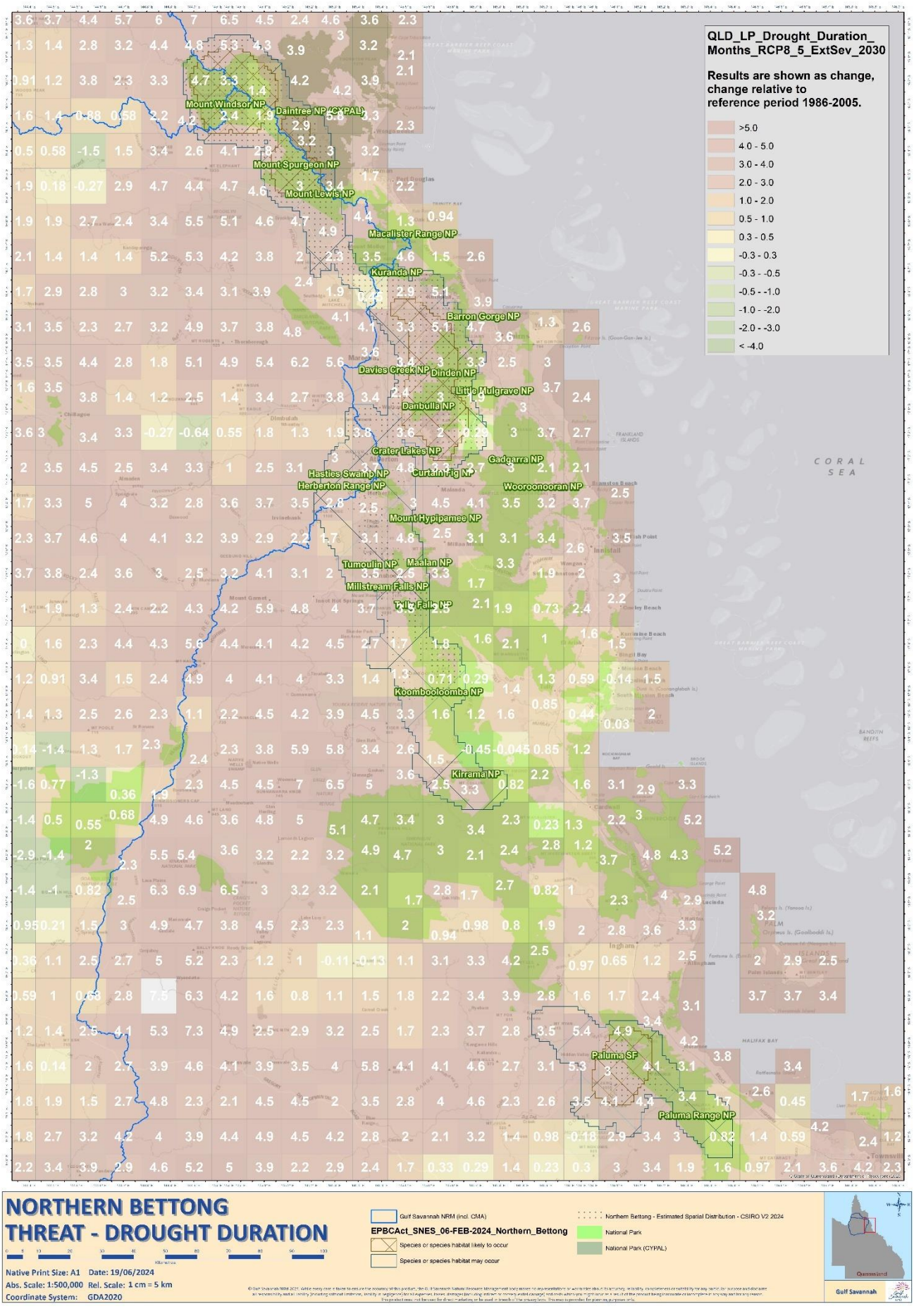
## Map 10 – Northern Greater Glider – Threat – Drought Duration



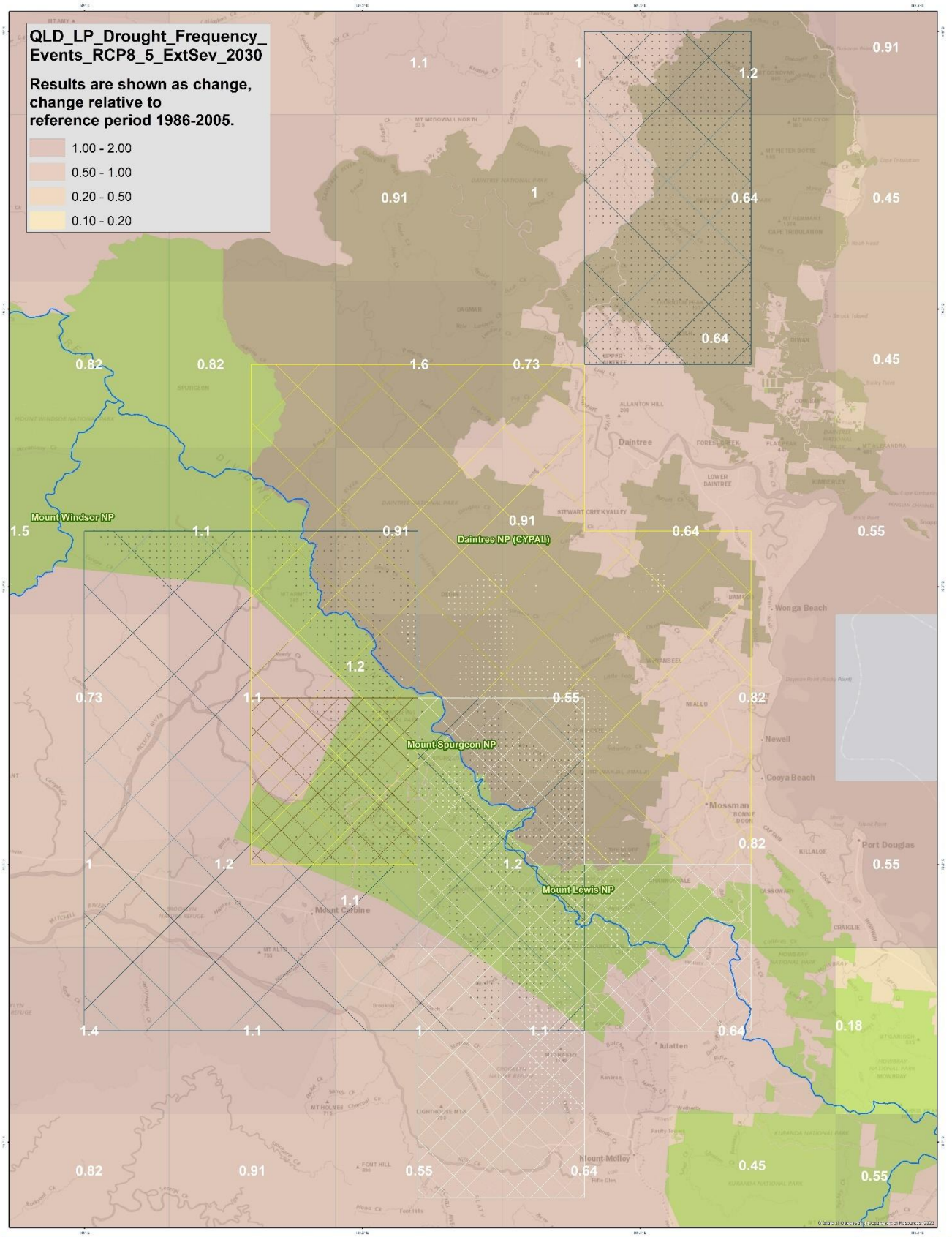
## Map 11 – Northern Bettong– Threat – Drought Frequency



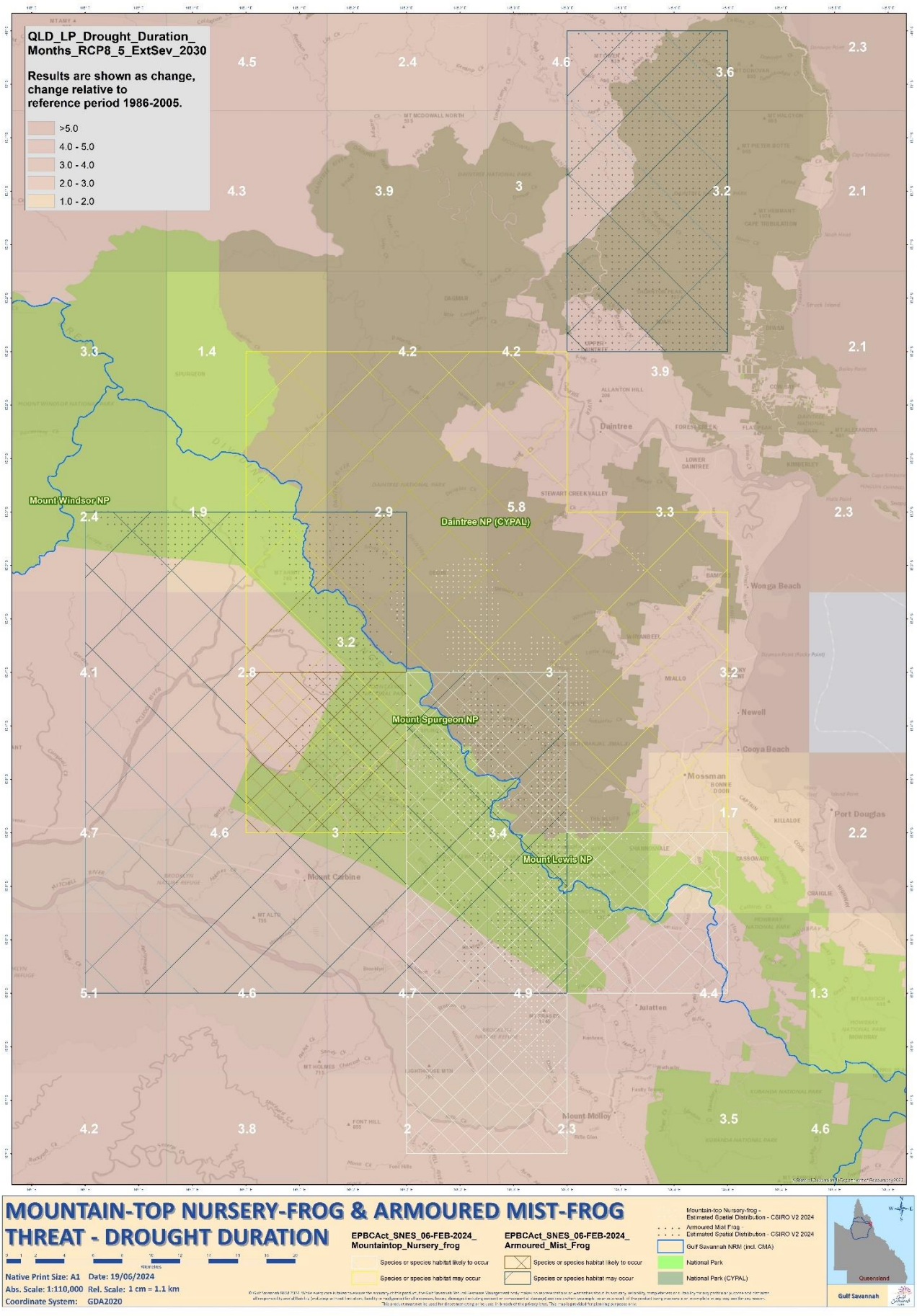
## Map 12 – Northern Bettong– Threat – Drought Duration



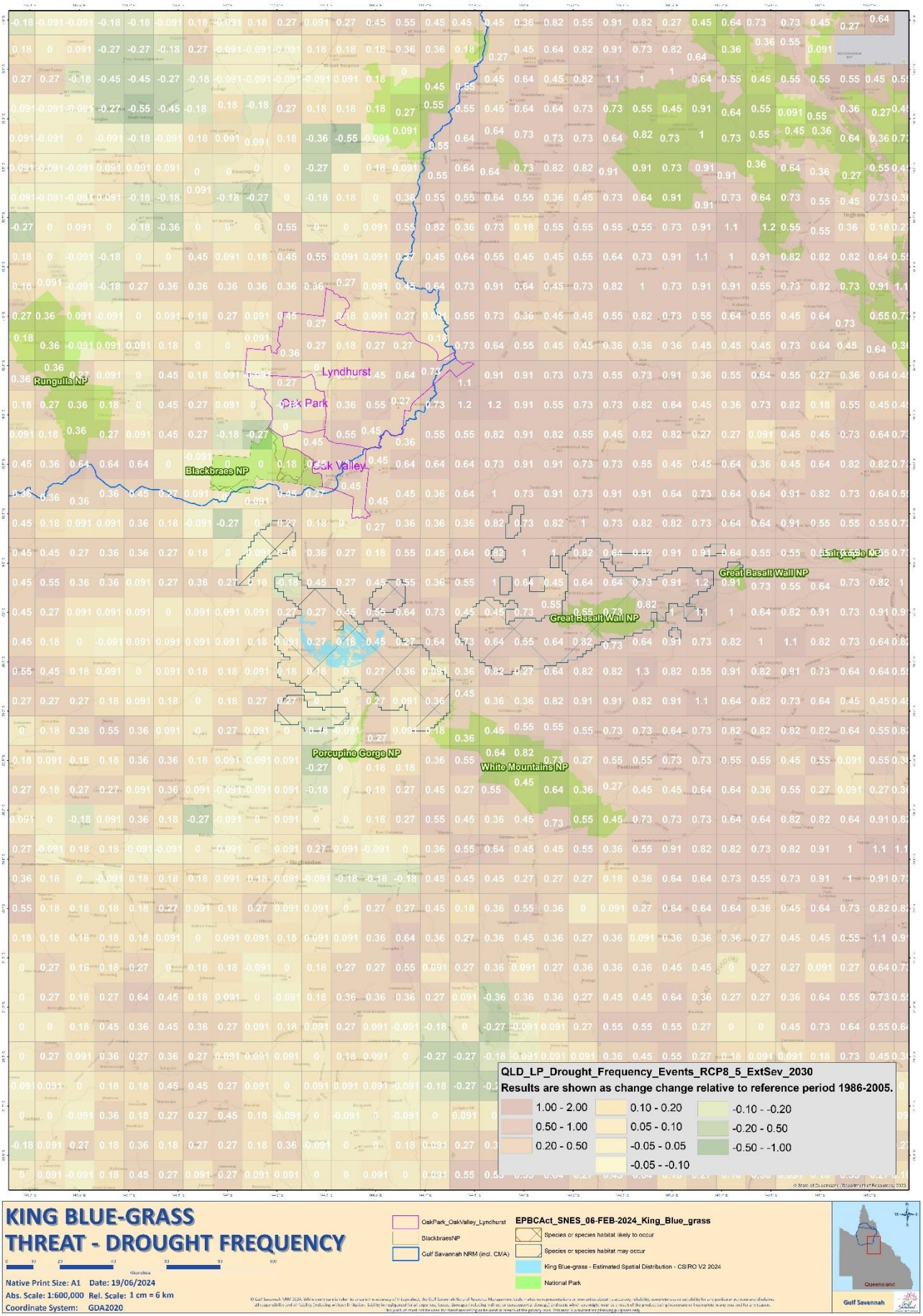
## Map 13 – Mountain-top Nursery Frog & Armoured Mist Frog– Threat – Drought Frequency



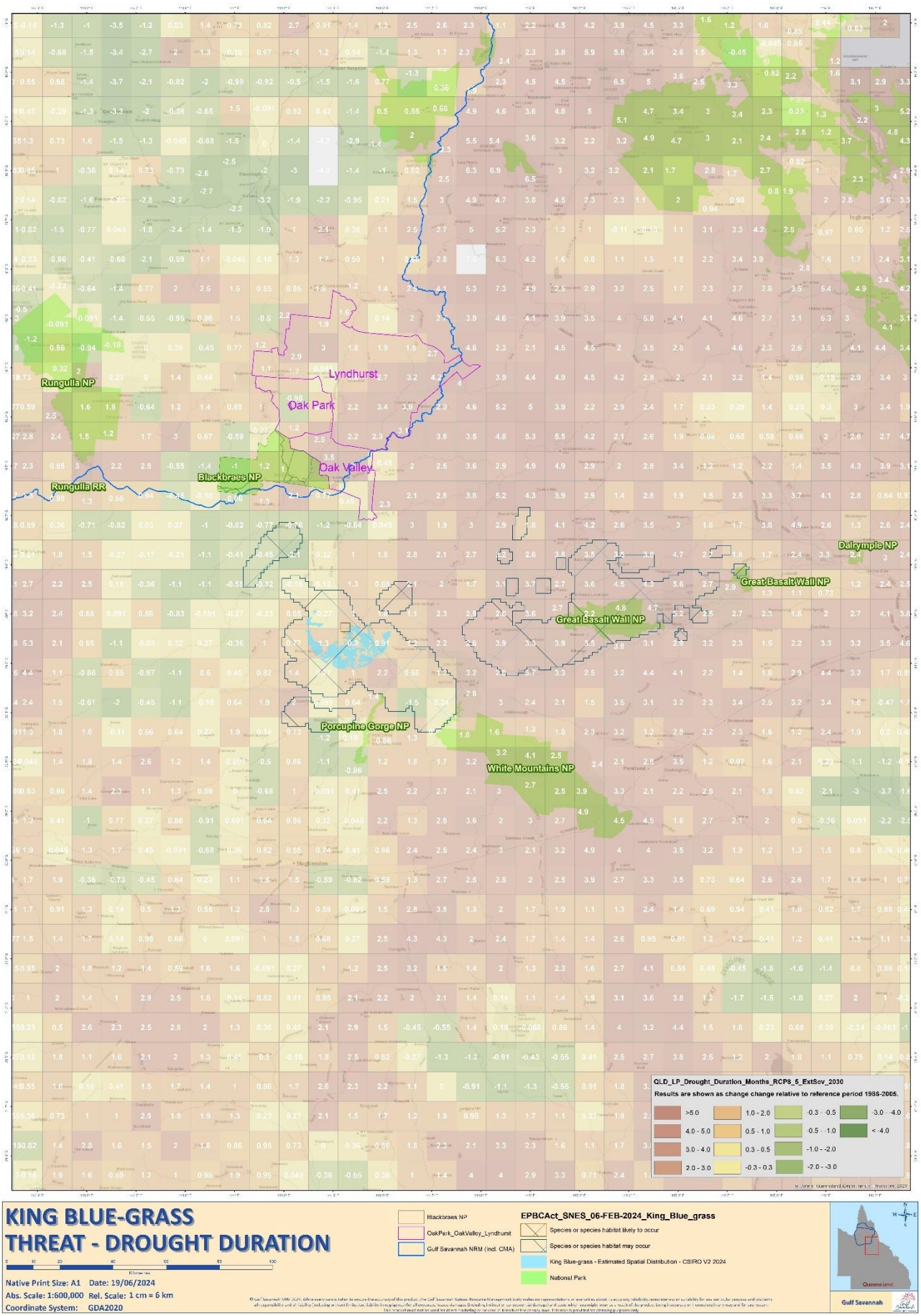
## Map 14 – Mountain-top Nursery Frog & Armoured Mist Frog– Threat – Drought Duration



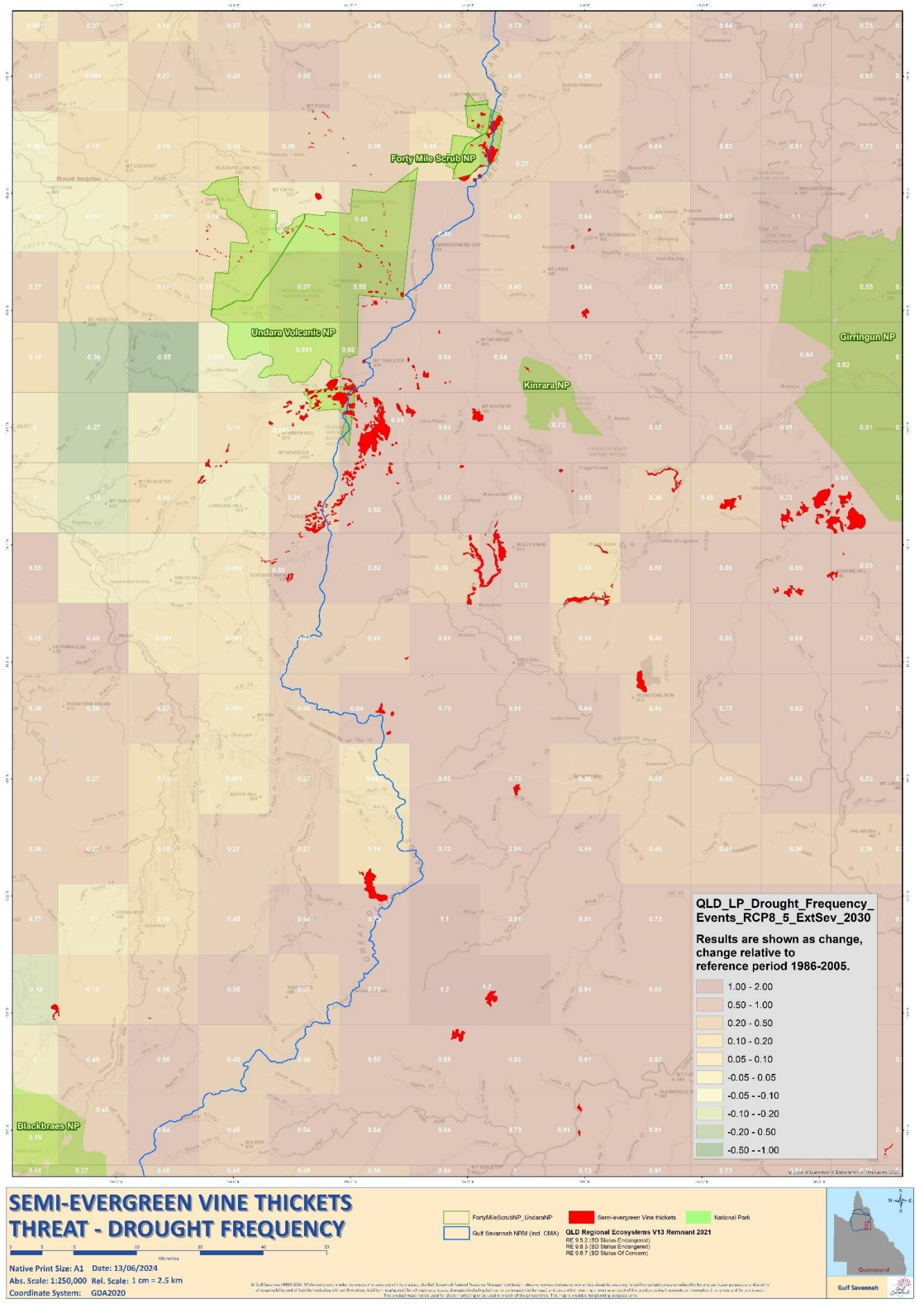
## Map 15 – King Blue Grass– Threat – Drought Frequency



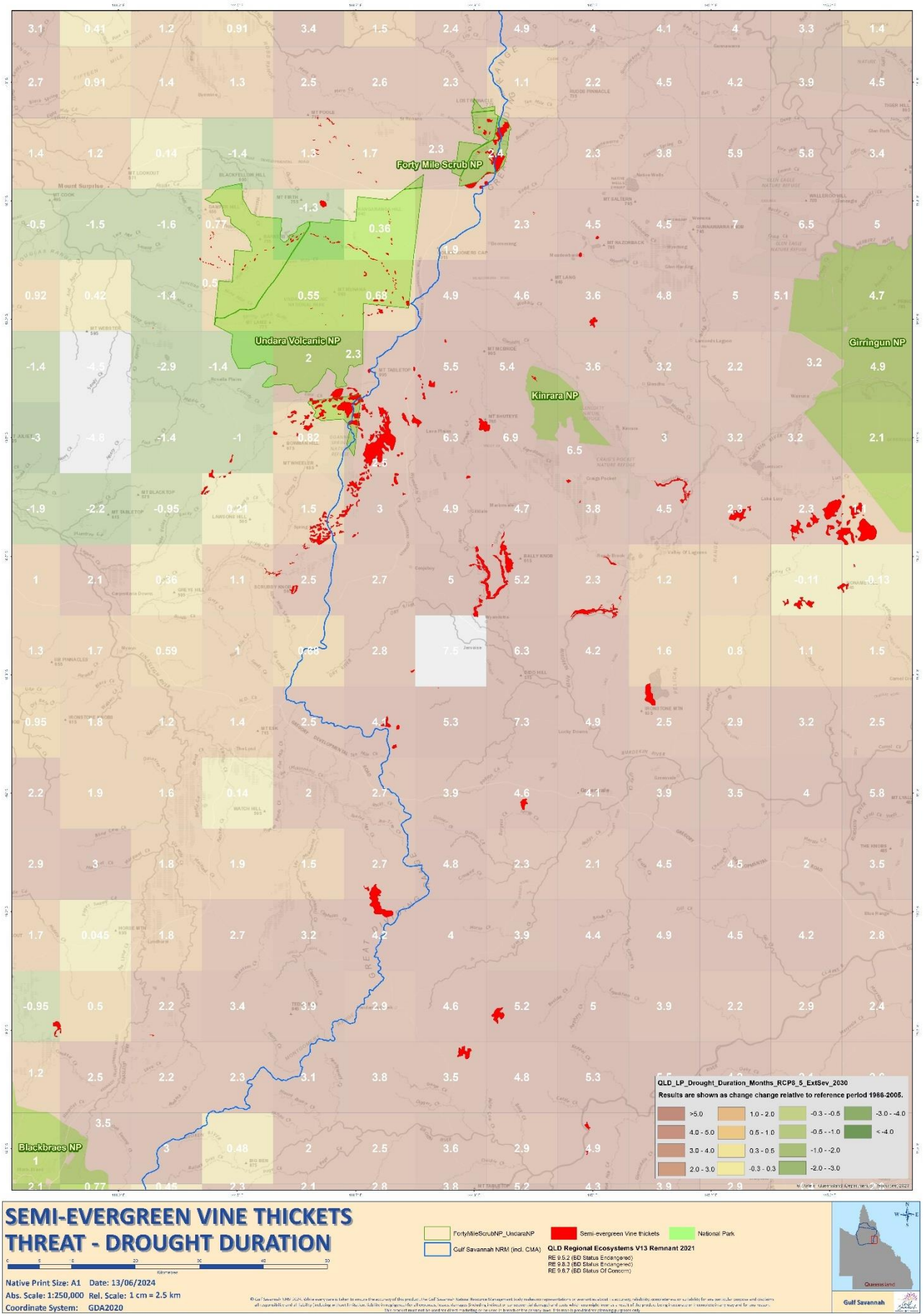
## Map 16 – King Blue Grass– Threat – Drought Duration



