

Declaration

I have read, understood and complied with Part 31, Division 2 of the Uniform Civil Procedure Rules 2005 and the Code of Conduct set out in Schedule 7 of the UCPR. I agree to be bound by the Code of Conduct. I have been engaged by the Environmental Defenders Office on behalf of the Nature Conservation Council to prepare an expert report for the Independent Planning Commission. The subject of my report relates to the proposed restart of the Redbank Power Station (SSD 56284960), specifically regarding biodiversity impacts of the proposed use of salvaged biomass sourced from Invasive Native Scrub (INS) in the Western and Central West Local Land Services regions.

Statement of expertise

My name is David M Watson and I am a Professor of Ecology and Programme lead for the team of 40 environmental scientists at the Gulbali Institute, based at Charles Sturt University's Albury Campus. I have a Bachelors degree in Science (Double major, Botany and Zoology) and an Honours Degree (First Class, Ecology) from Monash University, and a PhD in ecology from The University of Kansas (conferred August 1999), my dissertation quantifying species responses to habitat change and isolation in fragmented forests. I have been working as a professional ecologist and research scientist for over thirty years, gaining an international profile as a leading environmental scientist. My research team seeks to understand how ecological communities change across landscapes and through time, using experiments and long-term comparisons to measure patterns, identify underlying processes and establish mechanisms to improve biodiversity conservation with on-ground management. I have particular expertise on the ecology and conservation management of semi-arid and arid woodlands of inland Australia, primarily in western NSW, where I lead numerous field-based studies. I have published more than 140 peer-reviewed publications (refer to Curriculum vitae in Annexures). I was appointed to the NSW Threatened Species Scientific Committee for two terms (2015–2019), and have a close working knowledge of relevant state and federal legislation regarding threatened species and ecological communities.

Questions from brief:

(a) Potential impacts, if any, to threatened species which may arise because of this Project.

In particular:

- (i) The EIS states that Invasive Native Scrub (INS) will be sourced from the Western Local Land Services and Central West Local Land Services regions. Does INS provide habitat for native species in these regions, if so, which species? Of these species, please identify any which are NSW or Federally listed threatened species;**

Yes, the invasive native scrub the proponent seeks to source from both the Western and Central West Local Land Services regions of New South Wales provides important habitat for diverse assemblages of native species throughout both regions. These two regions span many landforms, from rocky plateaus and salt lakes to river valleys and extensive floodplains, each of which supports distinctive habitats. The most dominant habitat types in both regions in terms of area, structural complexity and number of native species supported is semi-arid woodland, including open and closed scrubland dominated by the INS tree and shrub species listed in Table 1. Many hundreds of native species live in these habitats, most reliant on shrub and tree dominated microhabitats, with many species restricted solely to this ecosystem (Thompson & Eldridge 2005). The term INS refers to these woodlands, primarily in relation to higher density stands with fewer large trees, which supports greater numbers of species than more open habitats (Doerr et al. 2009). Complete lists of flora and fauna reliant on INS for habitat can be generated from the Atlas of Living Australia and will vary depending on the location and area specified. Seventy-two plant species and 99 animal species listed as threatened (in New South Wales, federally, or both) have been recorded in INS and associated habitats within these regions (Table 2). This list includes 81 species listed as Endangered or Critically Endangered in New South Wales, all reliant on INS as primary habitat.

Table 1. List of the principal Invasive Native Scrub (INS) species of woody plants as considered by Local Land Services (Gavel et al. 2014) and the IUCN status of these species (International Union for Conservation of Nature, the international body that maintains global Red Lists of threatened species).