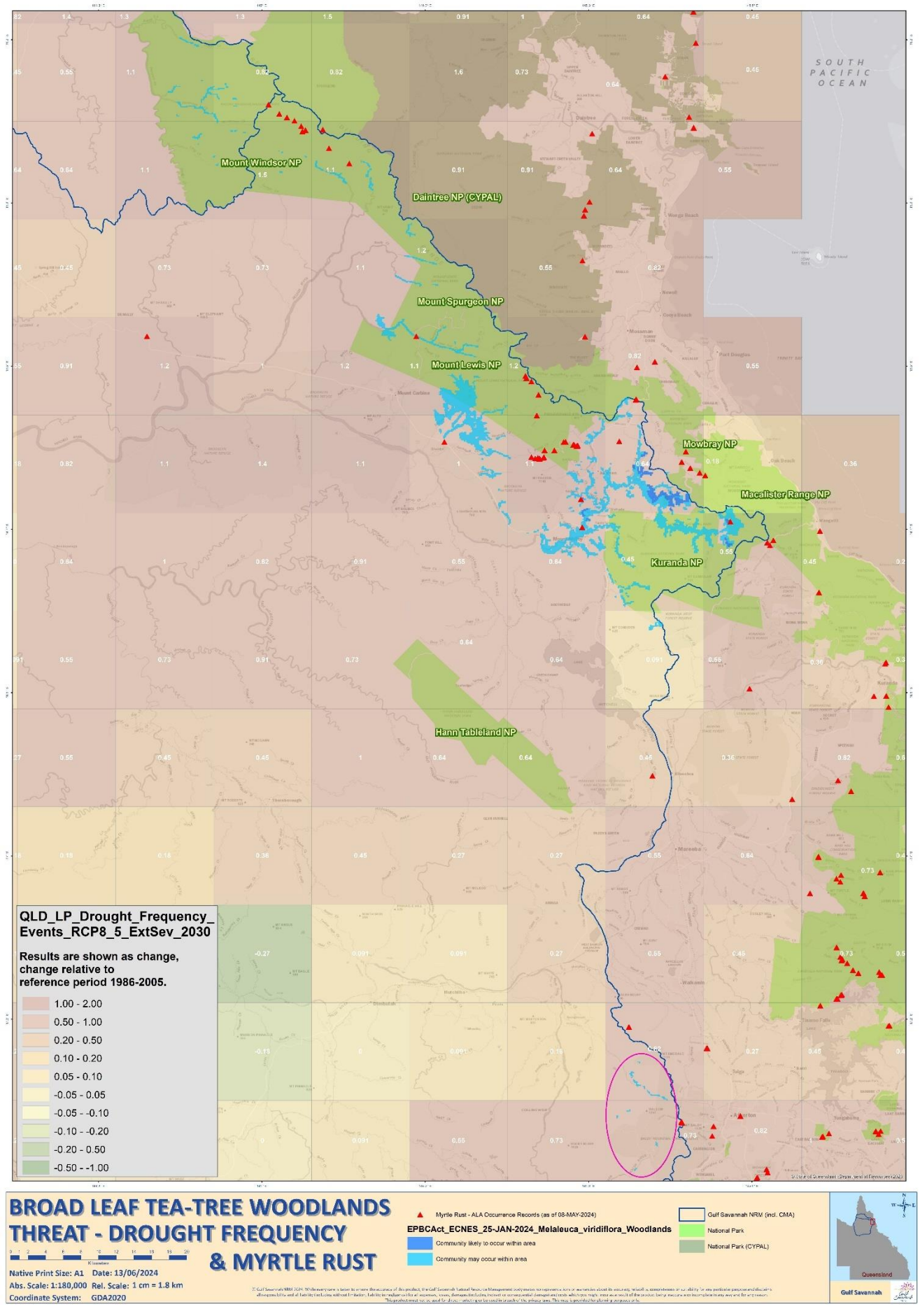
## Map 17 – Semi Evergreen Vine Thickets– Threat – Drought Frequency



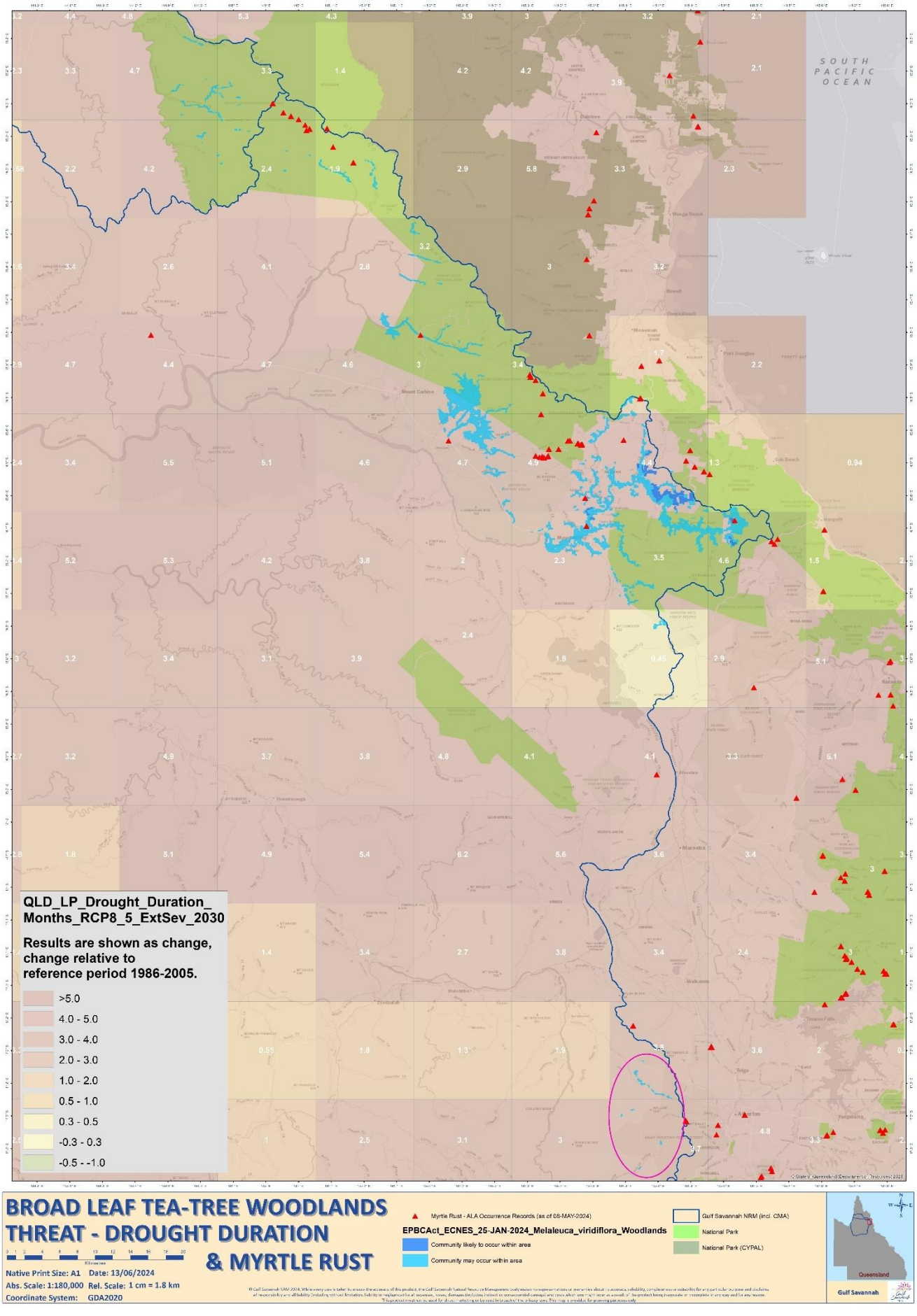
## Map 18 – Semi Evergreen Vine Thickets– Threat – Drought Duration



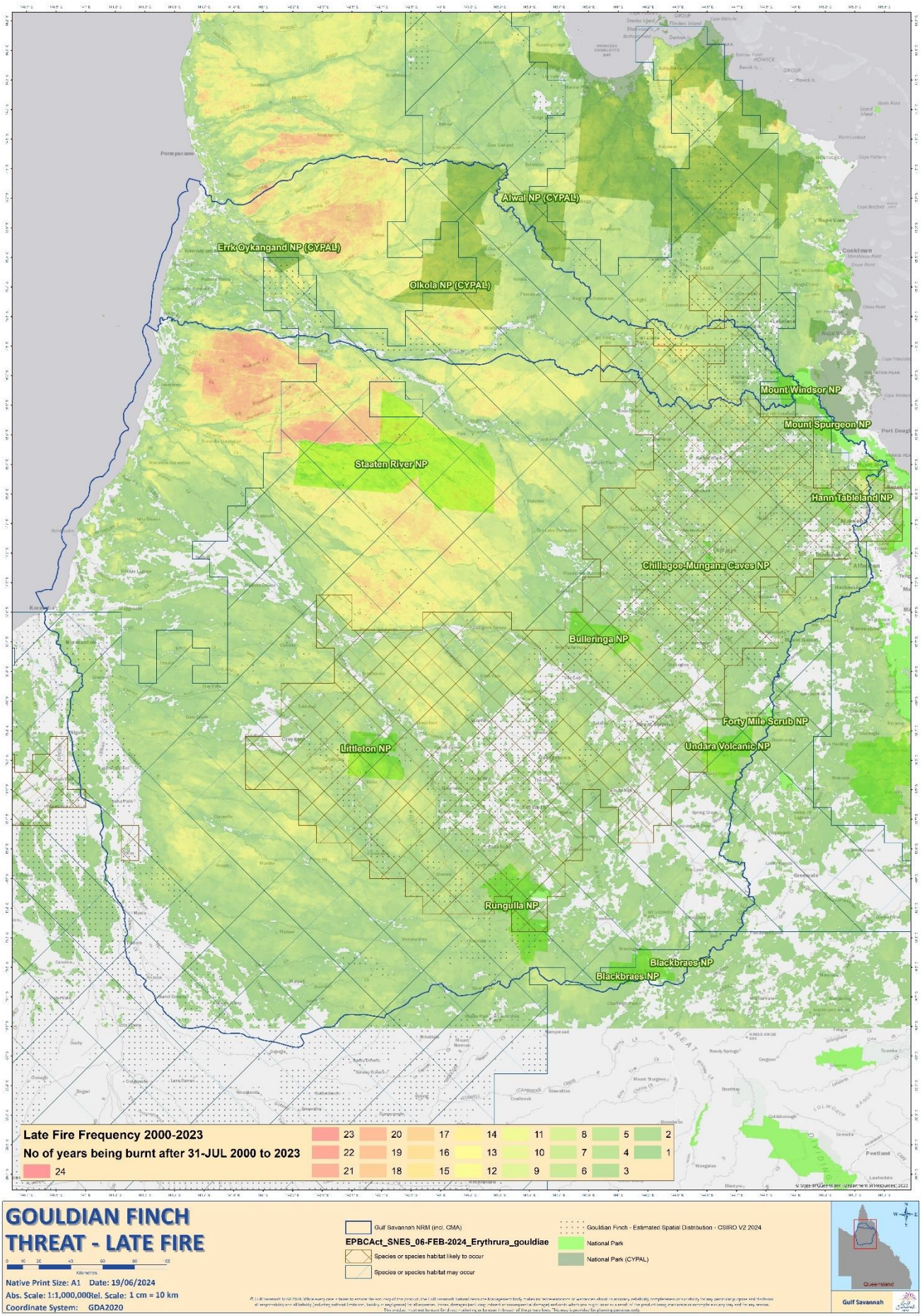
Map 19 – Broad Leaf Tea-tree Woodland -Threat – Drought Frequency & Myrtle Rust



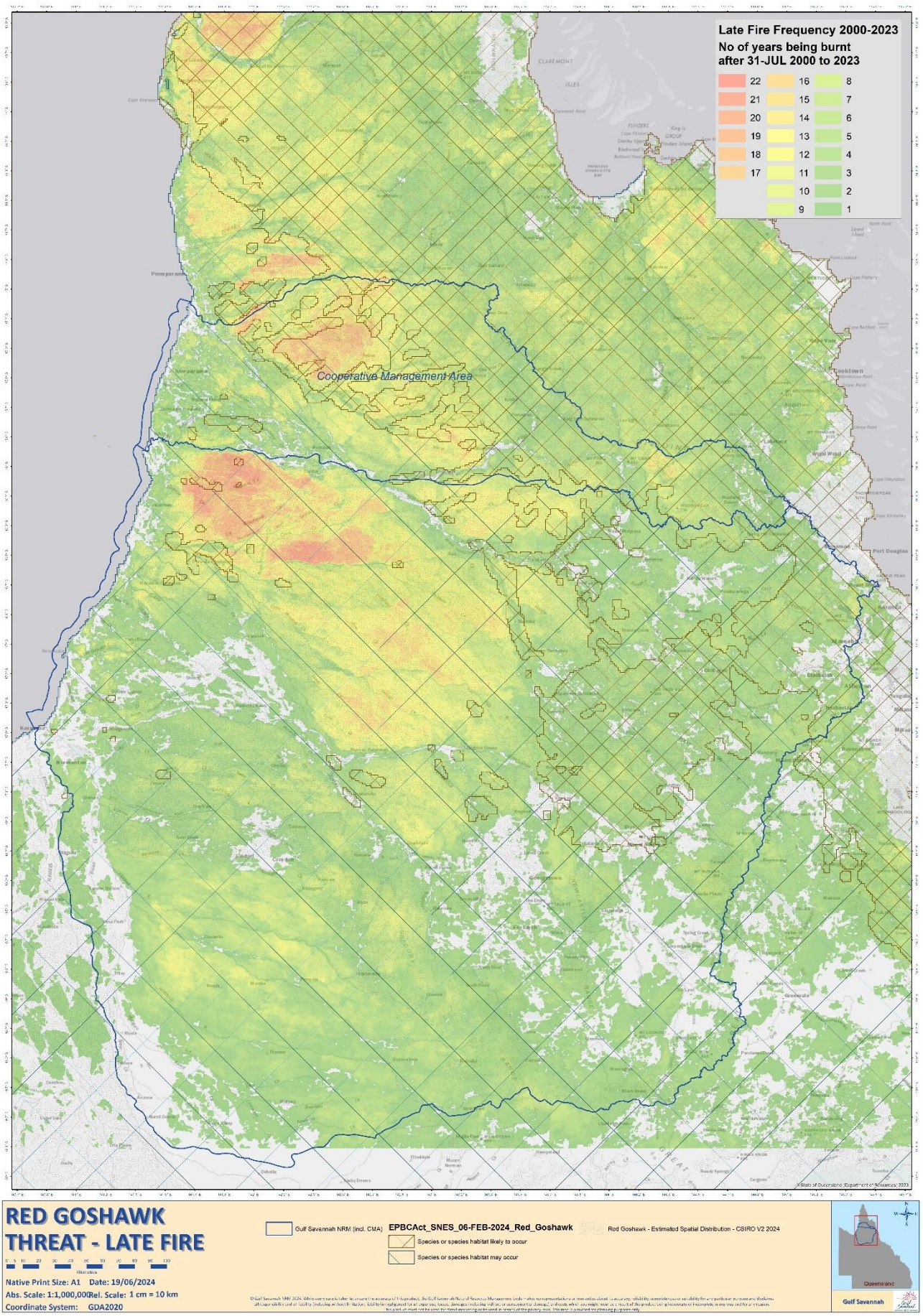
Map 20 – Broad Leaf Tea-tree Woodland -Threat – Drought Duration & Myrtle Rust



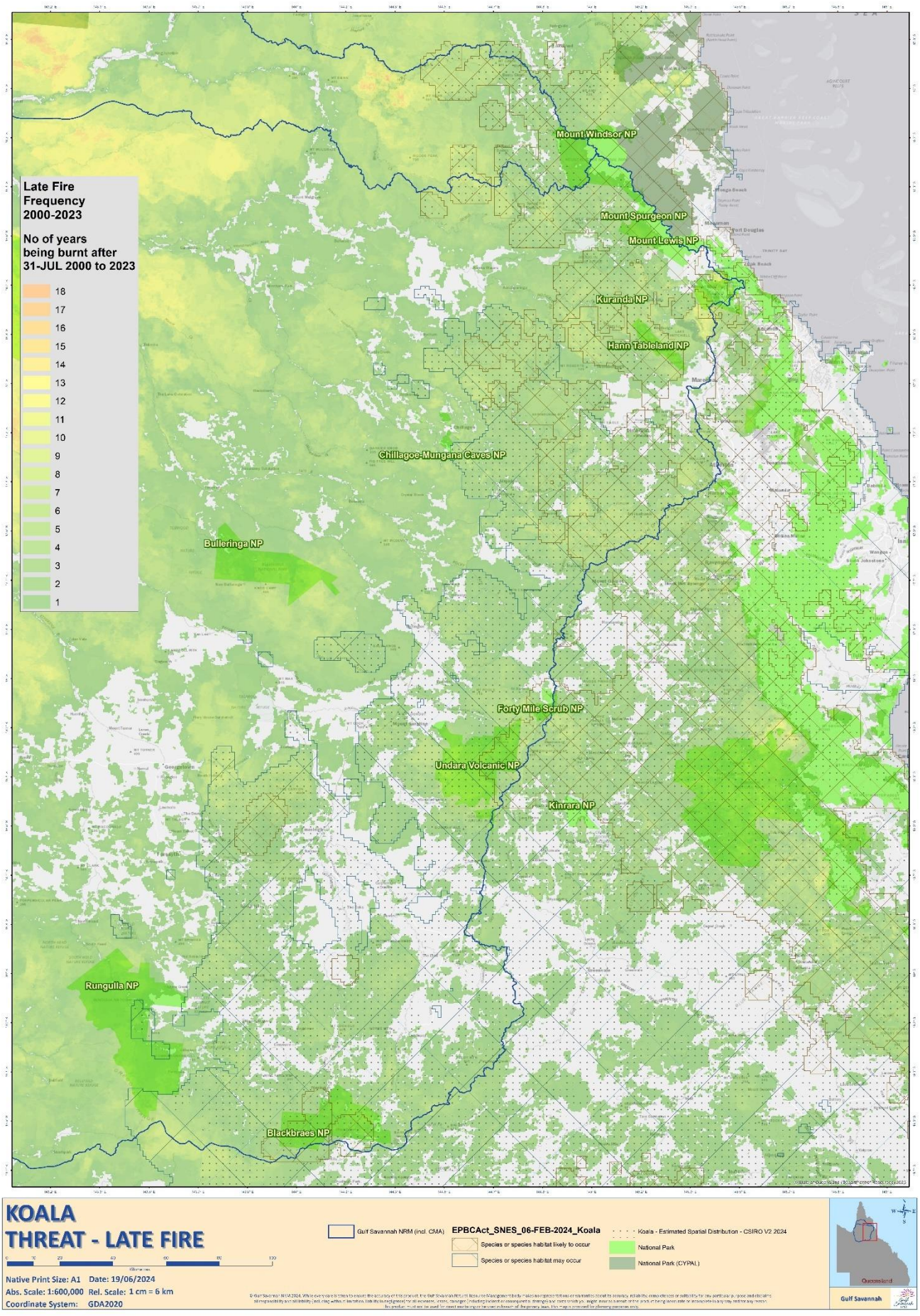
## Map 21 – Gouldian Finch -Threat – Late Fire



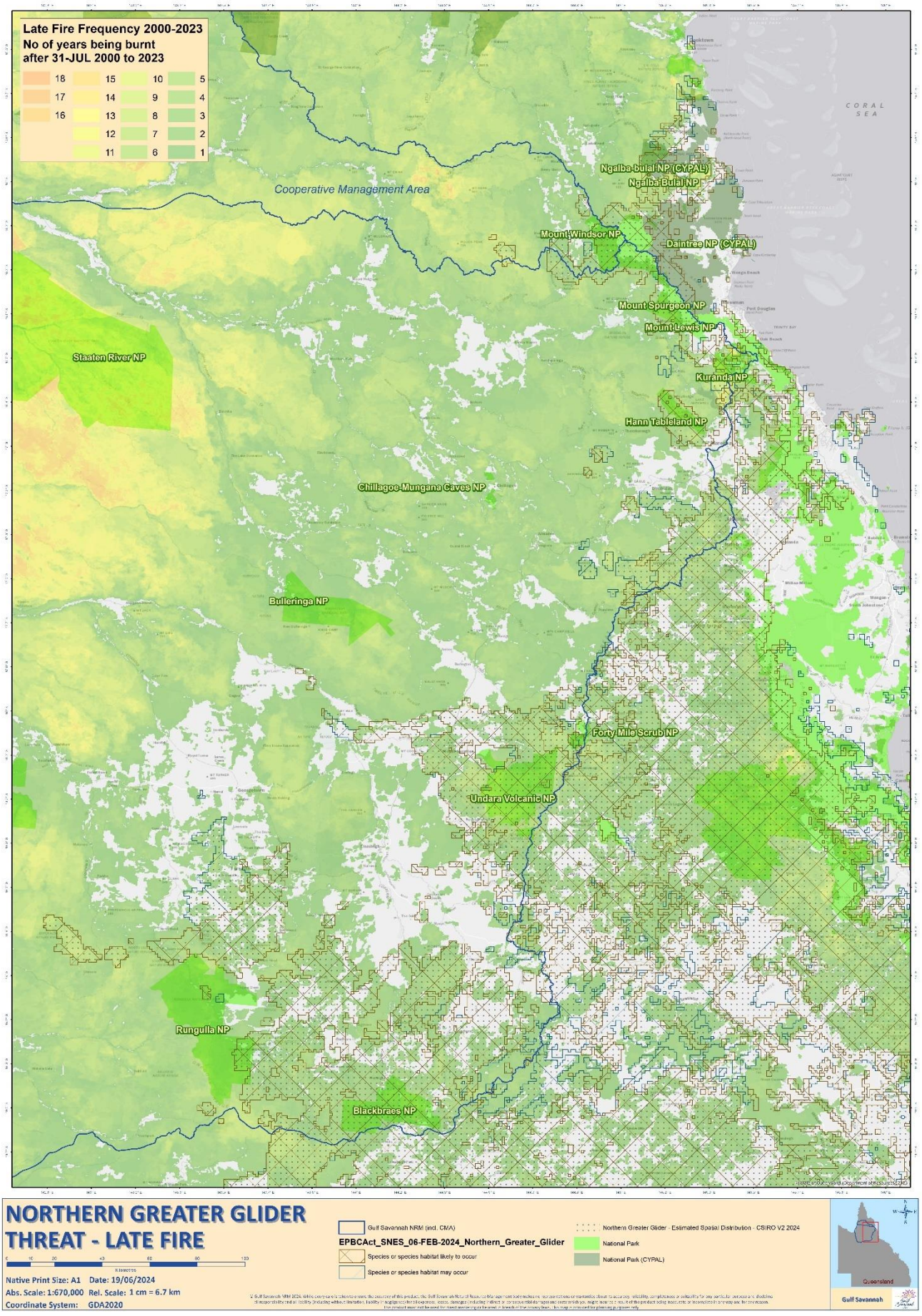
## Map 22 – Red Goshawk -Threat – Late Fire



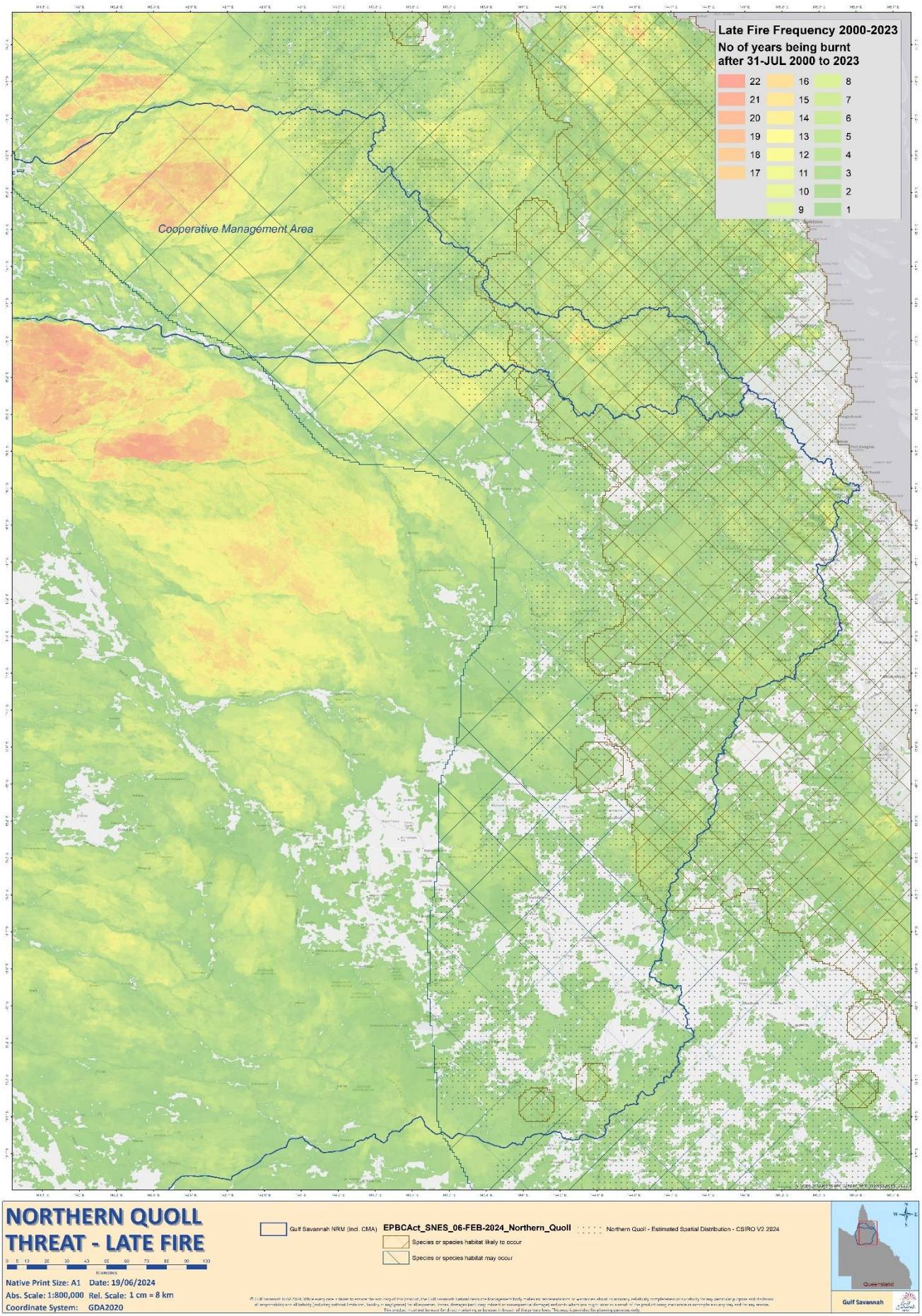
## Map 23 – Koala -Threat – Late Fire



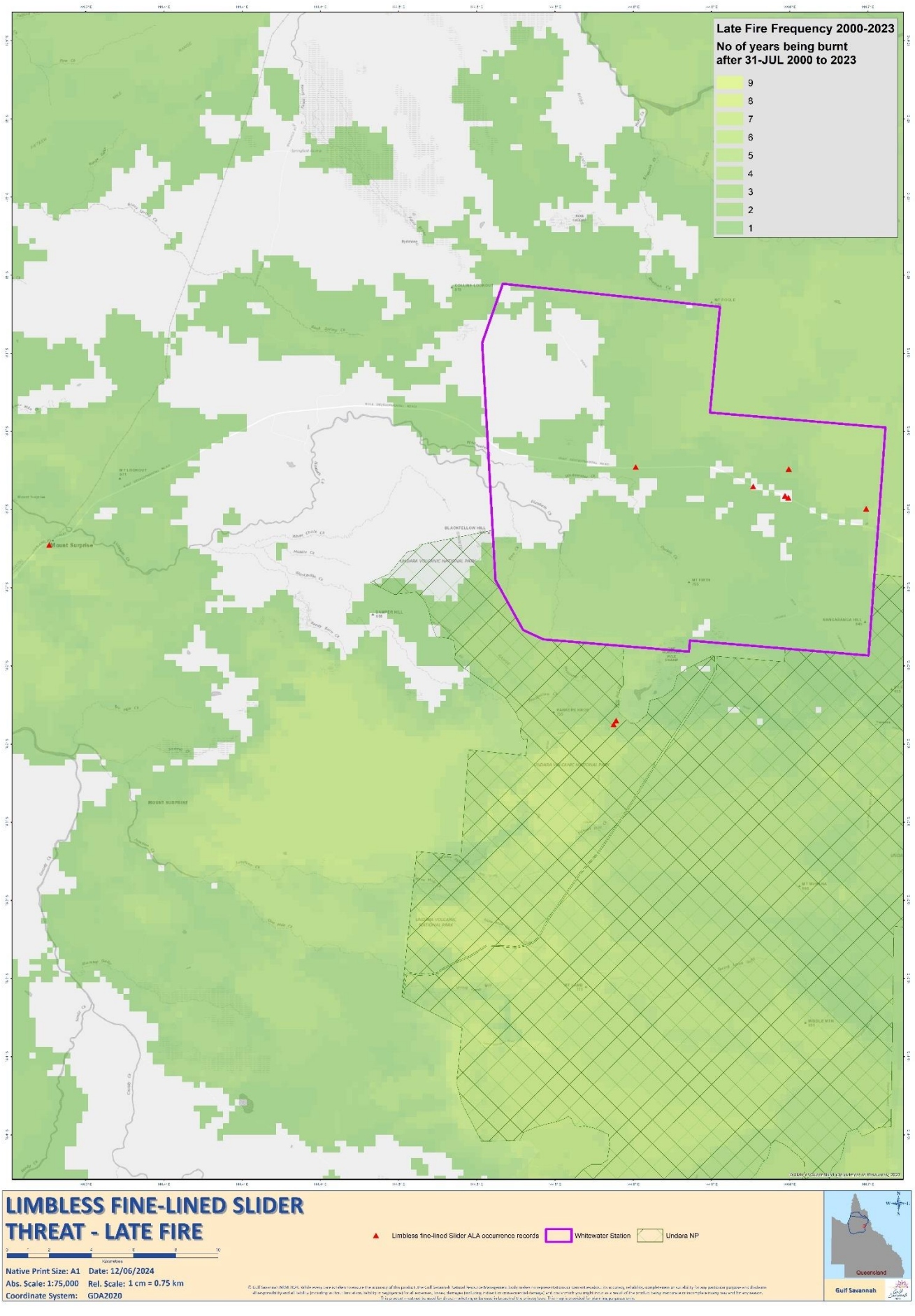
## Map 24 – Northern Greater Glider -Threat – Late Fire



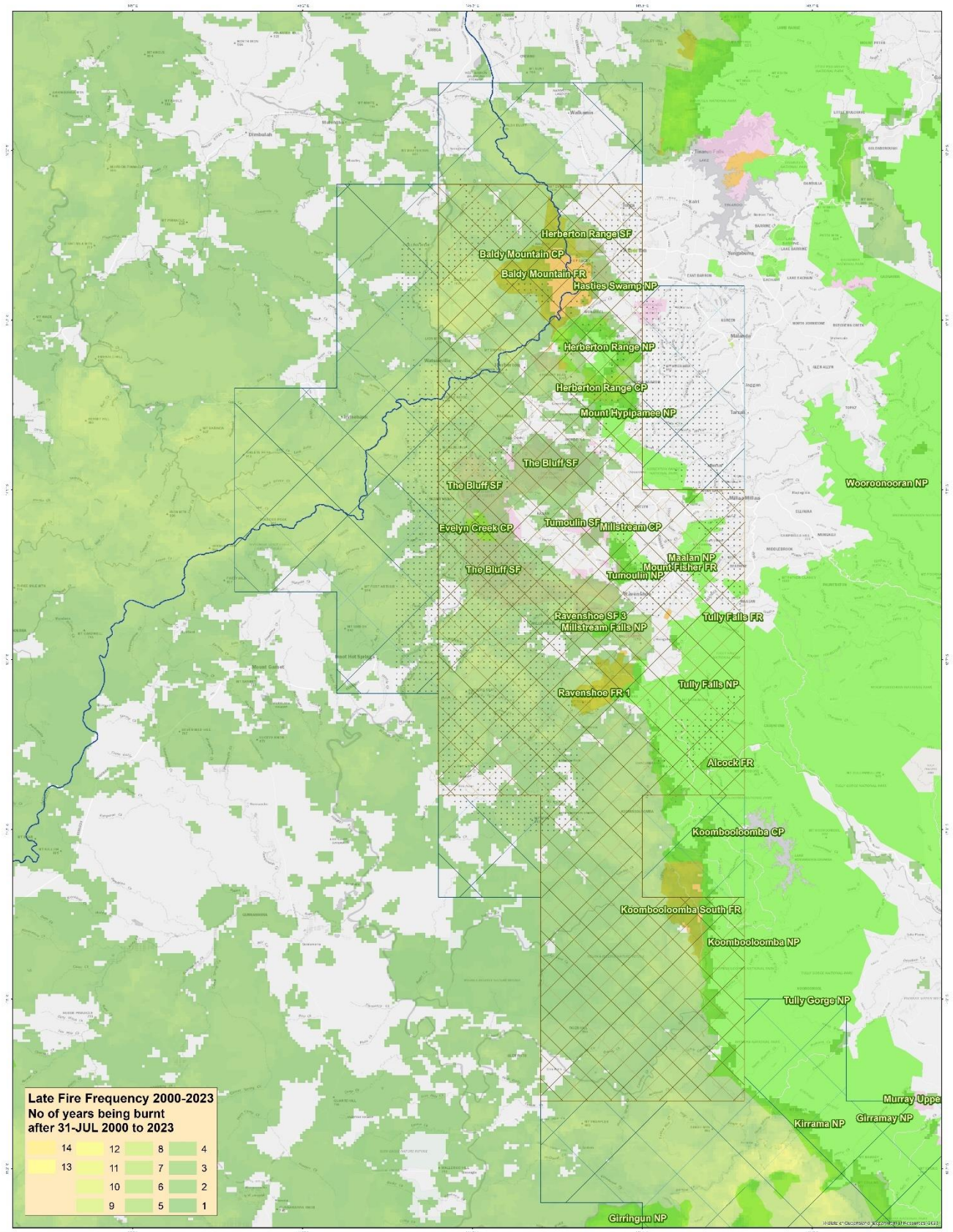
## Map 25 – Northern Quoll -Threat – Late Fire



## Map 26 – Limbless Fine-lined Slider -Threat – Late Fire



## Map 27 – Magnificent Brood Frog -Threat – Late Fire

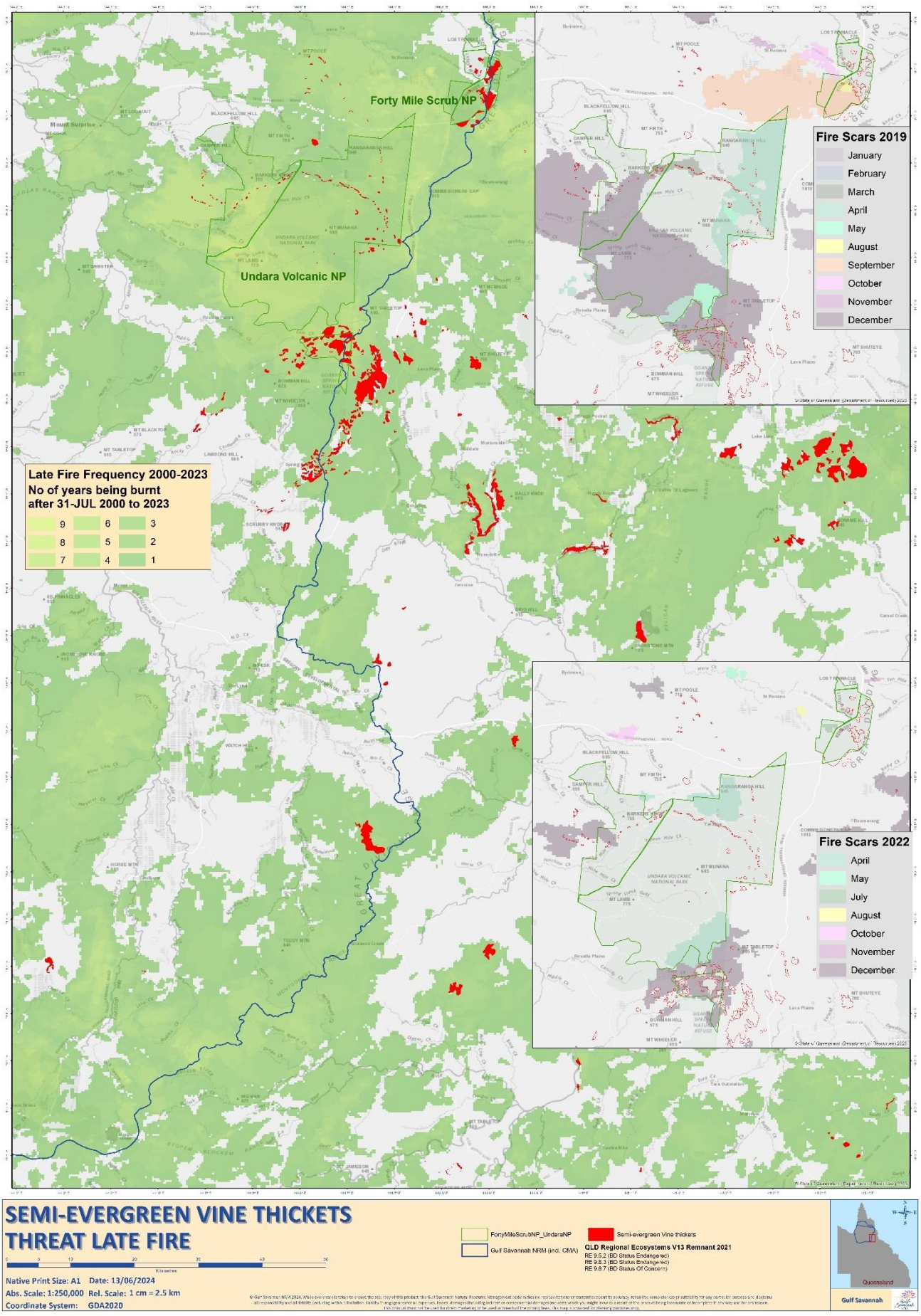



**MAGNIFICENT BROOD FROG THREAT - LATE FIRE**

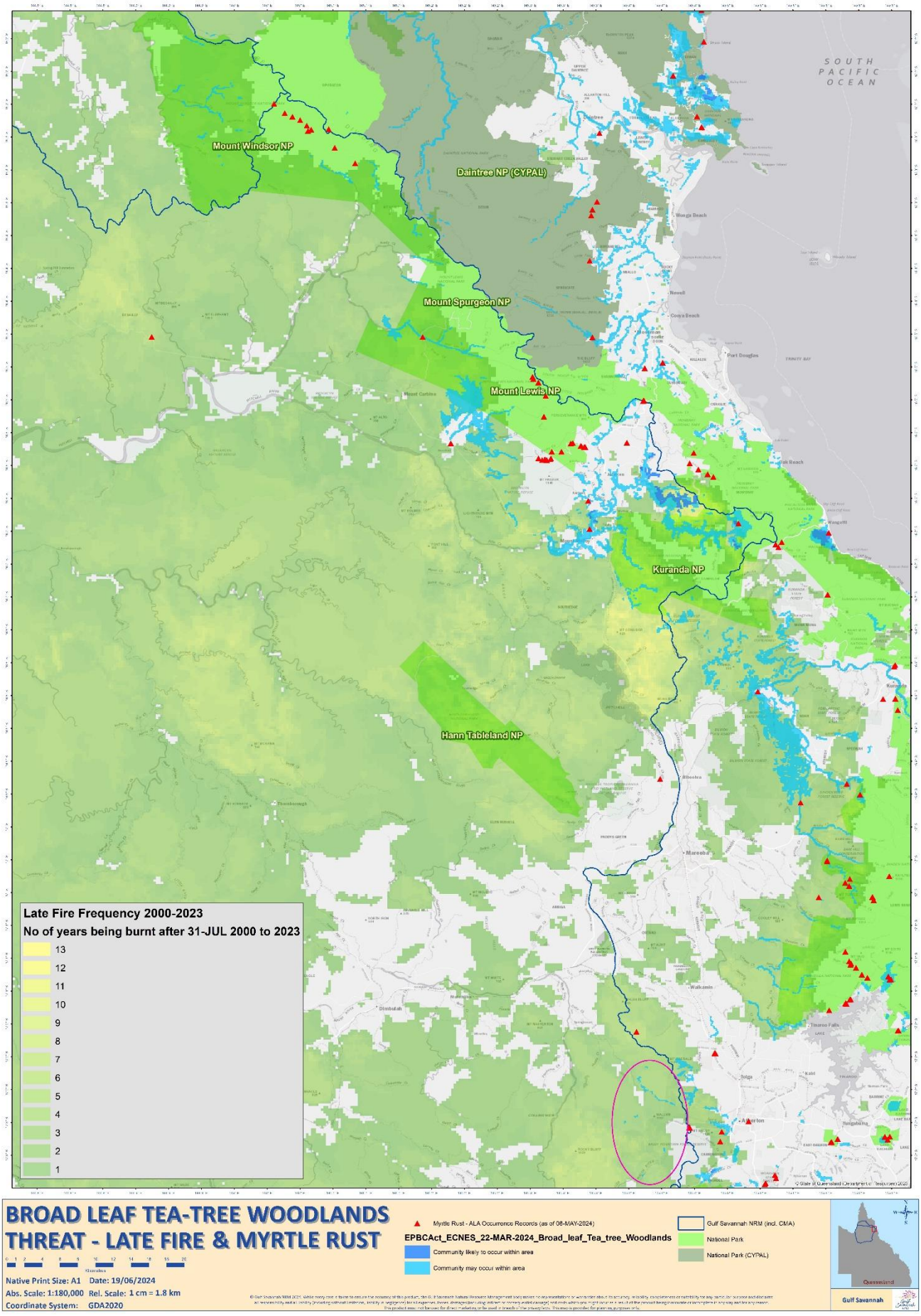
Native Print Size: A1 Date: 19/06/2024
Abs. Scale: 1:180,000 Rel. Scale: 1 cm = 1.8 km
Coordinate System: GDA2020

EPBCAct_SNES_06-FEB-2024_Pseudophryne_covacevichae
Species or species habitat likely to occur
Species or species habitat may occur
Magnificent Brood Frog - Estimated Spatial Distribution - CSIRO V2 2024
Gulf Savannah NRM (incl. CMA)
National Park
Conservation Park
State Forest
Forest Reserve

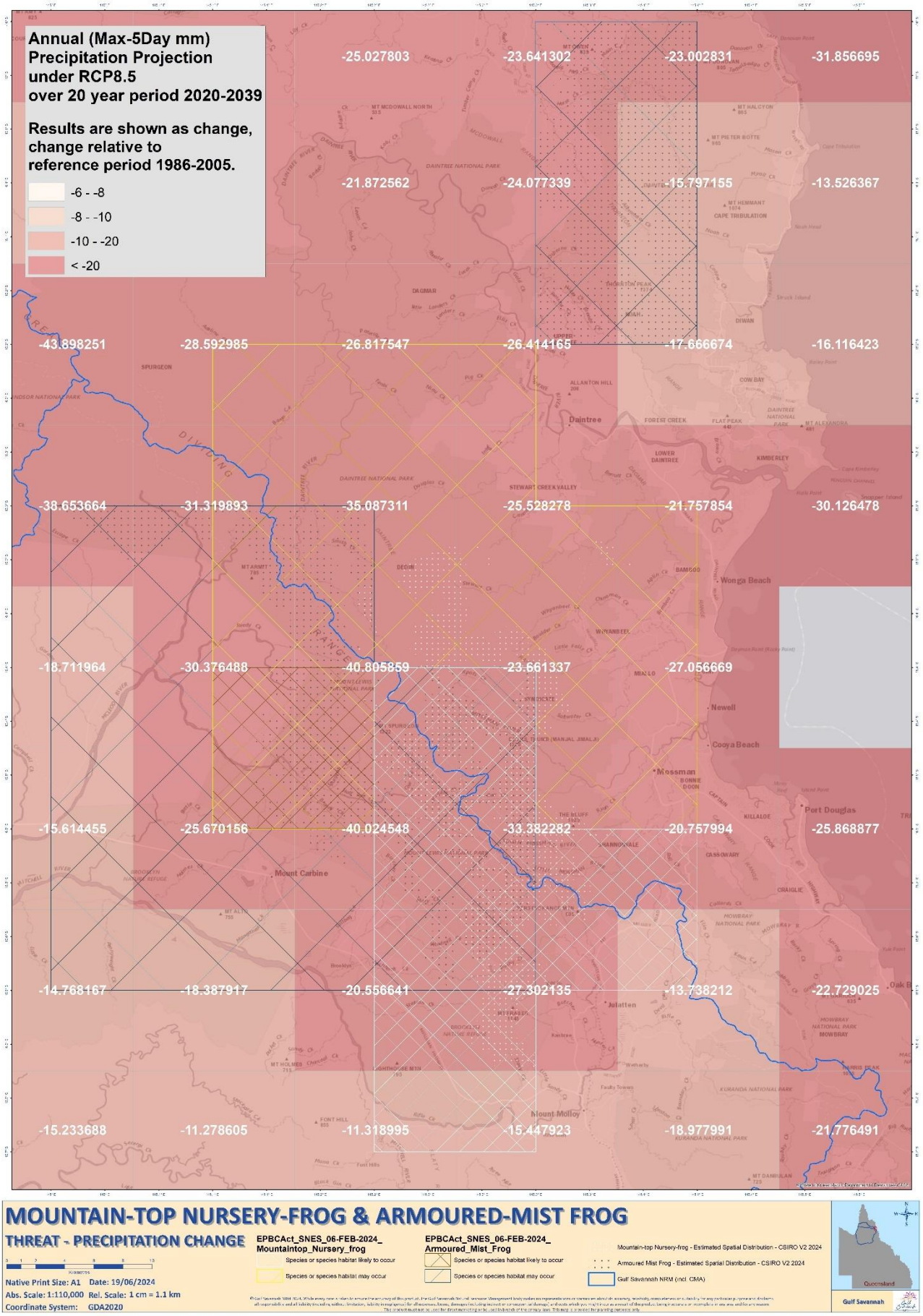
## Map 28 – Semi Evergreen Vine Thickets -Threat – Late Fire



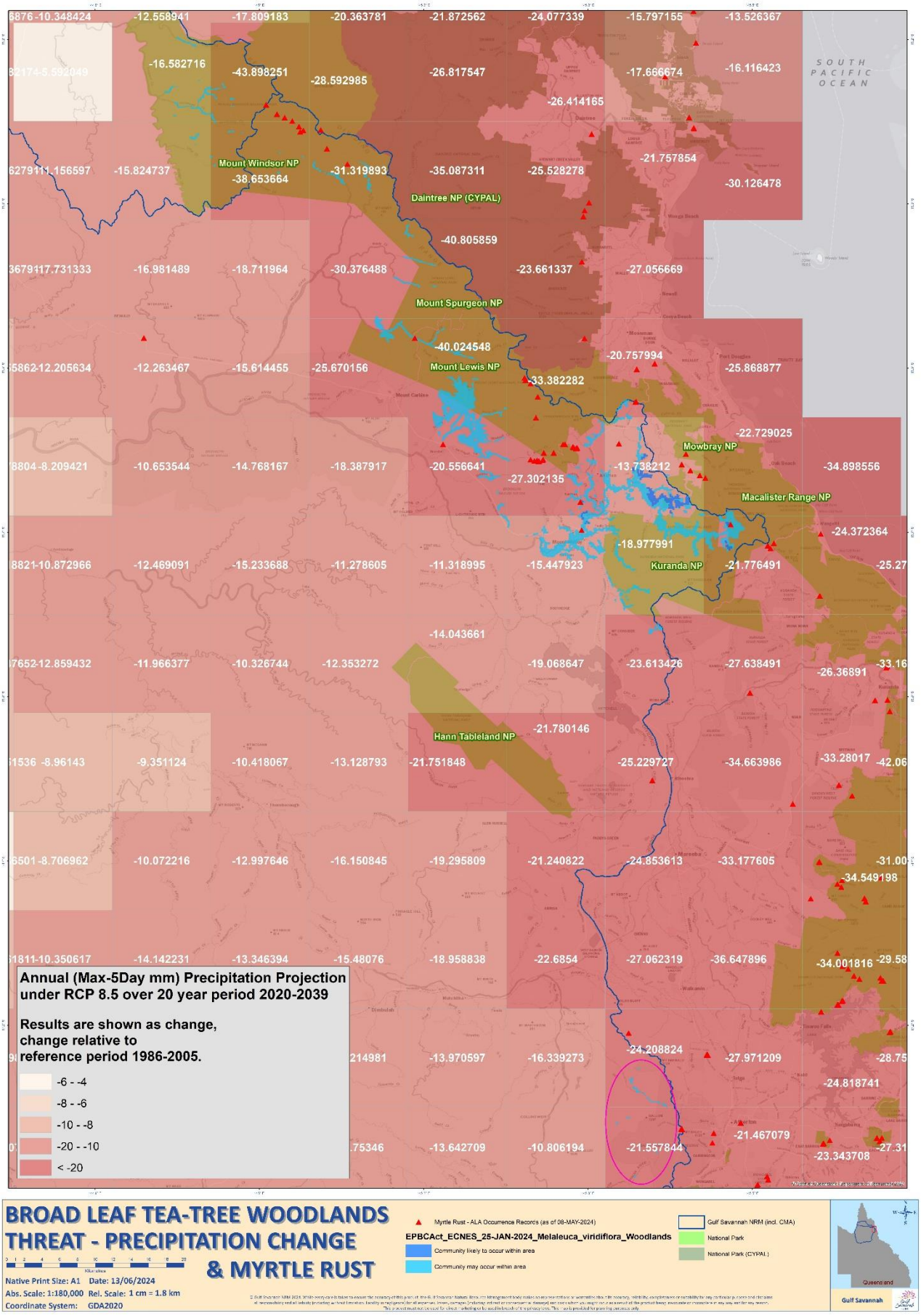
## Map 29 – Broad Leaf Tea-Tree Woodlands-Threat – Late Fire & Myrtle Rust



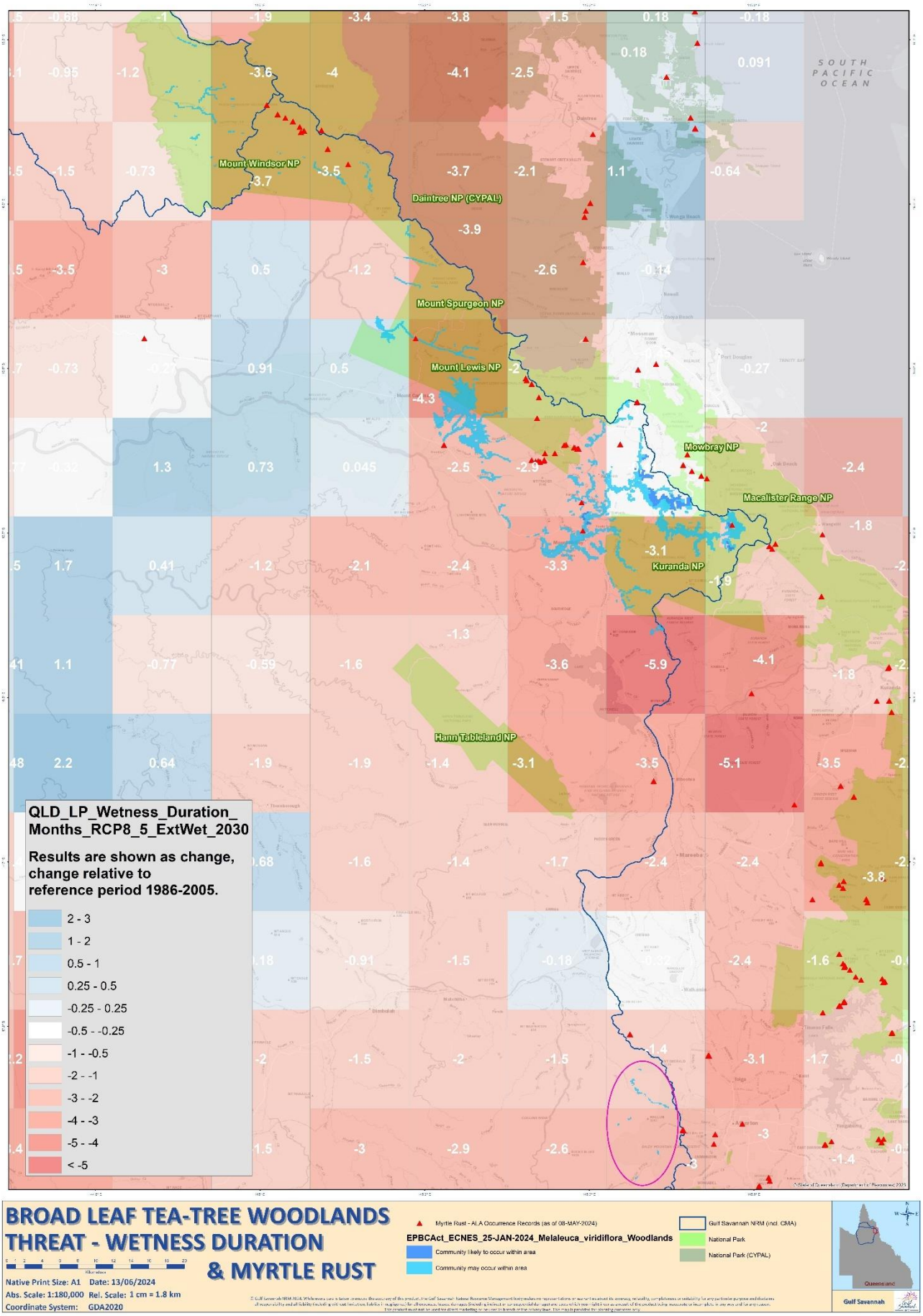
## Map 30 – Mountain-Top Nursery Frog & Armoured Mist Frog- Threat – Precipitation Change