Species	Scientific Name	Status	Ecological Value
Bimble box (poplar box)	<i>Eucalyptus populnea</i>	IUCN Vulnerable	Favoured food tree for koalas Important habitat for bird species when large and unfragmented (Hannah et al. 2007)
Broad-leaf or purple hopbush	<i>Dodonaea viscosa spatulata</i>	IUCN Least Concern	Provides foraging substrate for bird populations (Martin et al. 2004)
Budha	<i>Eremophila mitchellii</i>	IUCN Least Concern	Important food plant for wildlife including honeyeaters (Hobbs 1967; BGCI 2021)
Green turkey bush	<i>Eremophila gilesii</i>	Not assessed	Food plant and nectar source for over 30 species of native insect (Allsopp 1977)
Mulga	<i>Acacia aneura</i>	IUCN Least Concern	Important habitat for woodland birds, including threatened species (Belder et al. 2022)
Narrow-leaf hopbush	<i>Dodonaea viscosa angustissima</i>	IUCN Least Concern	Provides foraging substrate for bird populations (Martin et al. 2004)
Punty bush	<i>Senna artemisioides filifolia</i>	IUCN Least Concern	Favoured larval food plant for many butterflies and moths (McQuillan et al. 2019, Turner 2001)
Silver cassia	<i>Senna artemisioides</i>	Not assessed	Habitat for bird species, including night parrot (McDougall et al. 2009)
Turpentine	<i>Eremophila sturtii</i>	Not assessed	Important nectar-source for honeyeaters (Hobbs 1967) and other pollinators, also ethnobotanical uses (antibacterial/antifungal; Ndi et al. 2007)
White cypress pine	<i>Callitris glaucophylla</i>	IUCN Least Concern	Large remnants have great diversity of native flora and fauna, providing a mid-story element important for Threatened bird species (Thompson & Eldridge 2005)
Wilga	<i>Geijera parviflora</i>	IUCN Least Concern	Acts as an understory plant that increases plant and animal diversity, soil nutrients and soil moisture through shade (Warnock et al. 2007)
Yarran (yarrany)	<i>Acacia homalophylla</i>	IUCN Least Concern	Important host for grey mistletoe <i>Amyema quandang</i> (Milner et al. 2020), principal food source for the Vulnerable painted honeyeater <i>Grantiella picta</i> (Barea & Watson 2007) and butterflies, the Vulnerable (Dunn et al. 1994) satin azure <i>Ogyris amaryllis</i> and the red spotted jezebel <i>Delias aganippe</i> (Braby & Edwards 2006)

Table 2. Listed species of plants, insects, amphibians, reptiles, birds and mammals known to be present and dependent upon INS vegetation in the Western and Central West LLS regions of New South Wales and their status at state and federal levels (colour coded as black = Extinct, red = Critically Endangered, orange = Endangered, and yellow = Vulnerable).

Common Name	Scientific Name	NSW Status	Commonwealth Status
Plants			
A burr-daisy	<i>Calotis moorei</i>	Endangered	Endangered
A hopbush	<i>Dodonaea sinuolata</i> subsp. <i>acrodentata</i>	Endangered	
A saltbush	<i>Atriplex infrequens</i>	Vulnerable	Vulnerable
A saltbush	<i>Atriplex sturtii</i>	Endangered	
A spear-grass	<i>Austrostipa metatoris</i>	Vulnerable	Vulnerable
A spear-grass	<i>Austrostipa wakoolica</i>	Endangered	Endangered
Androcalva procumbens	<i>Androcalva procumbens</i>	Vulnerable	Vulnerable
Austral toadflax	<i>Thesium australe</i>	Vulnerable	Vulnerable
Belson's Panic	<i>Homopholis belsonii</i>	Endangered	Vulnerable
Black-eyed Susan	<i>Tetratheca juncea</i>	Vulnerable	Vulnerable
Bladder Senna	<i>Swainsona colutoides</i>	Endangered	
Bluebush Daisy	<i>Cratystylis conocephala</i>	Endangered	
Brilliant Hopbush	<i>Dodonaea microzyga</i> var. <i>microzyga</i>	Endangered	
Button Immortelle	<i>Leptorhynchus waitzia</i>	Endangered	
Chariot Wheels	<i>Maireana cheelii</i>	Vulnerable	Vulnerable
Cheilanthes sieberi subsp. pseudovellea	<i>Cheilanthes sieberi</i> subsp. <i>pseudovellea</i>	Endangered	
Climbing Caustic	<i>Euphorbia sarcostemmoides</i>	Endangered	
Cone Umbrella Sedge	<i>Cyperus conicus</i>	Endangered	
Coolabah Bertya	<i>Bertya opposens</i>	Vulnerable	Vulnerable
Creek Wattle	<i>Acacia rivalis</i>	Endangered	
Creeping Darling Pea	<i>Swainsona viridis</i>	Endangered	
Curly-bark Wattle	<i>Acacia curranii</i>	Vulnerable	Vulnerable
Desert Hopbush	<i>Dodonaea stenozyga</i>	Critically Endangered	
Dipteracanthus australasicus subsp. corynothecus	<i>Dipteracanthus australasicus</i> subsp. <i>corynothecus</i>	Endangered	
Fan Flower	<i>Scaevola collaris</i>	Endangered	
Finger Panic Grass	<i>Digitaria porrecta</i>	Endangered	