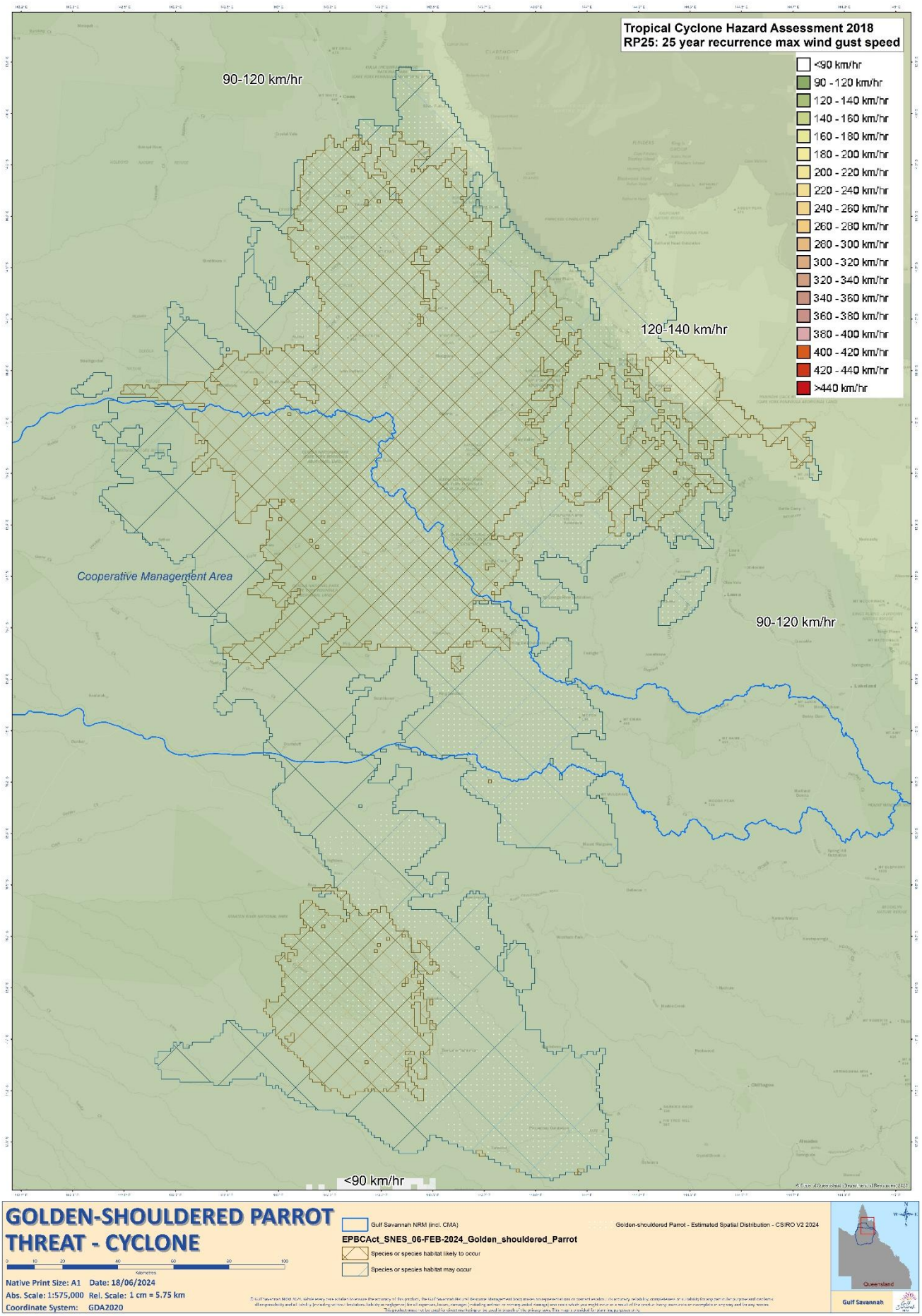
## Map 31 – Broad Leaf Tea-Tree- Threat – Precipitation Change & Myrtle Rust



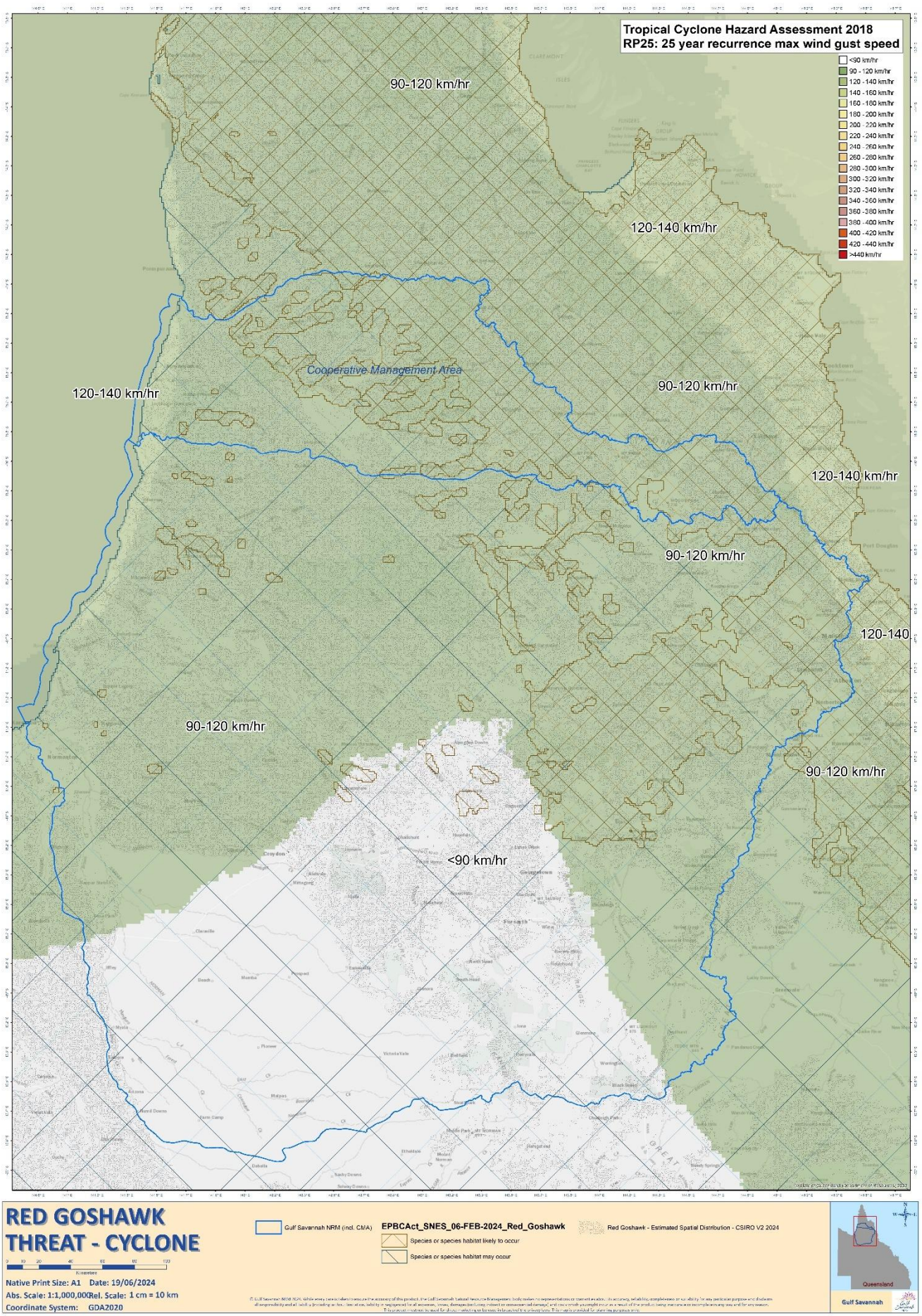
Map 32 – Broad Leaf Tea-Tree- Threat – Wetness Duration & Myrtle Rust



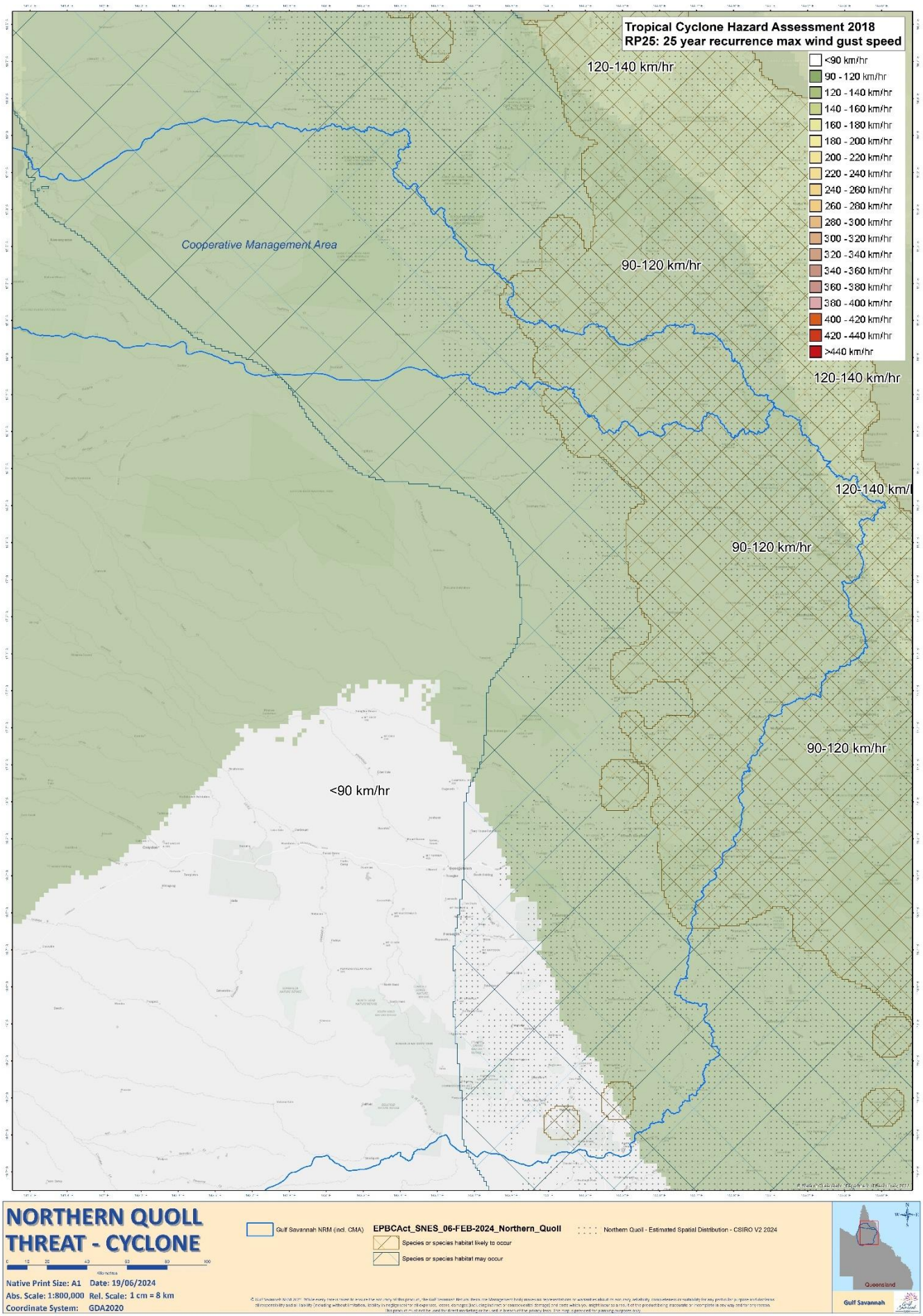
## Map 33 – Golden Shouldered Parrot- Threat – Cyclone



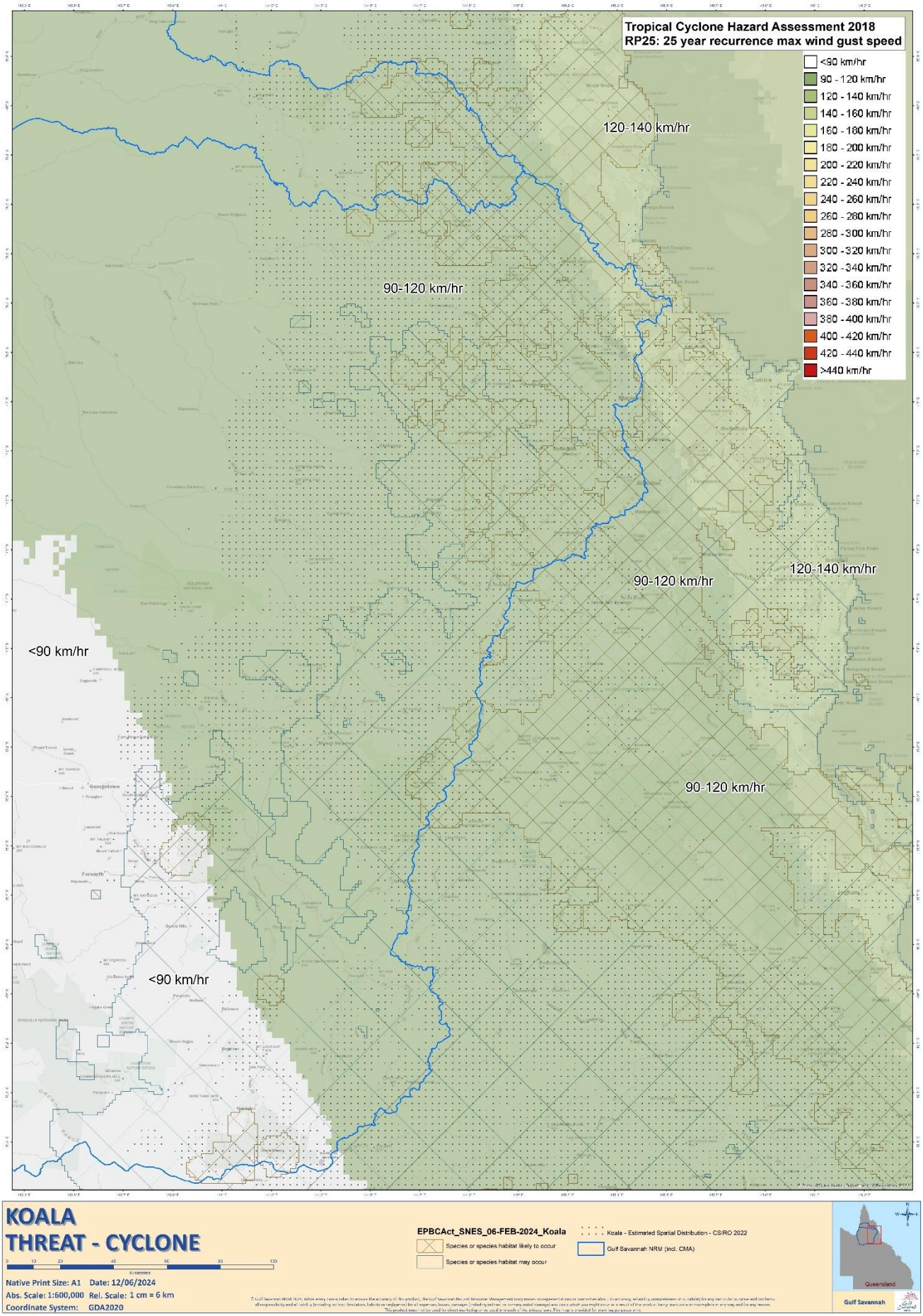
## Map 34 – Red Goshawk - Threat – Cyclone



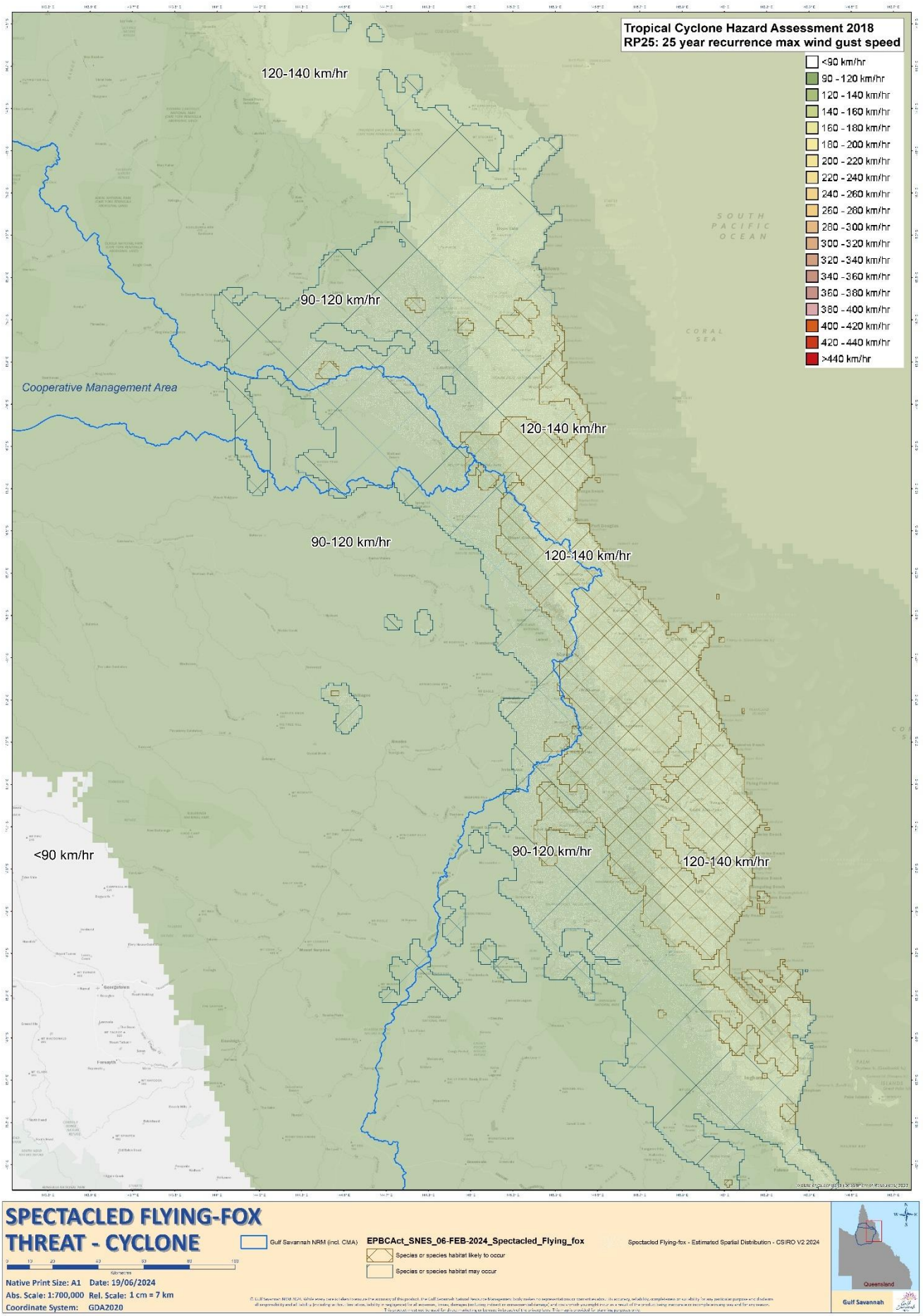
## Map 35 – Northern Quoll - Threat – Cyclone



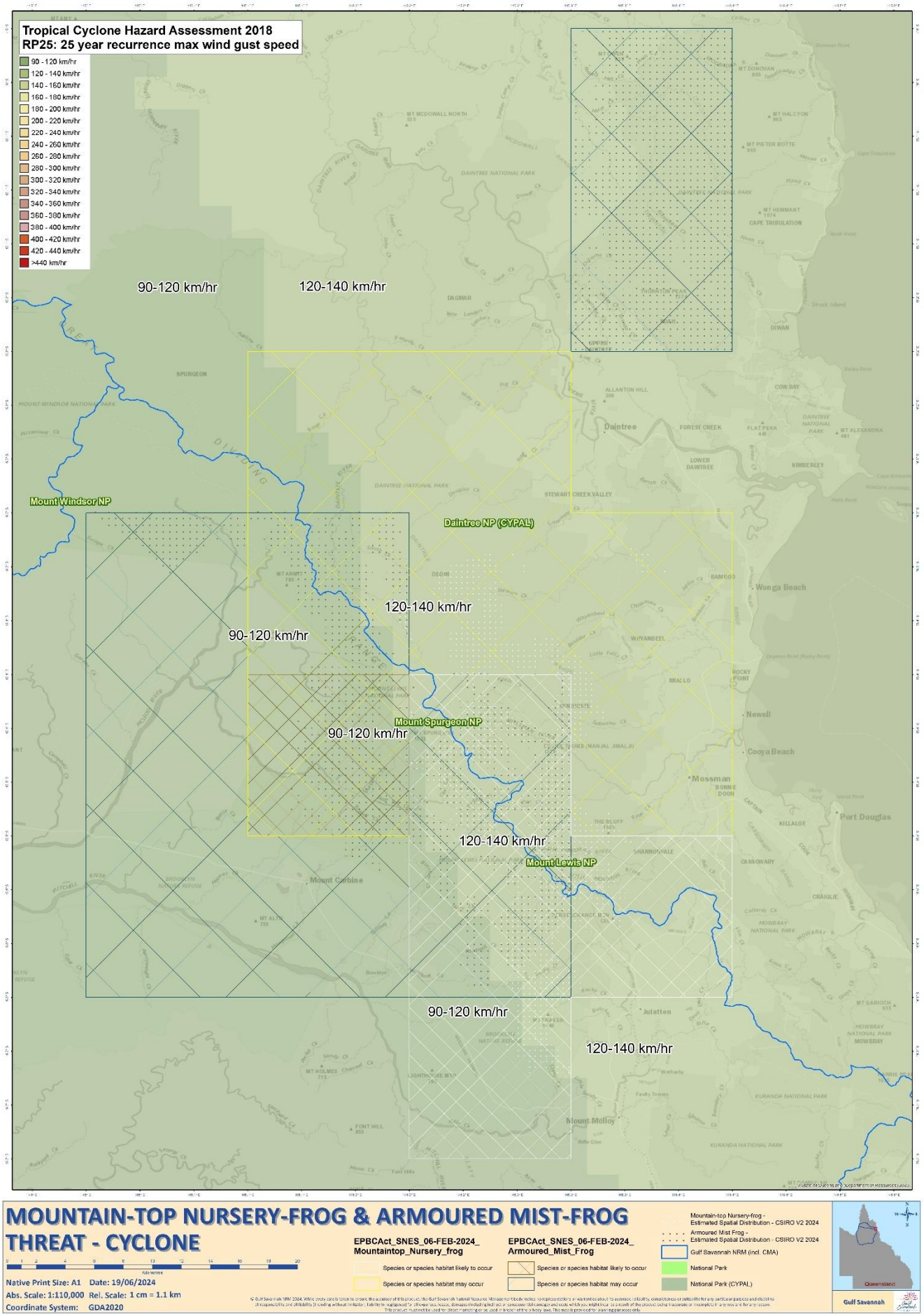
## Map 36 – Koala - Threat – Cyclone



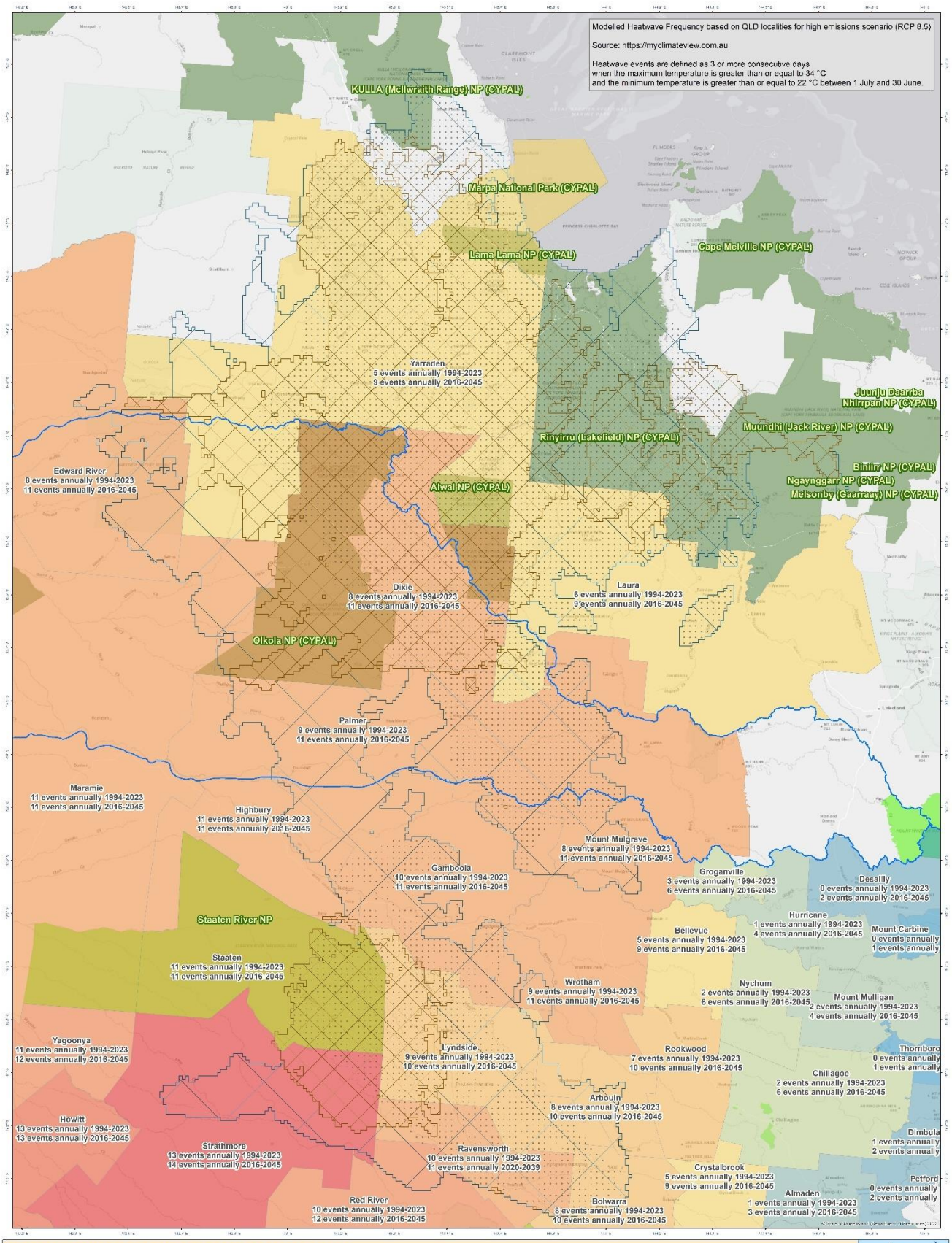
## Map 37 – Spectacled Flying-Fox - Threat – Cyclone



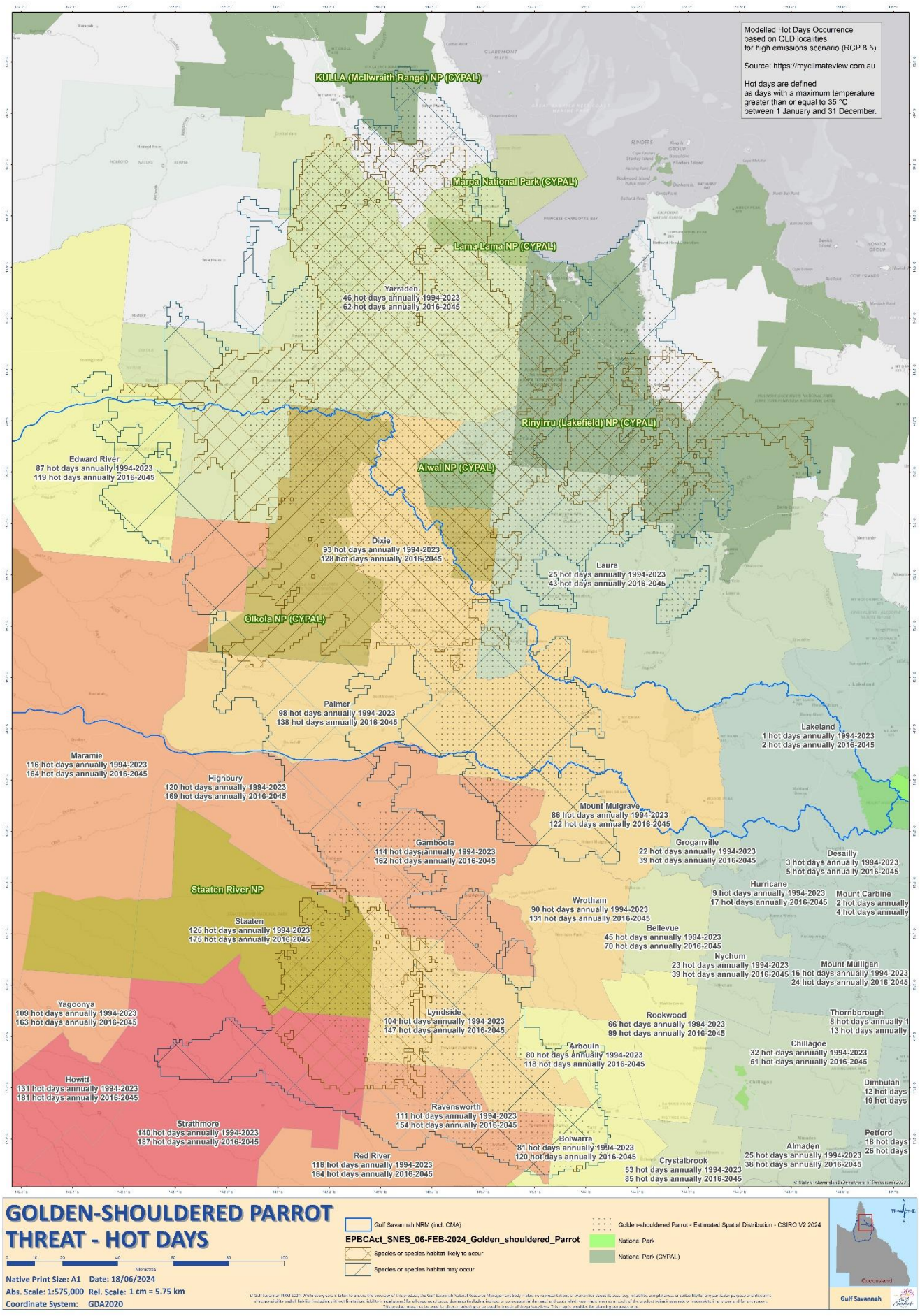
## Map 38 – Mountain Top Nursery Frog & Armoured Mist Frog - Threat – Cyclone



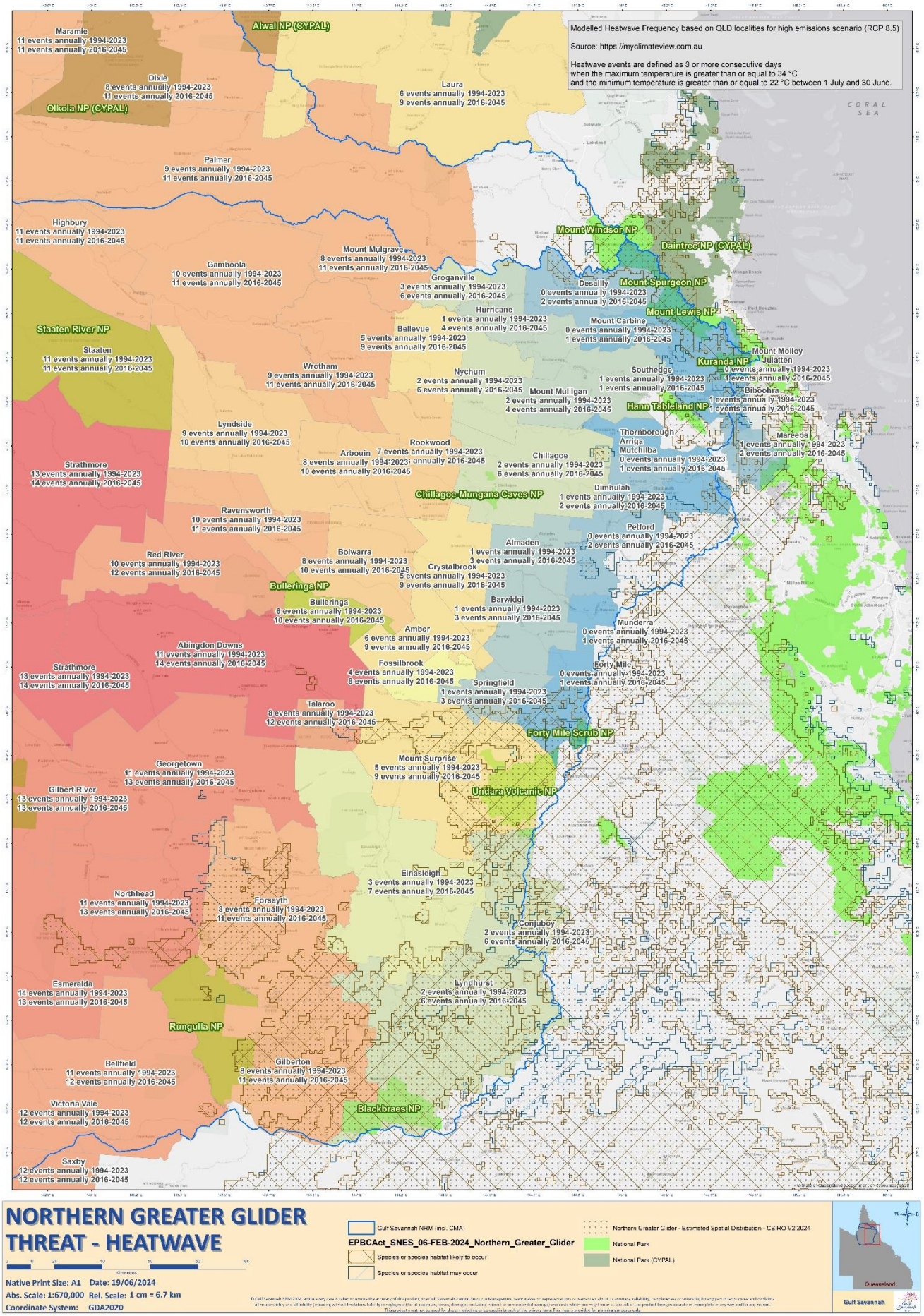
## Map 39 – Golden Shouldered Parrot - Threat – Heatwave



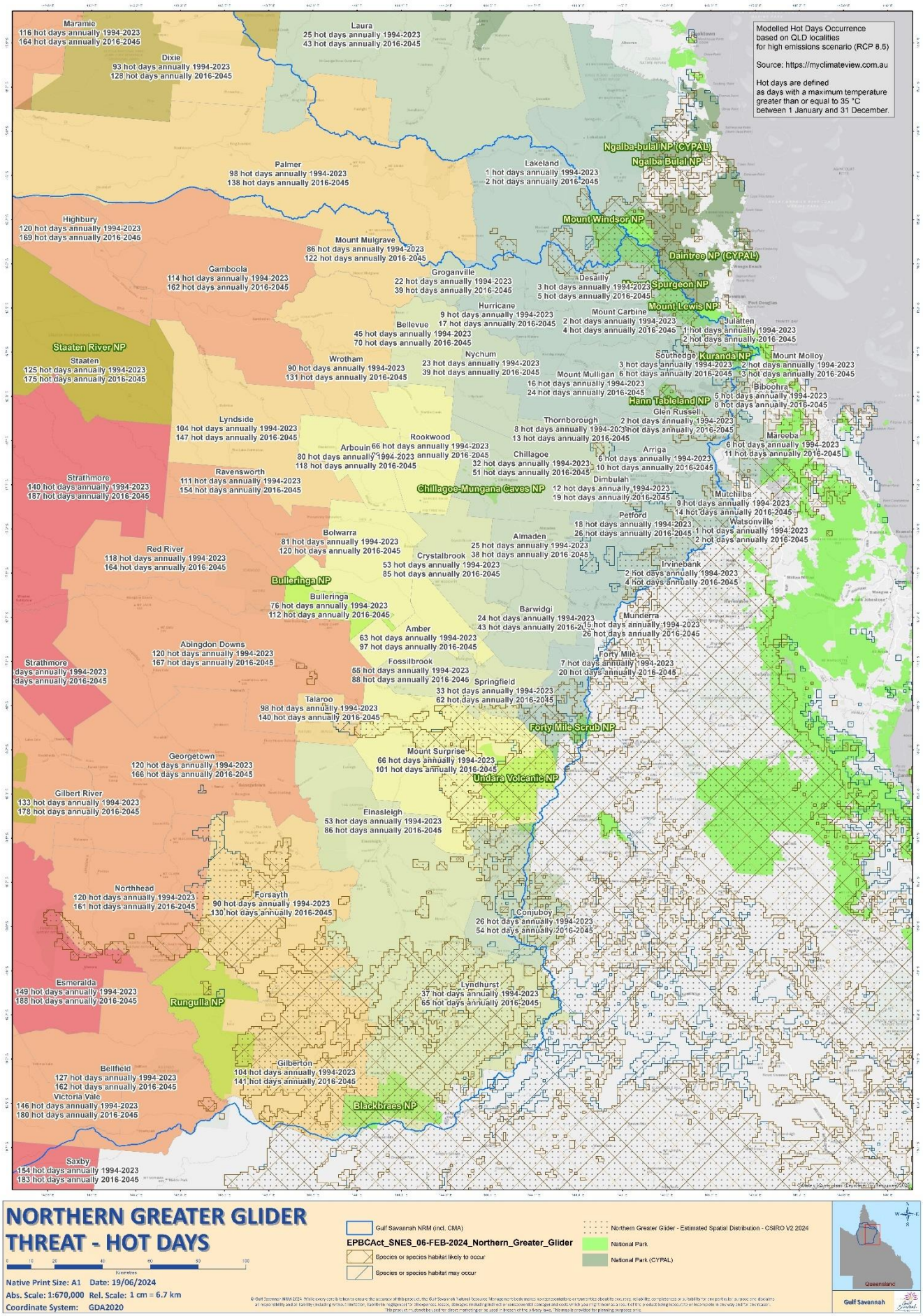
## Map 40 – Golden Shouldered Parrot - Threat – Hot Days



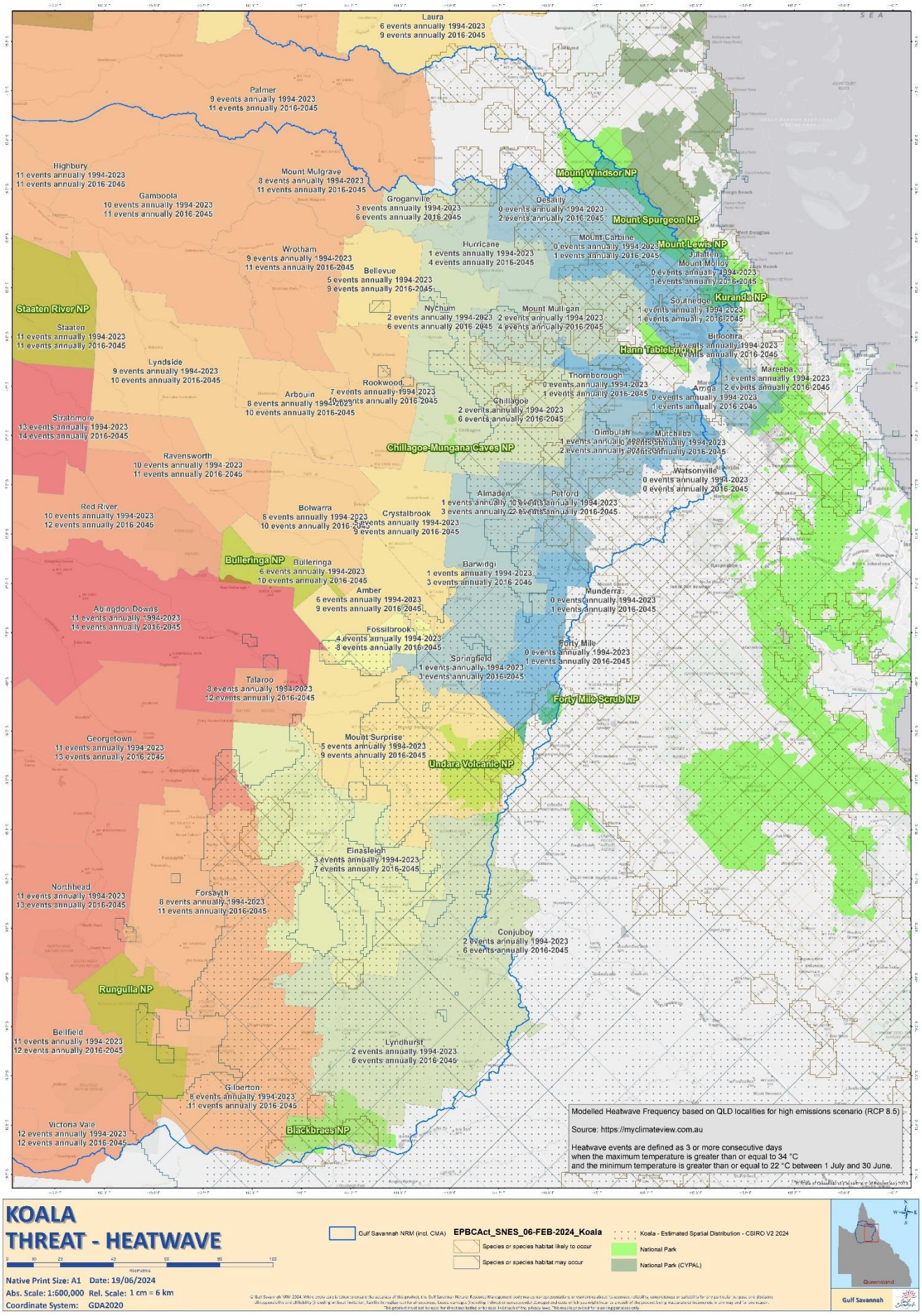
## Map 41 – Northern Greater Glider - Threat – Heatwave



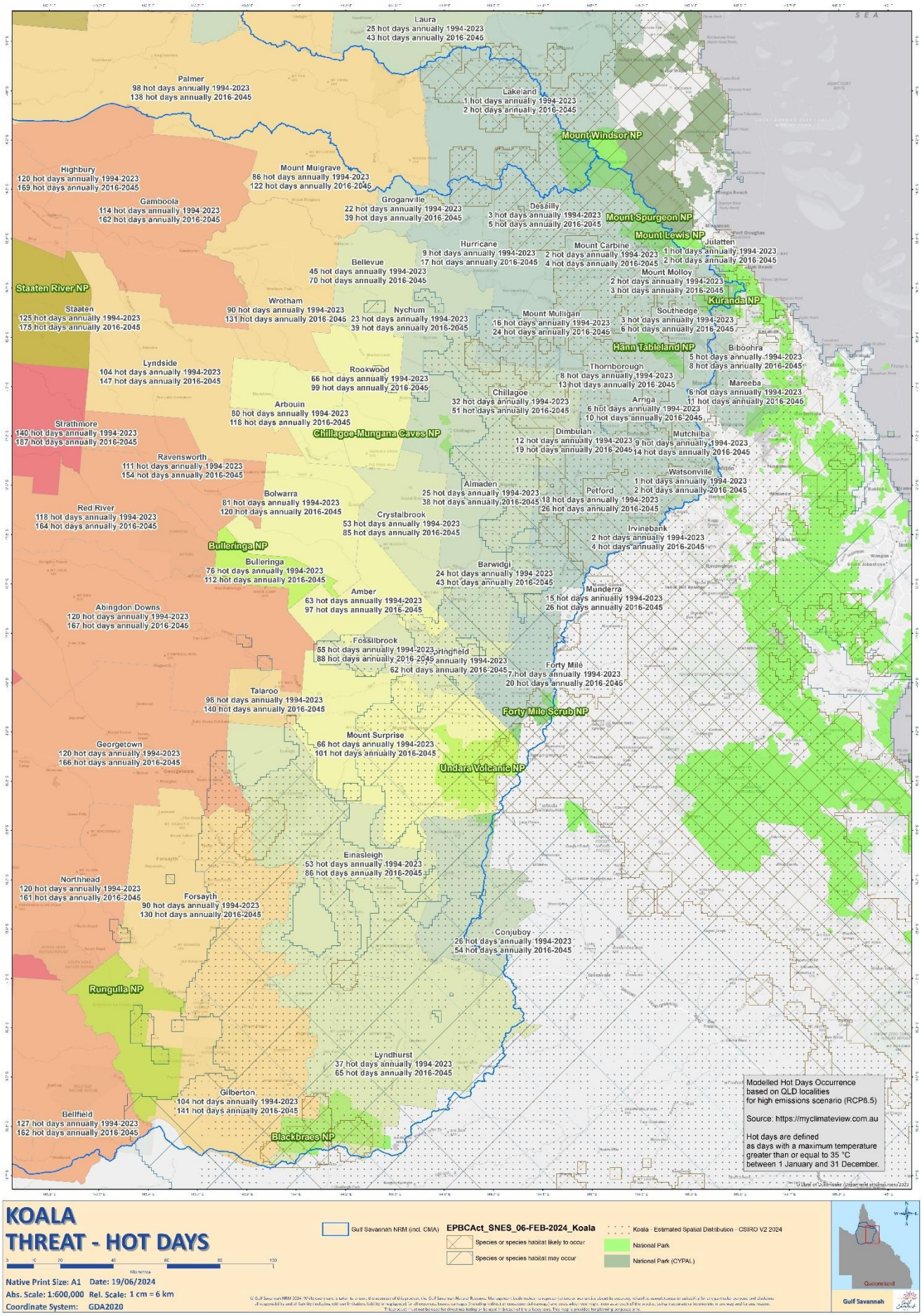
## Map 42 – Northern Greater Glider - Threat – Hot Days



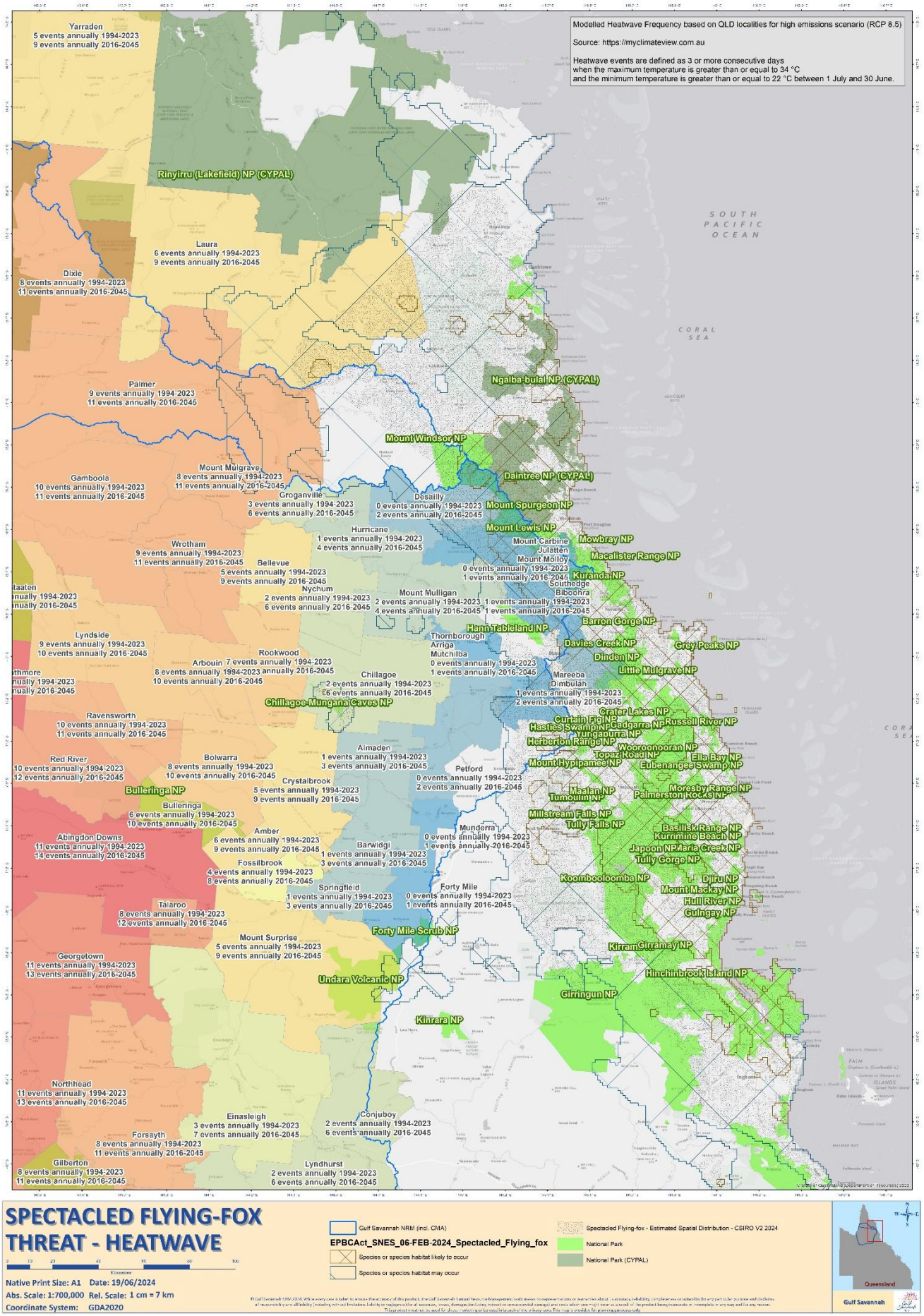
## Map 43 – Koala - Threat – Heatwave



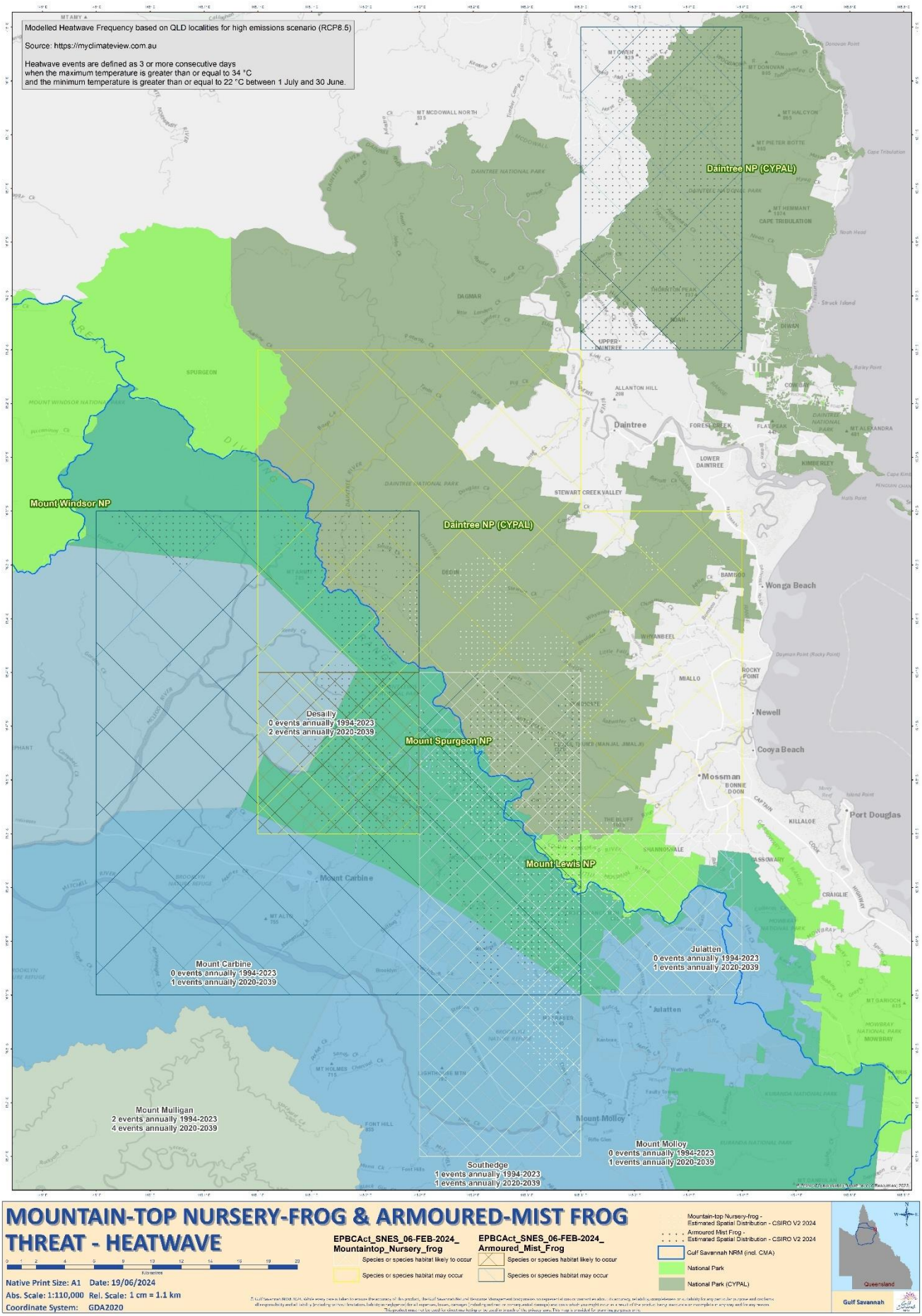
## Map 44 – Koala - Threat – Hot Days



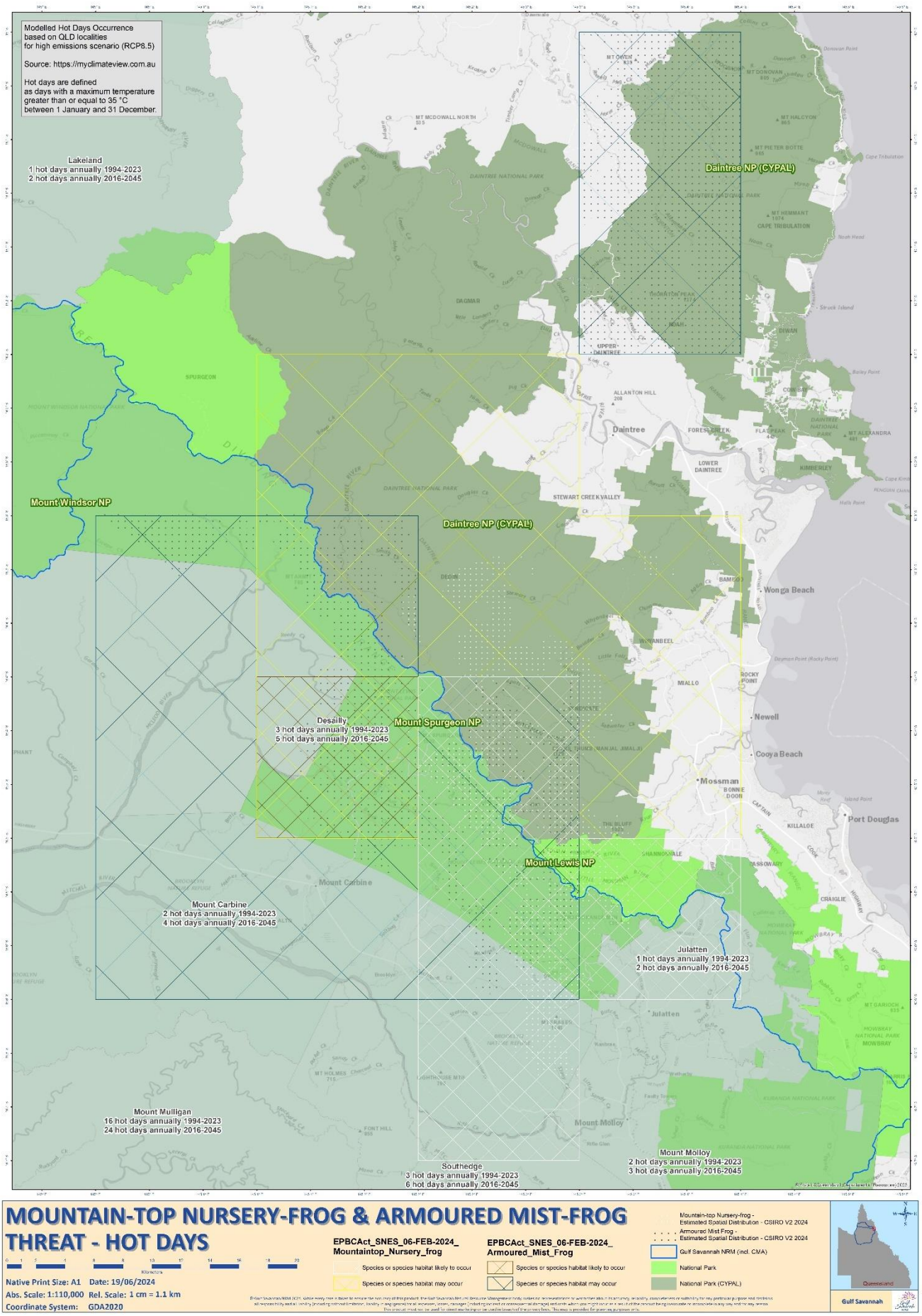
## Map 45 – Spectacled Flying-Fox - Threat – Heatwave