Flame Spider Flower	<i>Grevillea kennedyana</i>	Vulnerable	Vulnerable
Fleshy Minuria	<i>Kippistia suaedifolia</i>	Endangered	
Green Bird Flower	<i>Crotalaria cunninghamii</i>	Endangered	
Greenhood Orchid	<i>Pterostylis cobarensis</i>	Vulnerable	
Harrow Wattle	<i>Acacia acanthoclada</i>	Endangered	
Hoary Sunray	<i>Leucobrysum albicans</i> subsp. <i>tricolor</i>	Endangered	Endangered
Holly-leaf Grevillea	<i>Grevillea ilicifolia</i> subsp. <i>ilicifolia</i>	Critically Endangered	
Indigo	<i>Indigofera belmsii</i>	Endangered	
Koonamore Daisy	<i>Erodiophyllum elderi</i>	Endangered	
Lancewood	<i>Acacia petraea</i>	Endangered	
Large-leafed Monotaxis	<i>Monotaxis macrophylla</i>	Endangered	
Mallee Golden Wattle	<i>Acacia notabilis</i>	Endangered	
McKie's Stringybark	<i>Eucalyptus mckieana</i>	Vulnerable	Vulnerable
Narrow-leafed Bumble	<i>Capparis loranthifolia</i> var. <i>loranthifolia</i>	Endangered	
Native Milkwort	<i>Polygala linariifolia</i>	Endangered	
Phyllanthus maderaspatensis	<i>Phyllanthus</i> <i>maderaspatensis</i>	Endangered	
Pimelea curviflora var. curviflora	<i>Pimelea curviflora</i> var. <i>curviflora</i>	Vulnerable	Vulnerable
Pine Donkey Orchid	<i>Diuris tricolor</i>	Vulnerable	
Pink Velvet Bush	<i>Lasiopetalum bebrrii</i>	Critically Endangered	
Polycarpaea spirostylis subsp. glabra	<i>Polycarpaea spirostylis</i> subsp. <i>glabra</i>	Endangered	
Prasophyllum sp. Wybong	<i>Prasophyllum</i> sp. <i>Wybong</i>		Critically Endangered
Pterostylis despectans	<i>Pterostylis despectans</i>	Critically Endangered	Endangered
Purple-wood Wattle	<i>Acacia carneorum</i>	Vulnerable	Vulnerable
Rhaphidospora bonneyana	<i>Rhaphidospora bonneyana</i>	Extinct in NSW	Vulnerable
Rice Flower	<i>Pimelea elongata</i>	Endangered	
Sand-hill Spider Orchid	<i>Caladenia arenaria</i>	Endangered	Endangered
Showy Indigo	<i>Indigofera longibractea</i>	Endangered	
Shrub Sida	<i>Sida roblenae</i>	Endangered	
Silky Cow-Vine	<i>Ipomoea polymorpha</i>	Endangered	
Silky Swainson-pea	<i>Swainsona sericea</i>	Vulnerable	