## Map 46 – Mountain Top Nursery Frog & Armoured Mist Frog - Threat – Heatwave

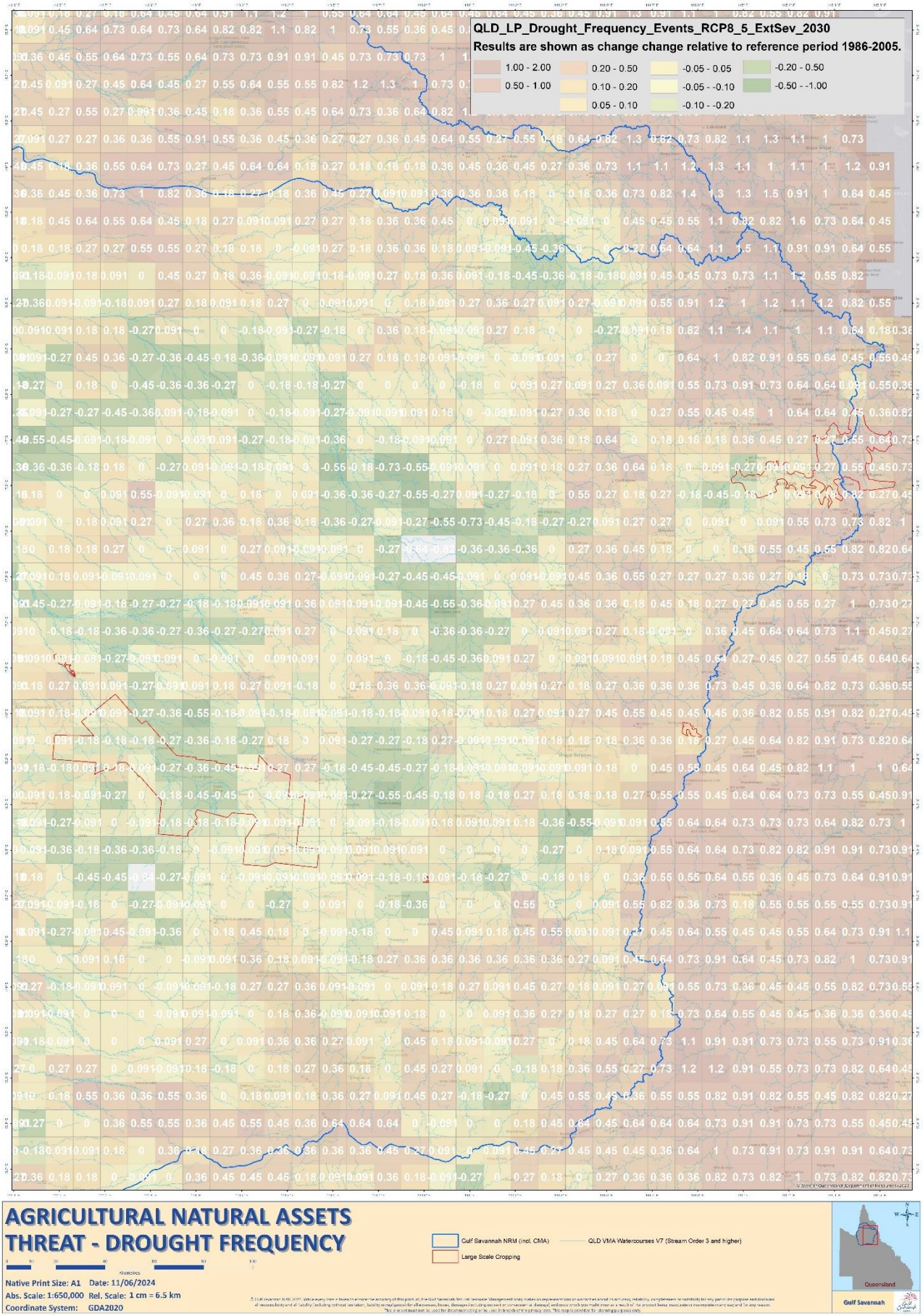


## Map 47 – Mountain Top Nursery Frog & Armoured Mist Frog - Threat – Hot Days

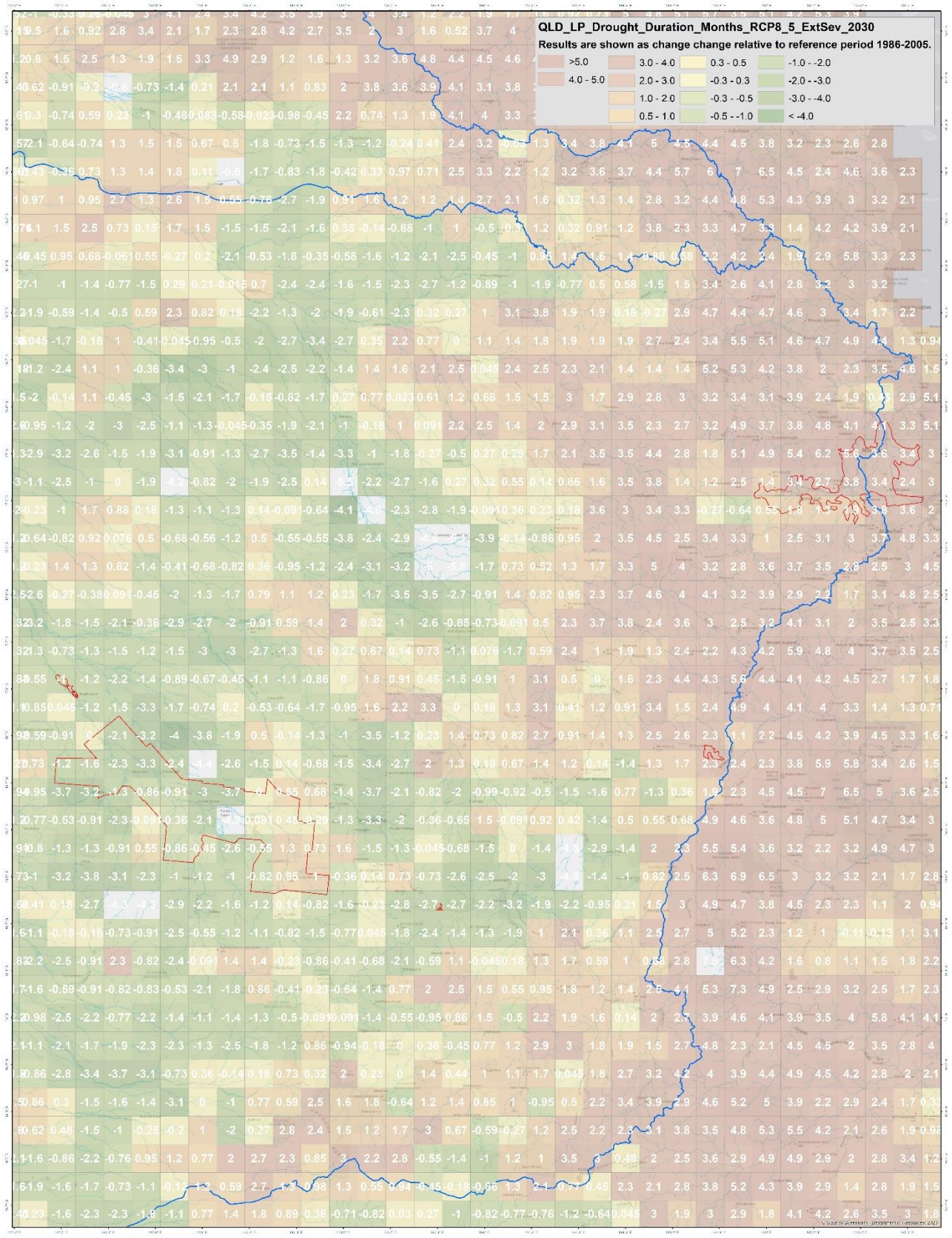


## APPENDIX 3: AGRICULTURAL NATURAL CAPITAL ASSET AND THREAT SPATIAL MAPPING

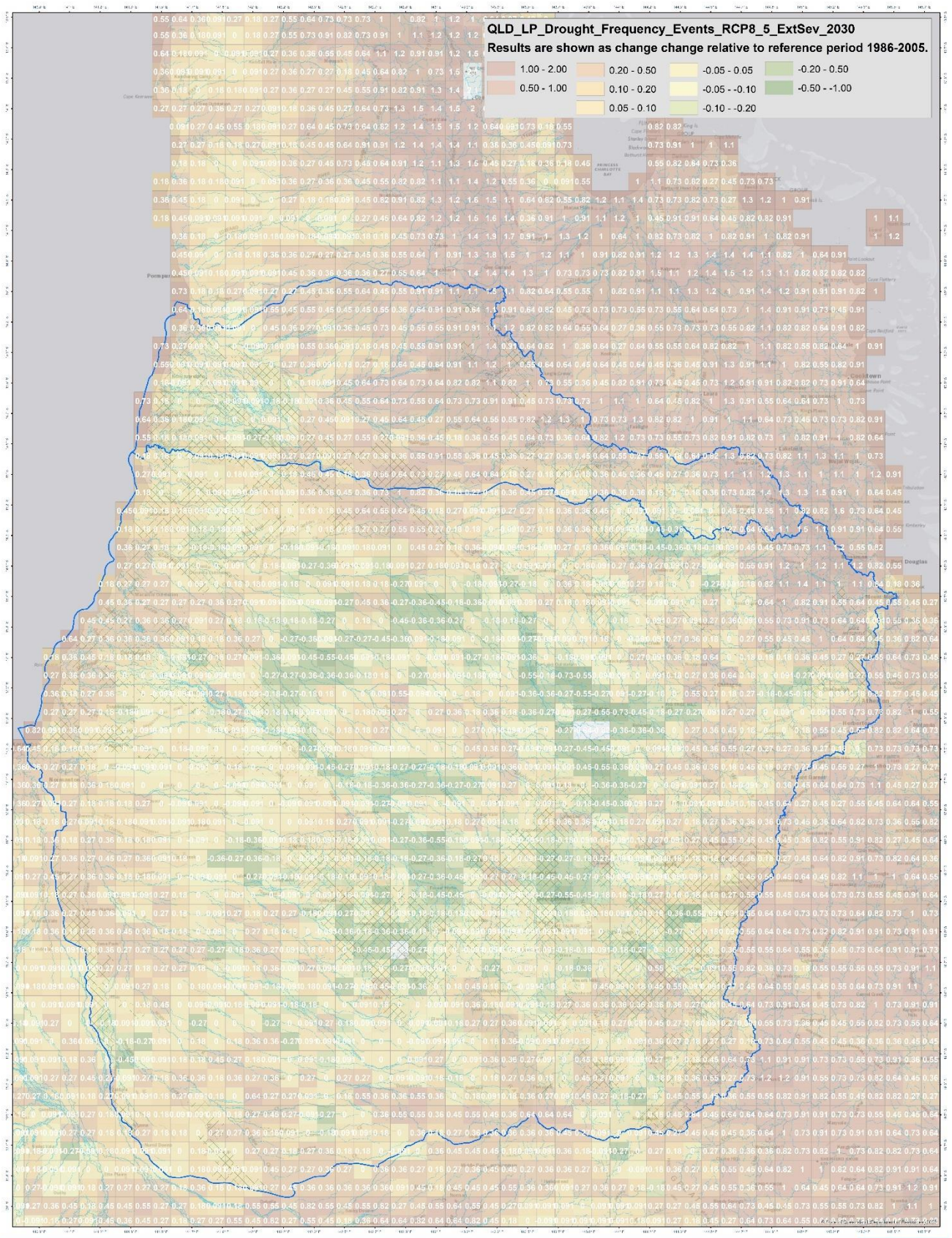
## Map 48 – Agricultural Natural Assets - Threat – Drought Frequency



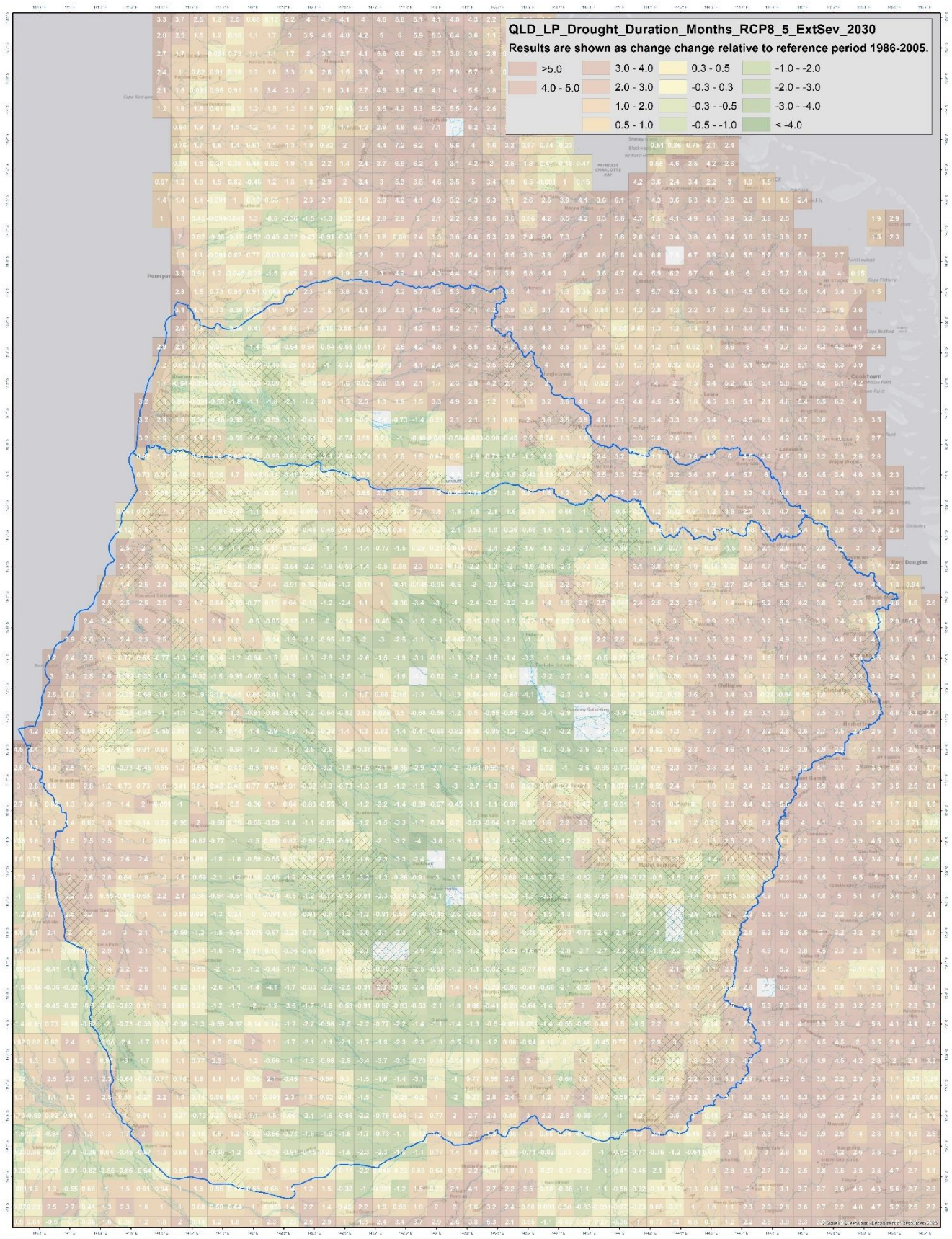
## Map 49 – Agricultural Natural Assets - Threat – Drought Duration



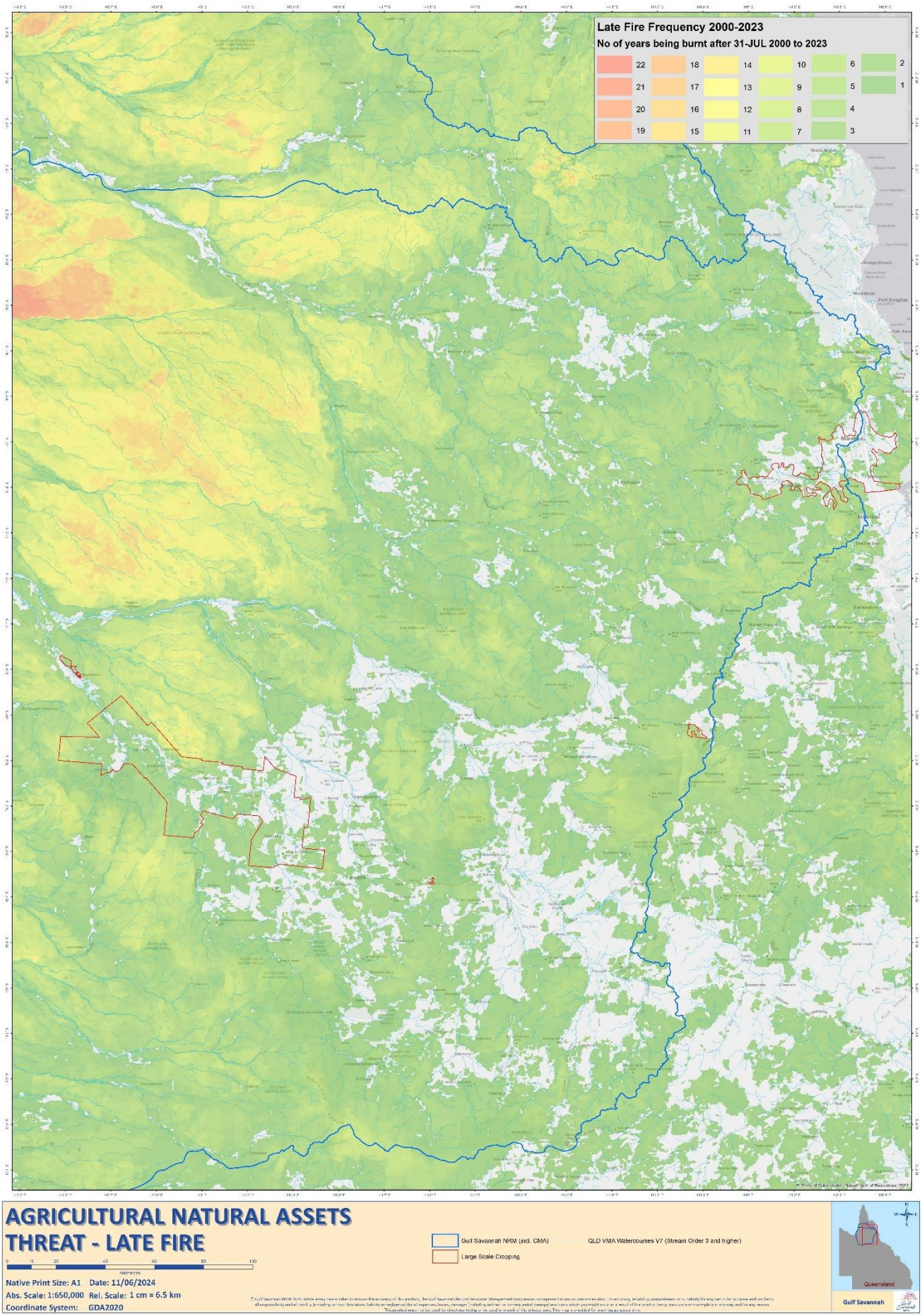
## Map 50 – Grazing Natural Assets - Threat – Drought Frequency



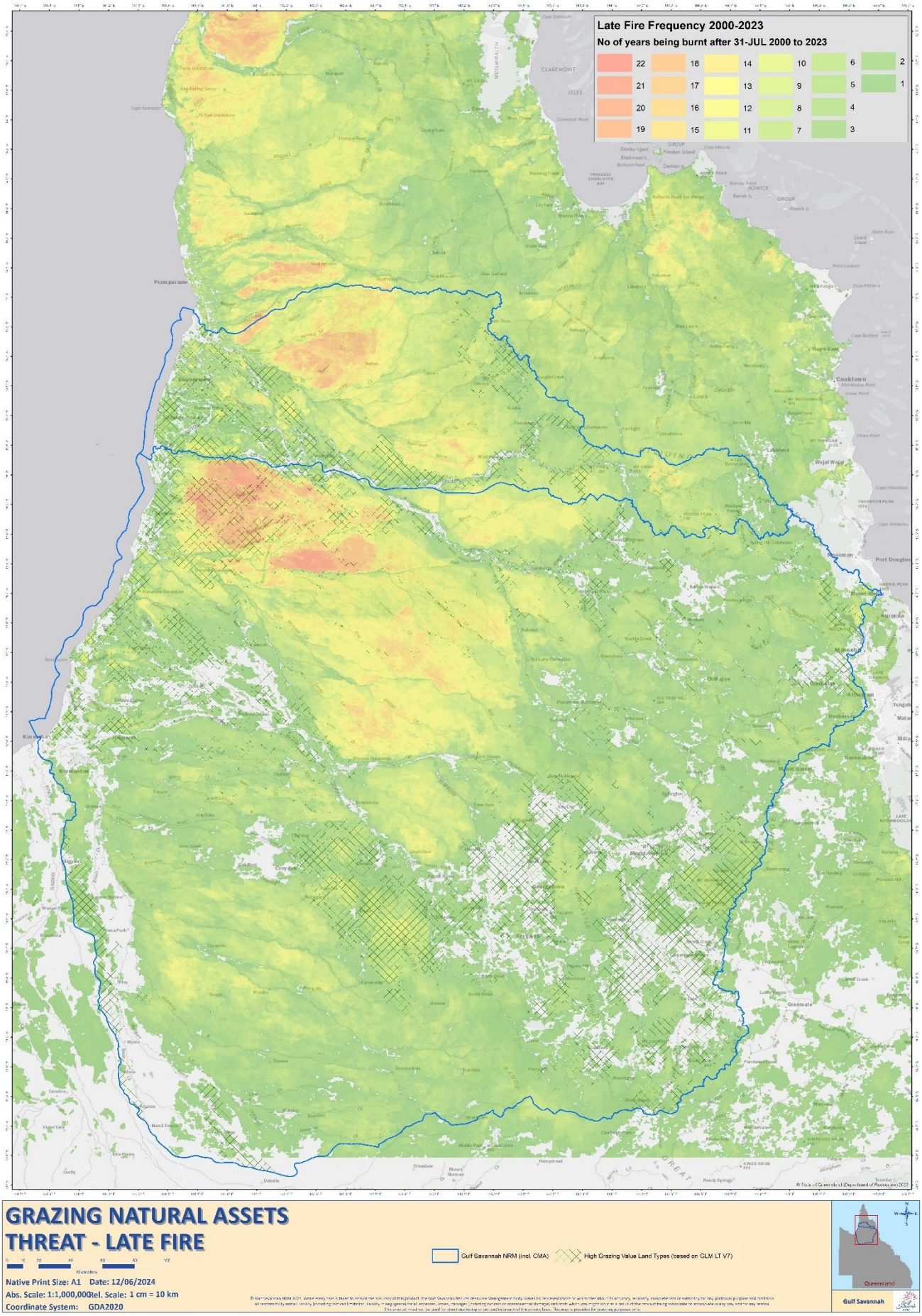
## Map 51 – Grazing Natural Assets - Threat – Drought Duration



## Map 52 – Agricultural Natural Assets - Threat – Late Fire

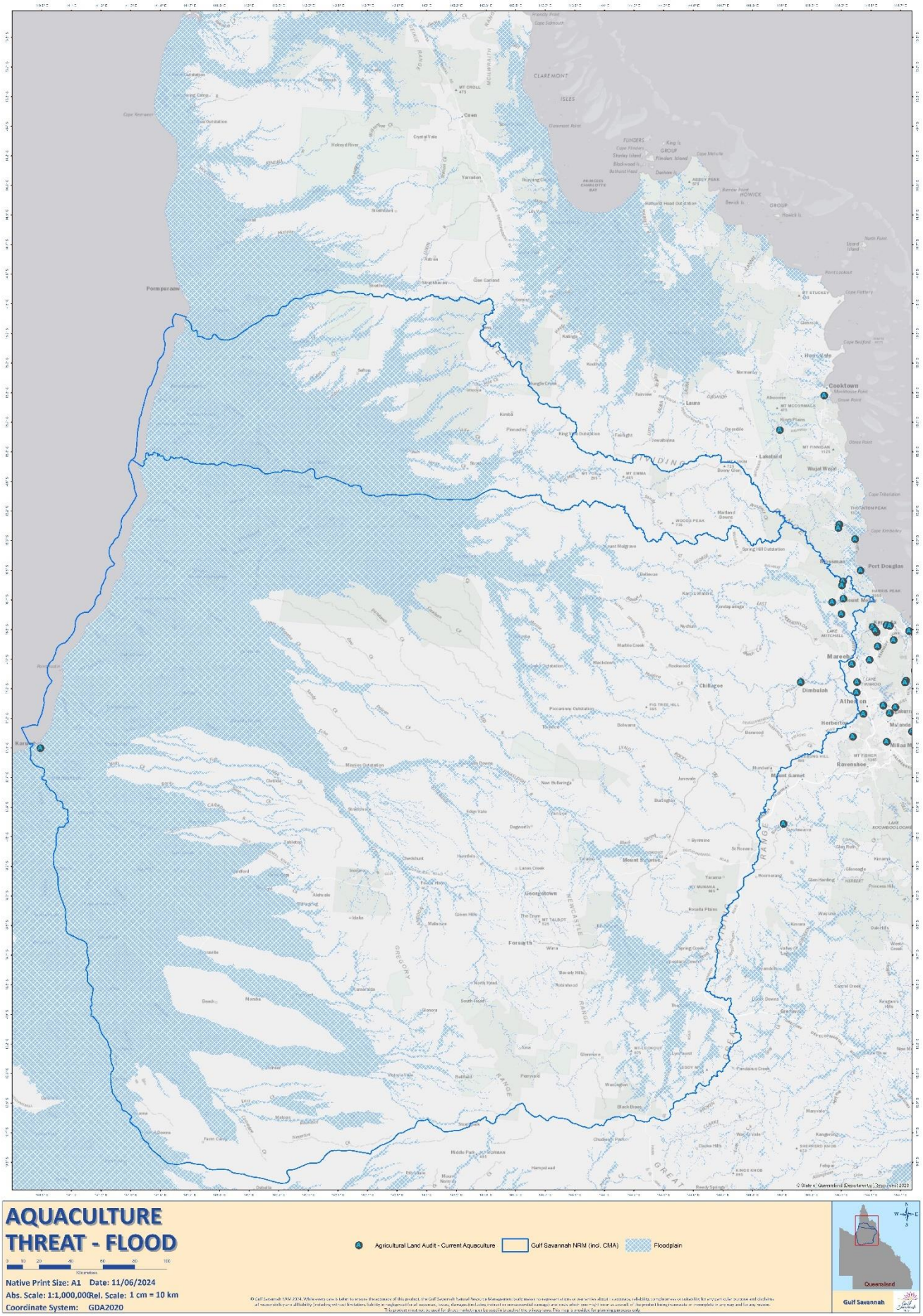


## Map 53 – Grazing Natural Assets - Threat – Late Fire

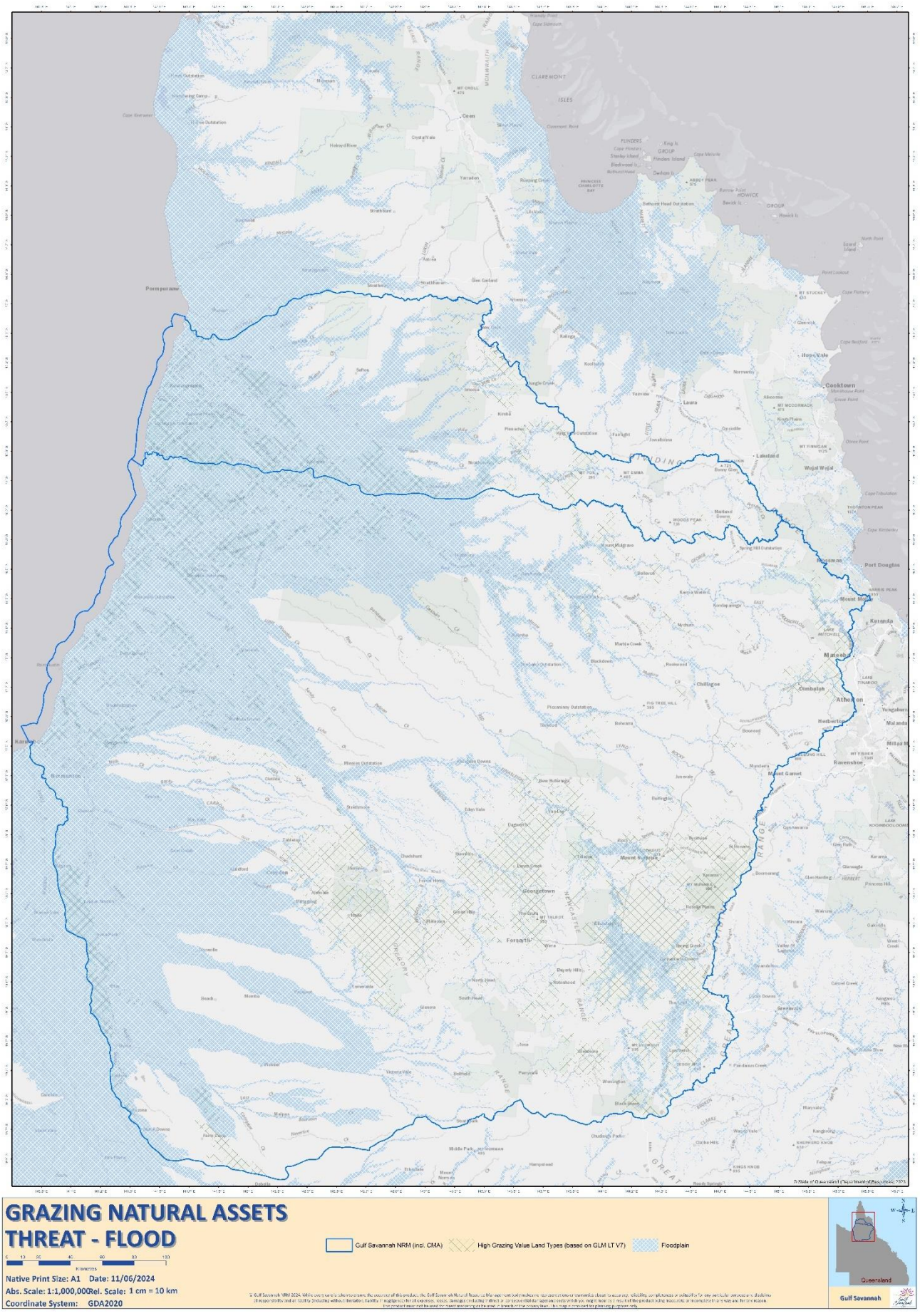


## Map 54 – Agricultural Natural Assets - Threat – Flood

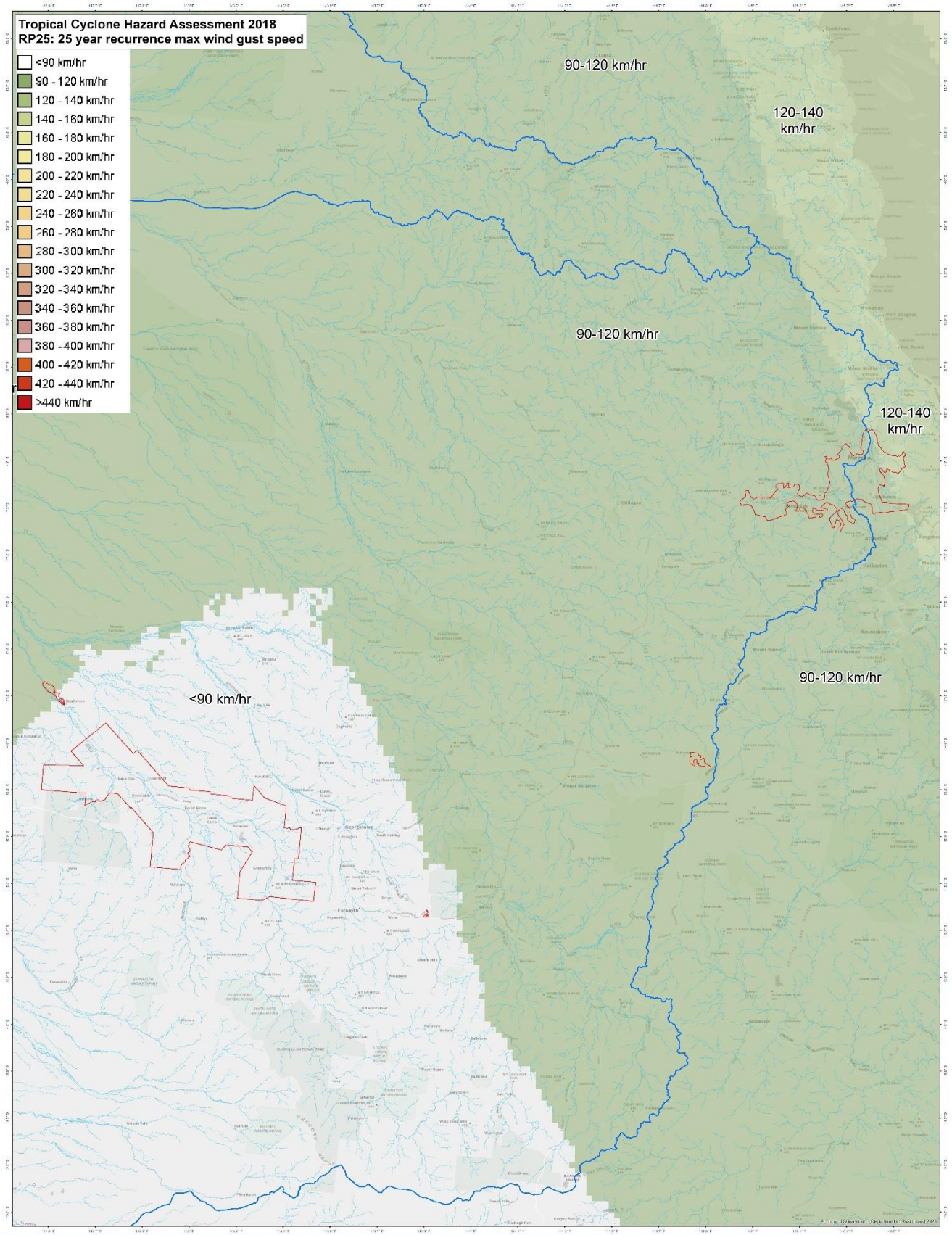
## Map 55 – Aquaculture - Threat – Flood

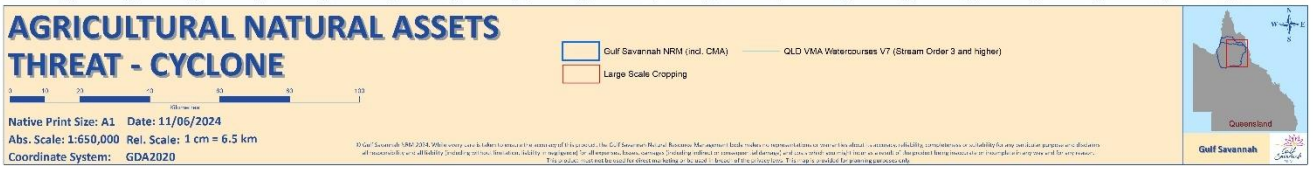


## Map 56 – Grazing Natural Assets - Threat – Flood

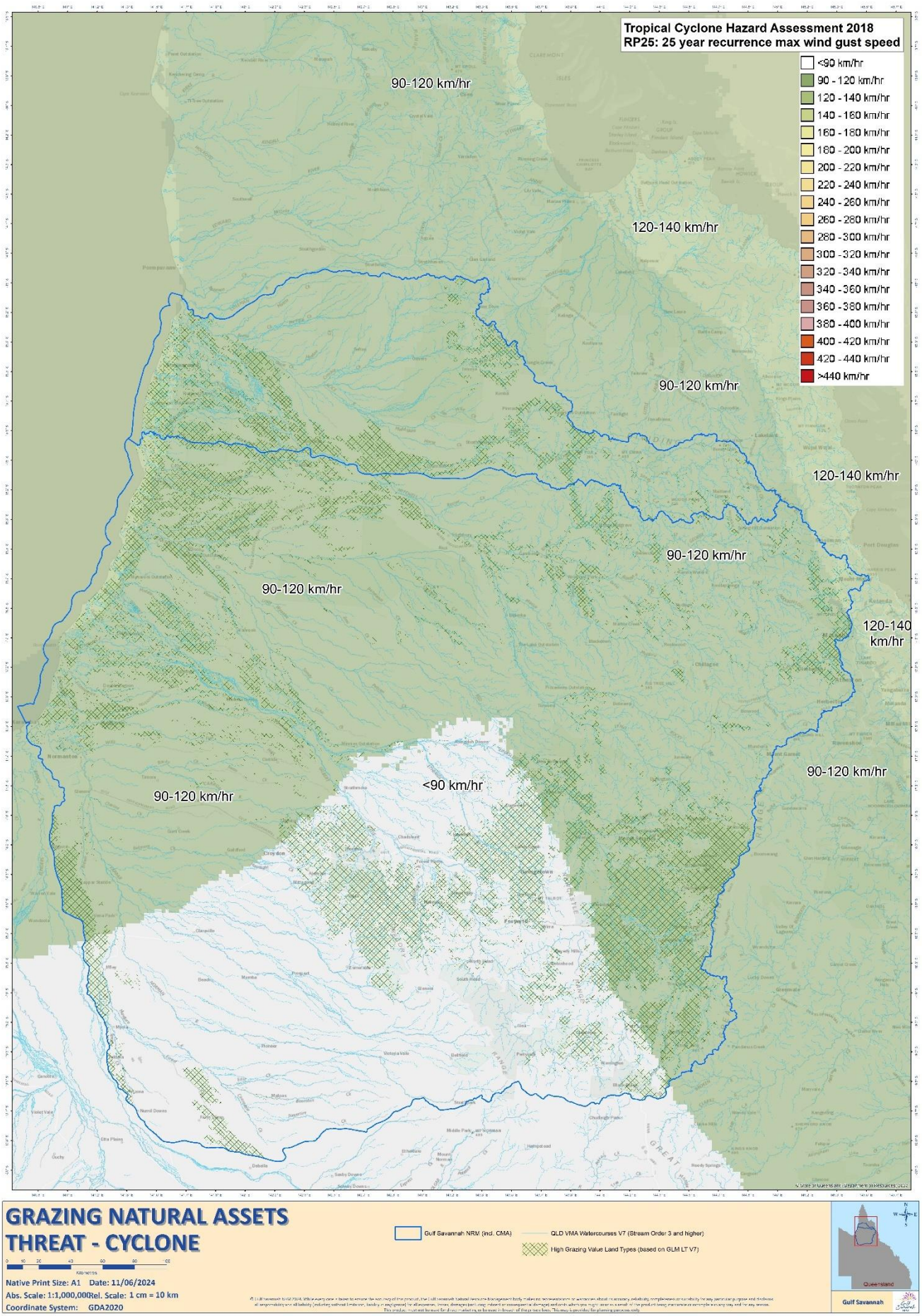


## Map 57 – Agricultural Natural Assets - Threat – Cyclone

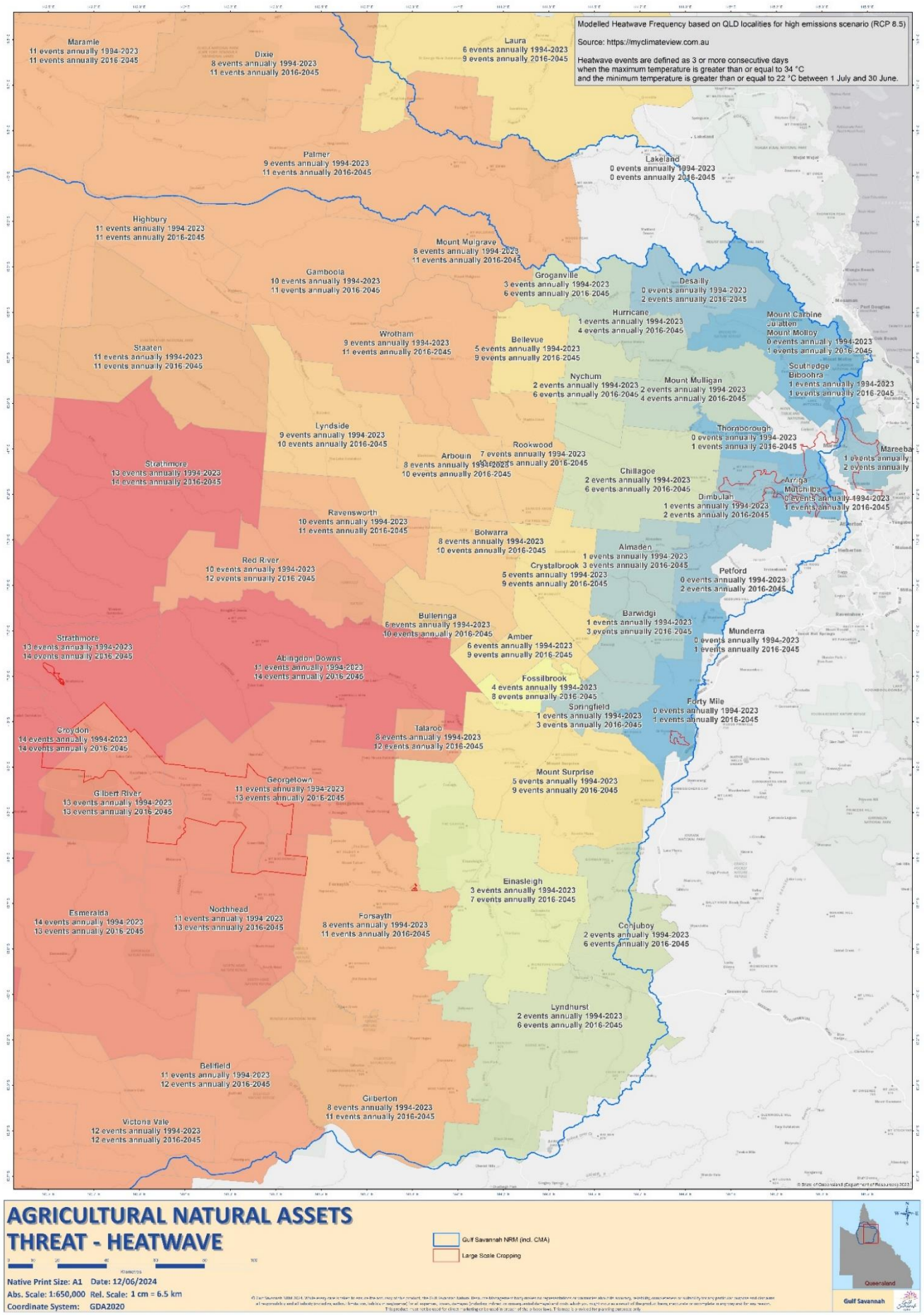


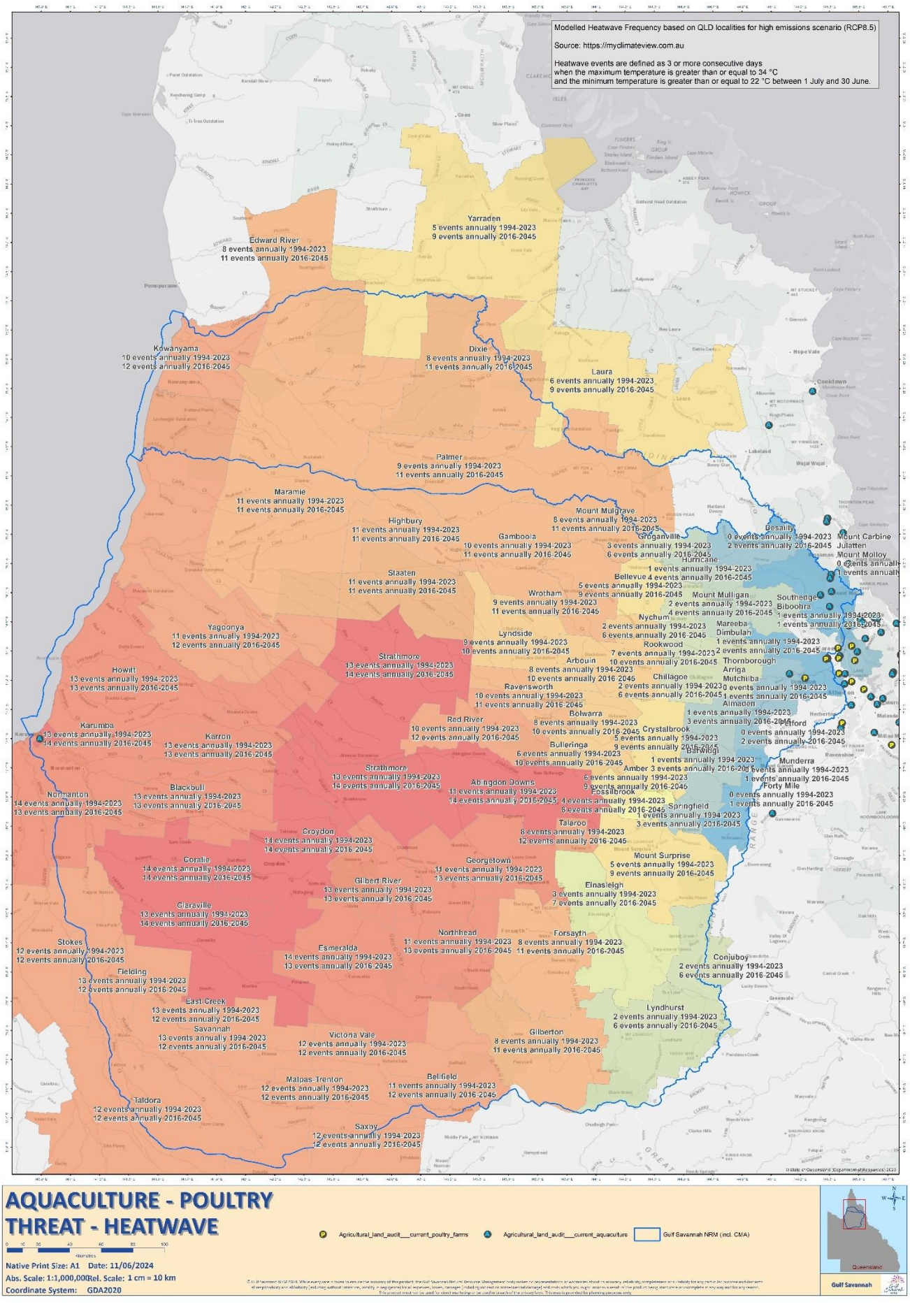
## Map 58 – Grazing Natural Assets - Threat – Cyclone



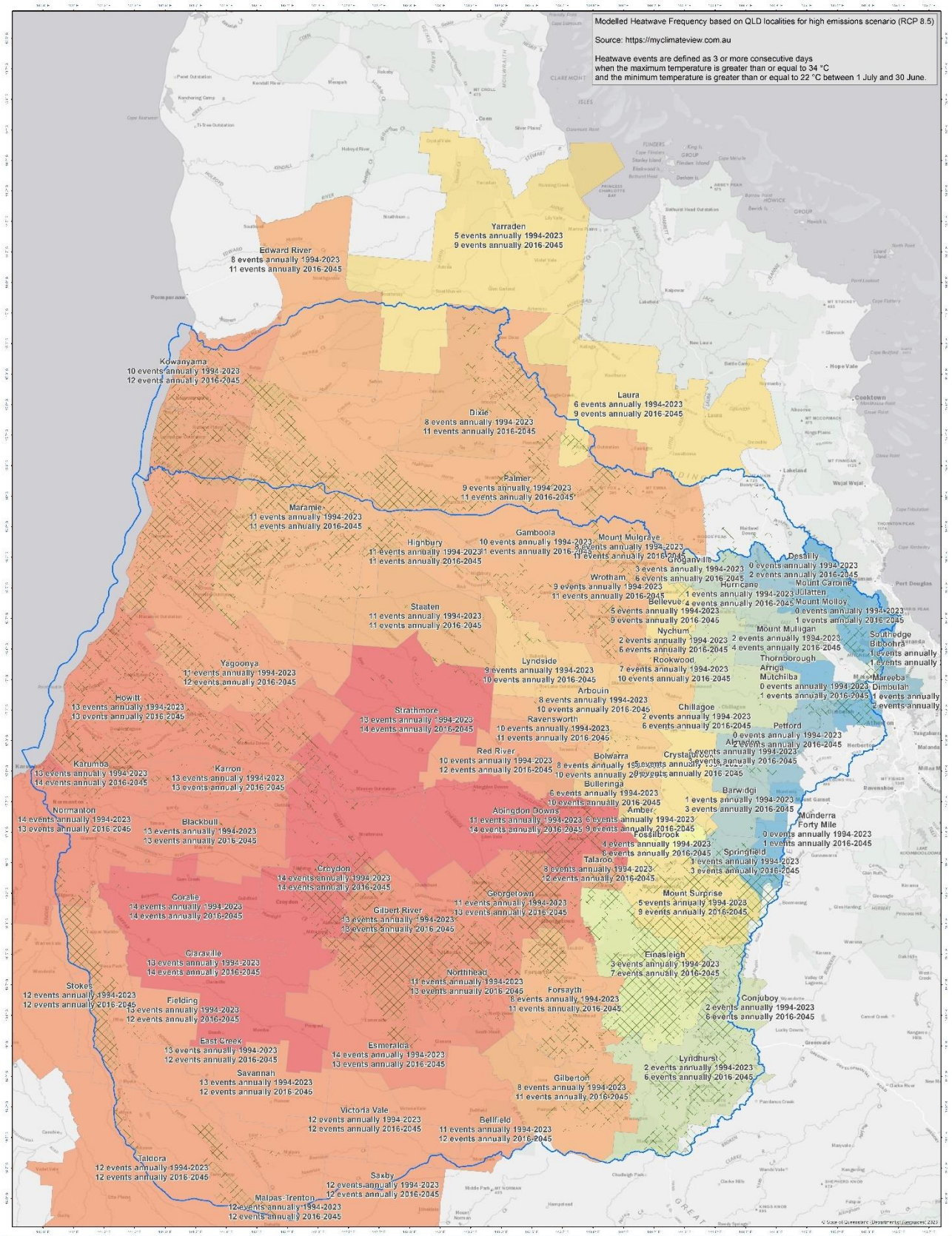
## Map 59 – Agricultural Natural Assets - Threat – Heatwave