Silver Indigo	<i>Indigofera leucotricha</i>	Endangered	
Slender Darling Pea	<i>Swainsona murrayana</i>	Vulnerable	Vulnerable
Southern Ningau	<i>Ningau yvonneae</i>	Vulnerable	
Spike-Rush	<i>Eleocharis obicis</i>	Vulnerable	Vulnerable
Spiny Everlasting	<i>Acanthocladium dockeri</i>	Extinct in NSW	Critically Endangered
Spiny Peppercress	<i>Lepidium aschersonii</i>	Vulnerable	Vulnerable
Squash Bush	<i>Osteocarpum scleropterum</i>	Endangered	
Tarengo Leek Orchid	<i>Prasophyllum petilum</i>	Endangered	Endangered
Thyme Rice-Flower	<i>Pimelea serpyllifolia</i> subsp. <i>serpyllifolia</i>	Endangered	
Western Goodenia	<i>Goodenia occidentalis</i>	Endangered	
Wild Orange	<i>Capparis canescens</i>	Endangered	
Winged Peppercress	<i>Lepidium monolocoides</i>	Endangered	Endangered
Woolly Ragwort	<i>Senecio garlandii</i>	Vulnerable	
Yellow Gum	<i>Eucalyptus leucoxylon</i> subsp. <i>pruinosa</i>	Vulnerable	
Yellow Swainson-pea	<i>Swainsona pyrophila</i>	Vulnerable	Vulnerable
Yellow-Keeled Swainsona	<i>Swainsona flavicarinata</i>	Endangered	
Insects			
Satin Azure	<i>Ogyris amaryllis</i>	Vulnerable (Dunn et al. 1994)	
Amphibians			
Painted Burrowing Frog	<i>Neobatrachus pictus</i>	Endangered	
Sloane's Froglet	<i>Crinia sloanei</i>	Endangered	Endangered
Reptiles			
A whip snake	<i>Demansia rimicola</i>	Vulnerable	
Barrier Range Dragon	<i>Ctenophorus mirrityana</i>	Endangered	
Border Thick-tailed Gecko	<i>Uvidicolus sphyrurus</i>	Vulnerable	Vulnerable
Centralian Blue-tongued Lizard	<i>Tiliqua multifasciata</i>	Vulnerable	
Children's Python	<i>Antaresia childreni</i>	Vulnerable	
Eastern Fat-tailed Gecko	<i>Diplodactylus platyurus</i>	Endangered	
Five-clawed Worm-skink	<i>Anomalopus mackayi</i>	Endangered	Vulnerable
Grey Snake	<i>Hemiaspis damelii</i>	Endangered	Endangered
Hunter Valley Delma	<i>Delma vescolineata</i>	Endangered	Endangered
Interior Blind Snake	<i>Anilius endoterus</i>	Endangered	

Jewelled Gecko	<i>Strophurus elderi</i>	Vulnerable	
Leopard Ctenotus	<i>Ctenotus pantherinus ocellifer</i>	Endangered	
Mallee Slender Blue-tongue Lizard	<i>Cyclodomorphus melanops elongatus</i>	Endangered	
Mallee Worm-lizard	<i>Aprasia inaurita</i>	Endangered	
Marble-faced Delma	<i>Delma australis</i>	Endangered	
Narrow-banded Snake	<i>Brachynophis fasciolatus</i>	Vulnerable	
Pink-tailed Legless Lizard	<i>Aprasia parapulchella</i>	Vulnerable	Vulnerable
Ringed Brown Snake	<i>Pseudonaja modesta</i>	Endangered	
Slender Bluetongue	<i>Cyclodomorphus venustus</i>	Endangered	
Southern Sandplain Gecko	<i>Lucasium microplax</i>	Vulnerable	
Wedgesnout Ctenotus	<i>Ctenotus brooksi</i>	Vulnerable	
Western Blue-tongued Lizard	<i>Tiliqua occipitalis</i>	Vulnerable	
White's Skink population in the Broken Hill Complex Bioregion	<i>Liopholis whitii</i> population in the Broken Hill Complex Bioregion	Endangered Population	
Woma	<i>Aspidites ramsayi</i>	Vulnerable	
Yellow-tailed Plain Slider	<i>Lerista xanthura</i>	Vulnerable	
Birds			
Australian Bustard	<i>Ardeotis australis</i>	Endangered	
Barking Owl	<i>Ninox connivens</i>	Vulnerable	
Black Falcon	<i>Falco subniger</i>	Vulnerable	
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	Vulnerable	
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	Vulnerable	
Blue-winged Parrot	<i>Neophema chrysostoma</i>	Vulnerable	Vulnerable
Brolga	<i>Antigone rubicunda</i>	Vulnerable	
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	Vulnerable	Vulnerable
Bush Stone-curlew	<i>Burhinus grallarius</i>	Endangered	
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	Vulnerable	
Diamond Firetail	<i>Stagonopleura guttata</i>	Vulnerable	Vulnerable
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable	
Flame Robin	<i>Petroica phoenicea</i>	Vulnerable	
Flock Bronzewing	<i>Phaps bistrionica</i>	Endangered	
Gilbert's Whistler	<i>Pachycephala inornata</i>	Vulnerable	