## Map 60 – Aquaculture & Poultary - Threat – Heatwave

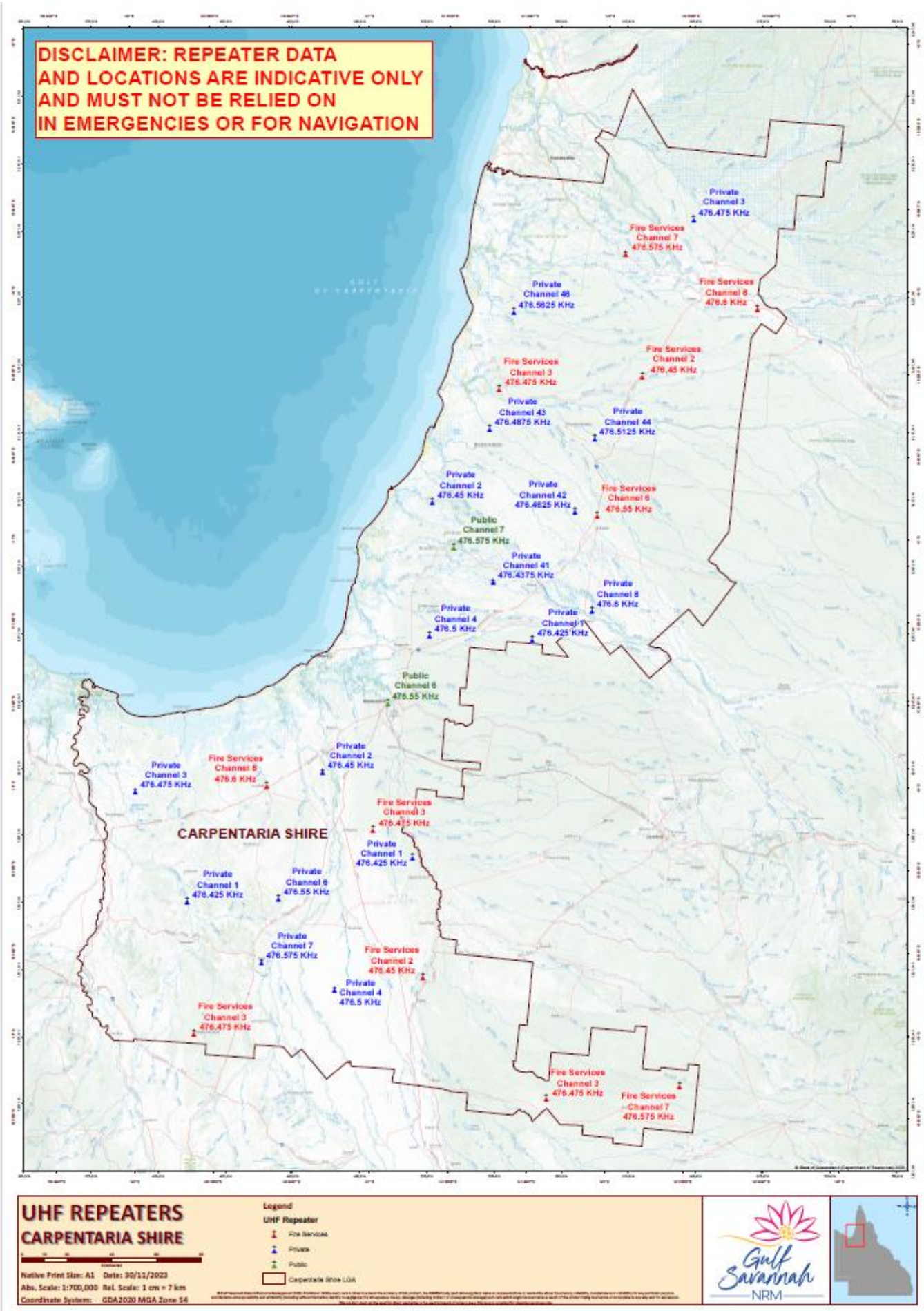


## Map 61 – Grazing Natural Assets - Threat – Heatwave

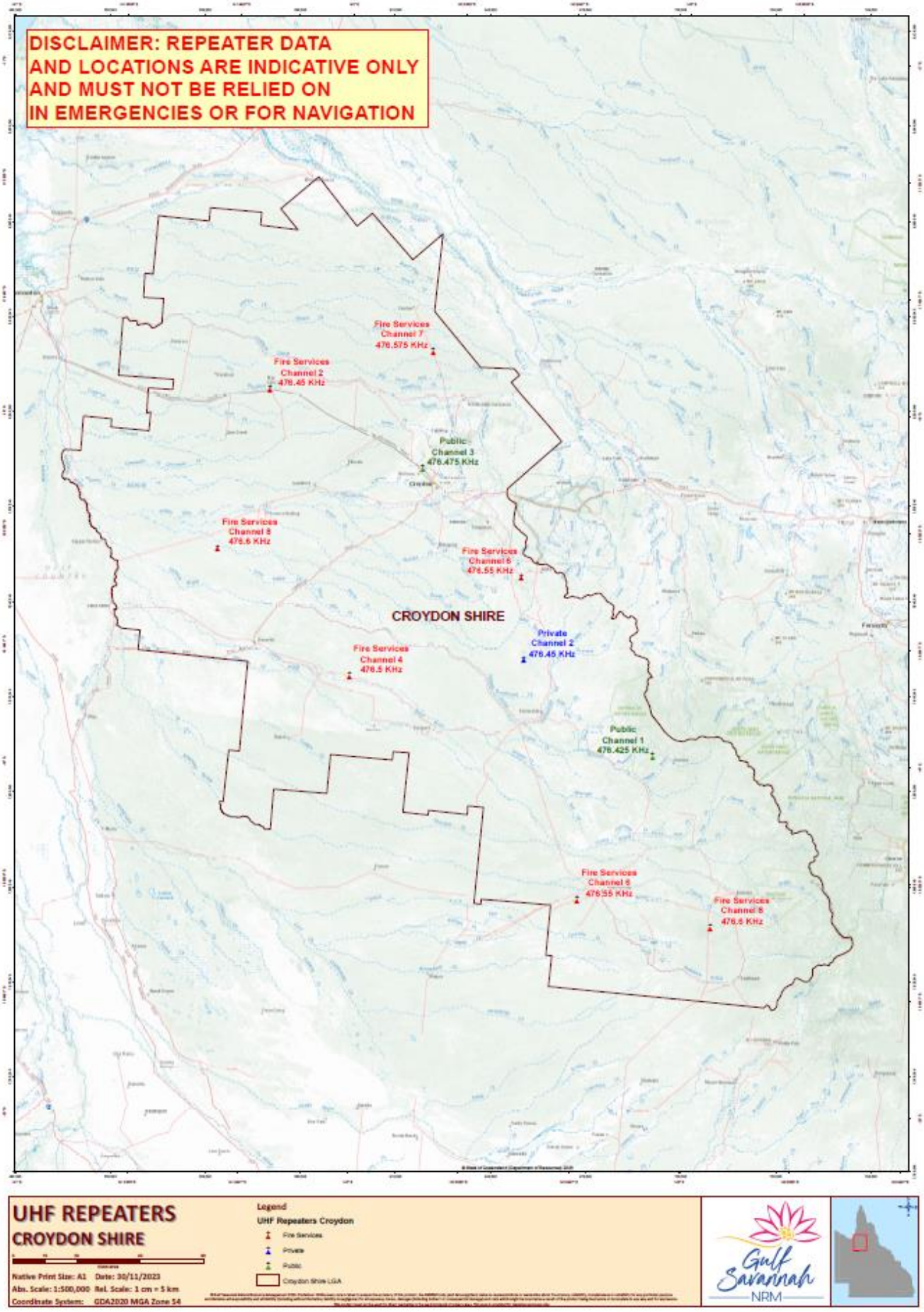


## APPENDIX 4: UHF REPEATER STATION MAPS

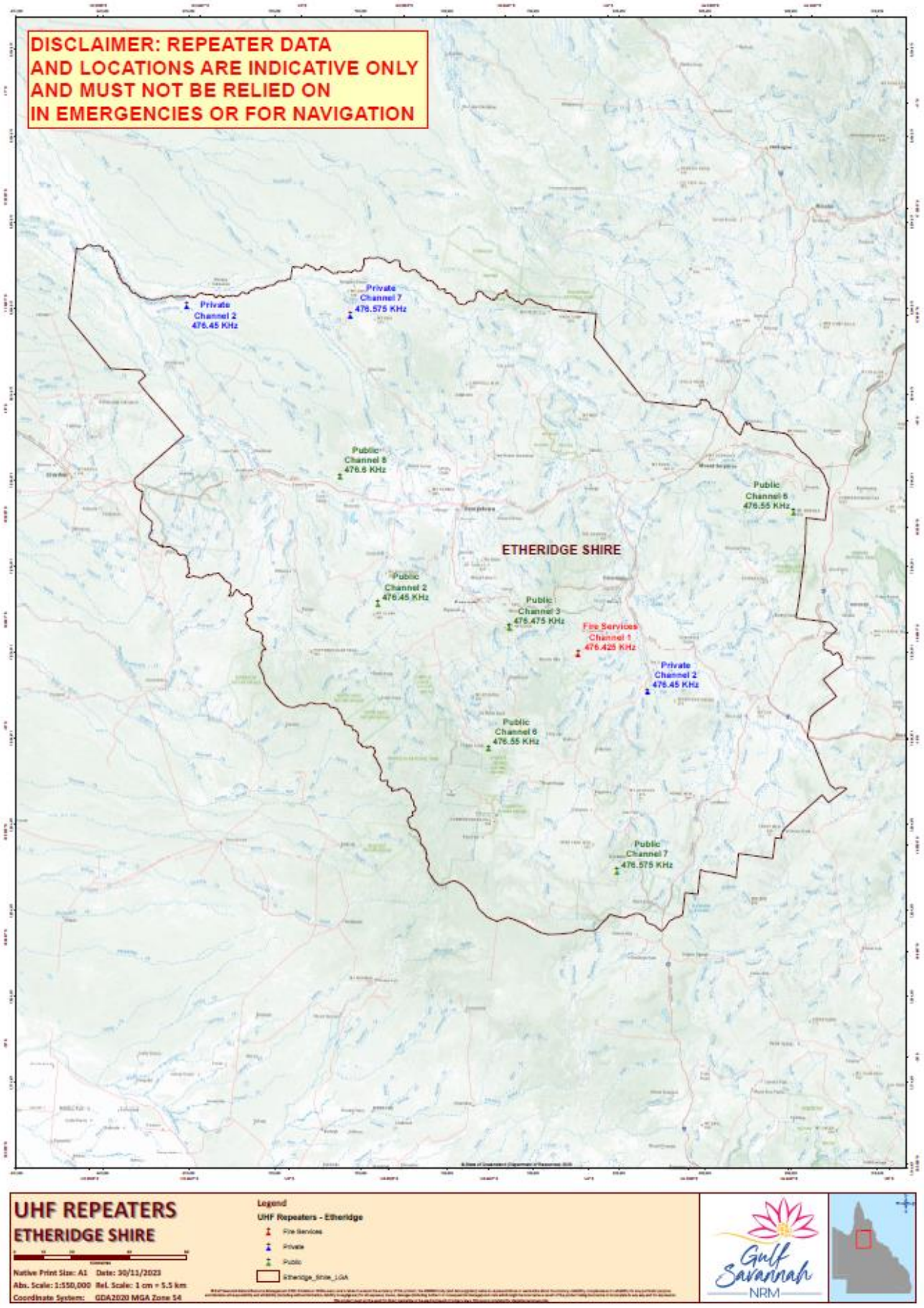
Map 62 – UHF Repeaters – Carpentaria Shire



Map 63 – UHF Repeaters – Croydon Shire

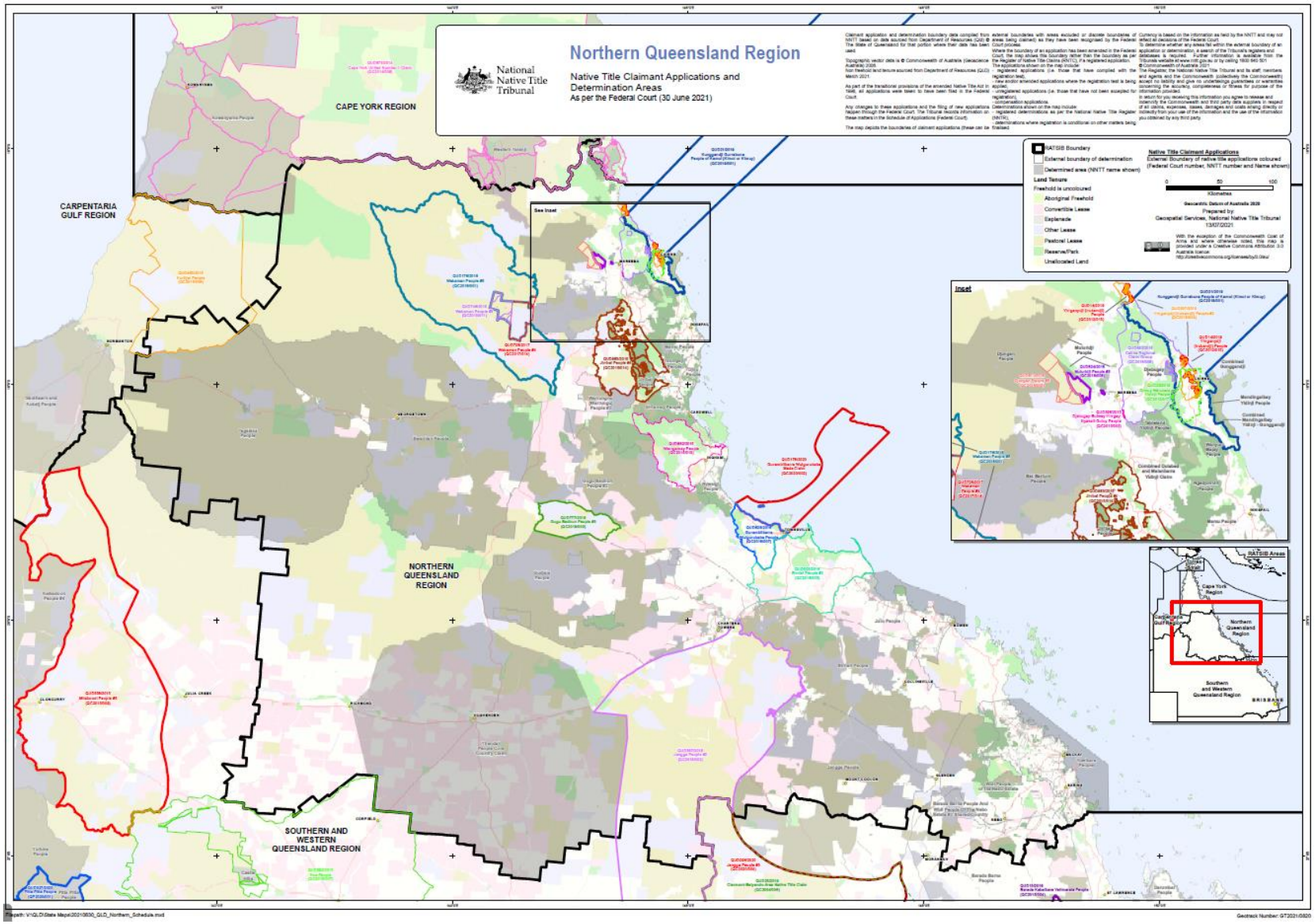


Map 64 – UHF Repeaters – Etheridge Shire

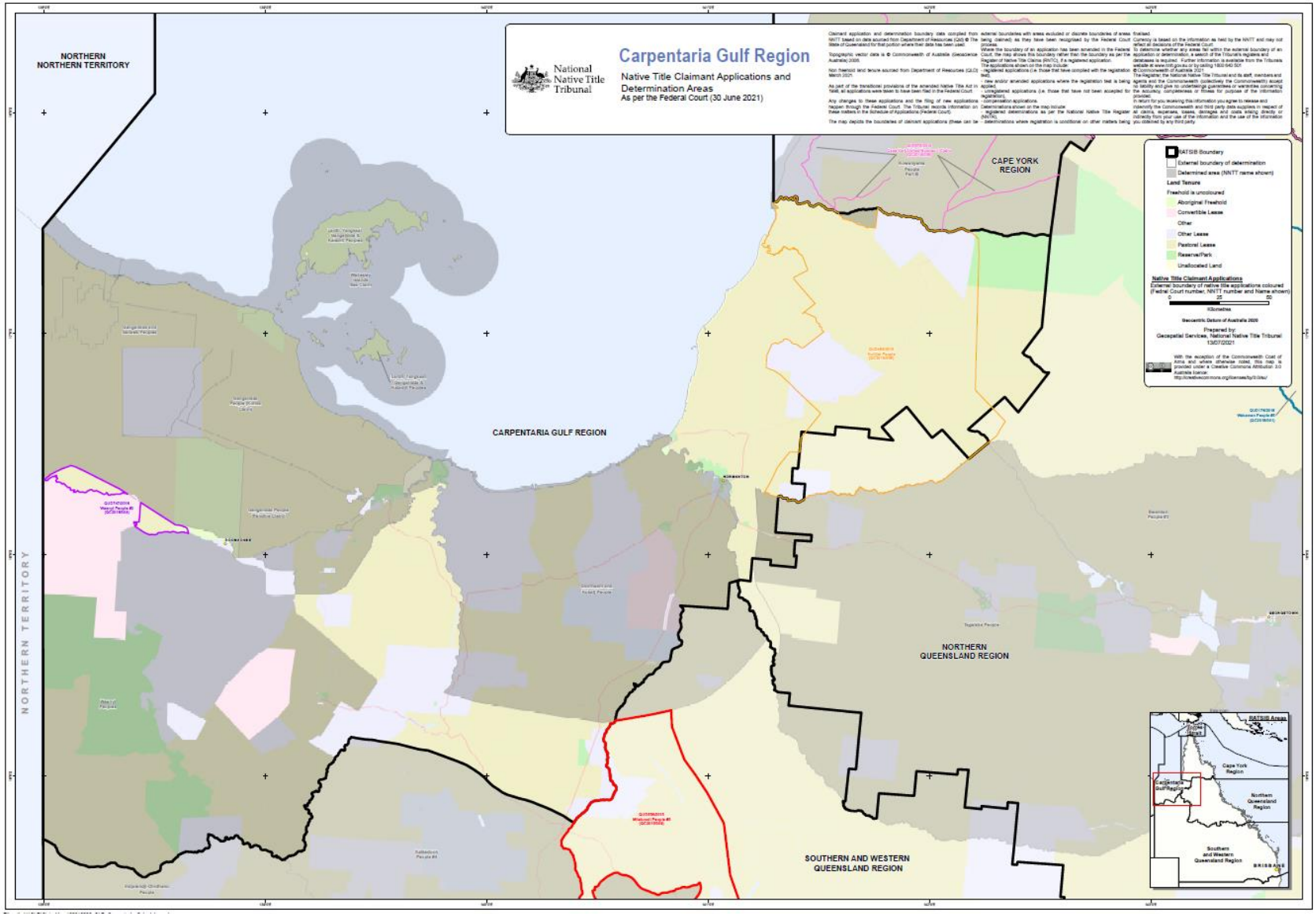


## APPENDIX 5: NATIVE TITLE MAPS

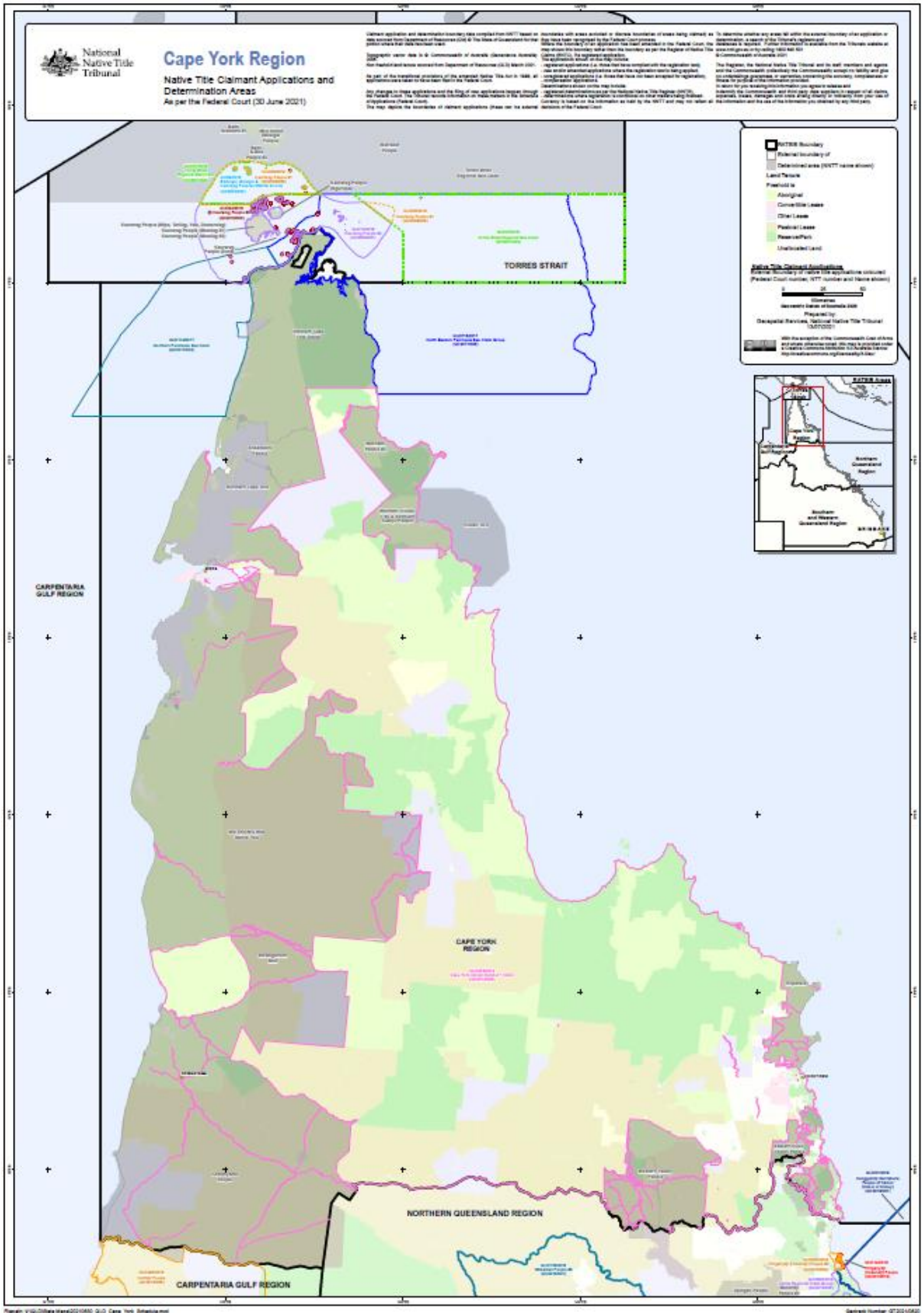
Map 65 – Native Title – Northern Queensland Region



Map 66 – Native Title – Carpentaria Gulf Region



Map 67 – Native Title – Cape York Region



## APPENDIX 6: Assets omitted from the plan during prioitisation process

| Species | Scientific name | EPBC |
|---|---|---|
| Armoured mist frog | *Litoria lorica* | Critically Endangered |
| Freshwater sawfish | *Pristis pristis* | Vulnerable |
| Golden-shouldered parrot | *Psephotus chrysopterygius* | Endangered |
| Gouldian finch | *Erythrura gouldiae* | Endangered |
| Green turtle | *Chelonia mydas* | Vulnerable |
| King blue-grass | *Dichanthium queenslandicum* | Endangered |
| Koala | *Phascolarctos cinereus* | Endangered |
| Limbless fine-lined slider | *Lerista Ameles* | Not listed |
| Magnificent brood frog | *Pseudophryne covacevichae* | Vulnerable |
| Mountain-top nursery frog | *Cophixalus monticola* | Critically Endangered |
| Mount Surprise slider | *Lerista Storri* | Not listed |
| Northern bettong | *Bettongia tropica* | Endangered |
| Northern greater glider | *Petauroides minor* | Vulnerable |
| Northern quoll | *Dasyurus hallucatus* | Endangered |
| Olive ridley turtle | *Lepidochelys olivacea* | Endangered |
| Red goshawk | *Erythrotriorchis radiatus* | Endangered |
| Spectacled flying fox | *Pteropus conspicillatus* | Endangered |
| | | |
| **Ecological communities** | | |
| Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland | | Endangered |
| Semi-evergreen vine thicket - 40 mile/Undara National Parks | | Endangered |

### Species / ecological communities omitted from the plan

| Species / Ecological community | Reason |
|---|---|
| Eastern curlew (*Numenius madagascariensis*) | There is no foreseeable way to manage threats to this species in Australia, threats largely occur outside the region. Drought/floods could impact food resources but the species is highly mobile and can move to other feeding areas. |
| Lyon's grassland skink (*Proablepharus barrylyoni*) | This species conservation advice does not list any natural disasters as a threat, primary threats are grazing and weeds. Removal of grass through fire may cause some impacts but the species could hide in soil cracks during these events. |
| Spotted-tailed quoll (*Dasyurus maculatus*) | The percentage of the species distribution in the Northern Gulf is very small. |
| Yellow-bellied glider (*Petaurus australis*) | The percentage of the species distribution in the Northern Gulf is very small. |
| Purple wattle (*Acacia purpureopetala*) | No disaster scenarios are listed as a conservation concern for this species, late season wildfire could be a problem as the conservation advice lists identifying fire intensity and internal required to promote seed germination as an action for the species conservation. |
| Talaroo Hot Springs and nearby riverine locations | The only identified threat was heatwaves due to the impact heatwaves can cause to freshwater invertebrates. It was considered that due to the |

| | |
|---|---|
| | springs being a hotwater spring organisms would be adapted to higher water temperatures. |
| The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin | There are only small areas located within the Northern Gulf region. Spatial mapping indicated that no predicted threats overlapped with GAB communities. |
| Blackbraes and Staaten River National Parks | These parks were initially identified as reasonal assets due to their high biodiversity significance. Given that species included in this plan are located within these National Parks, the decision was made to not include them as whole units. This is because mitigating threats to the priority species located in these parks will protect other biodiversity assets in the parks. |
| Wet tropics | The percentage of the distribution of the Wet Tropics in the Northern Gulf is very small. |