Grey Falcon	<i>Falco hypoleucos</i>	Vulnerable	Vulnerable
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	Vulnerable	
Hall's Babbler	<i>Pomatostomus halli</i>	Vulnerable	
Little Eagle	<i>Hieraaetus morphnoides</i>	Vulnerable	
Little Lorikeet	<i>Parvipsitta pusilla</i>	Vulnerable	
Malleefowl	<i>Leipoa ocellata</i>	Endangered	Vulnerable
Masked Owl	<i>Tyto novaehollandiae</i>	Vulnerable	
Mukarrthippi Grasswren	<i>Amytornis striatus striatus</i>	Critically Endangered	Critically Endangered
Murray Mallee Striated Grasswren	<i>Amytornis striatus howei</i>	Endangered	Endangered
Painted Honeyeater	<i>Grantiella picta</i>	Vulnerable	Vulnerable
Pied Honeyeater	<i>Certhionyx variegatus</i>	Vulnerable	
Pink Cockatoo	<i>Lophochroa leadbeateri</i>	Vulnerable	Endangered
Purple-crowned Lorikeet	<i>Parvipsitta porphyrocephala</i>	Vulnerable	
Purple-gaped Honeyeater	<i>Lichenostomus cratitius</i>	Vulnerable	
Red-tailed Black-Cockatoo (inland subspecies)	<i>Calyptorhynchus banksii samueli</i>	Vulnerable	
Regent Parrot (eastern subspecies)	<i>Polytelis anthopeplus monarchoides</i>	Endangered	Vulnerable
Scarlet Robin	<i>Petroica boodang</i>	Vulnerable	
Scarlet-chested Parrot	<i>Neophema splendida</i>	Vulnerable	
Shy Heathwren	<i>Hylacola canta</i>	Vulnerable	
South-eastern Glossy Black-Cockatoo	<i>Calyptorhynchus lathami lathami</i>	Vulnerable	Vulnerable
South-eastern Hooded Robin	<i>Melanodryas cucullata cucullata</i>	Endangered	Endangered
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	Vulnerable	
Southern Whiteface	<i>Aphelocephala leucopsis</i>	Vulnerable	Vulnerable
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>	Vulnerable	
Spotted Harrier	<i>Circus assimilis</i>	Vulnerable	
Square-tailed Kite	<i>Lophoictinia isura</i>	Vulnerable	
Squatter Pigeon (southern subspecies)	<i>Geophaps scripta scripta</i>	Critically Endangered	Vulnerable
Superb Parrot	<i>Polytelis swainsonii</i>	Vulnerable	Vulnerable
Thick-billed Grasswren (north-west NSW subspecies)	<i>Amytornis modestus obscurior</i>	Critically Endangered	Critically Endangered
Turquoise Parrot	<i>Neophema pulchella</i>	Vulnerable	

Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	
White-fronted Chat	<i>Epthianura albifrons</i>	Vulnerable	
White-throated Needletail	<i>Hirundapus caudacutus</i>	Vulnerable	Vulnerable
Mammals			
Bolam's Mouse	<i>Pseudomys bolami</i>	Endangered	
Bristle-faced Free-tailed Bat	<i>Setirostris eleryi</i>	Endangered	
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Vulnerable	
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	Vulnerable	Vulnerable
Desert Mouse	<i>Pseudomys desertor</i>	Critically Endangered	
Dusky Hopping-mouse	<i>Notomys fuscus</i>	Endangered	Vulnerable
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	Vulnerable	
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Vulnerable	
Forrest's Mouse	<i>Leggadina forresti</i>	Vulnerable	
Inland Forest Bat	<i>Vespadelus baverstocki</i>	Vulnerable	
Koala	<i>Phascolarctos cinereus</i>	Endangered	Endangered
Kultarr	<i>Antechinomys laniger</i>	Endangered	
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Vulnerable	
Large-eared Pied Bat	<i>Chalinolobus dmyeri</i>	Endangered	Endangered
Little Pied Bat	<i>Chalinolobus picatus</i>	Vulnerable	
Long-haired Rat	<i>Rattus villosissimus</i>	Vulnerable	
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	Vulnerable	Vulnerable
Pilliga Mouse	<i>Pseudomys pilligaensis</i>	Vulnerable	Vulnerable
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>	Vulnerable	
Squirrel Glider	<i>Petaurus norfolcensis</i>	Vulnerable	
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>	Vulnerable	
Western Pygmy-possum	<i>Cercartetus concinnus</i>	Endangered	
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Vulnerable	

The Central West LLS region covers 31,365 km² with approximately 38% vegetated to some extent and 62% cleared or significantly modified (NSW LLS 2025a). It includes the Lachlan, Macquarie-Bogan and Castlereagh River catchments and several important wetlands including the RAMSAR listed Macquarie Marshes. Towns in the region include Nyngan, Coonabarabran, Dubbo, Condobolin and Forbes. Principal native vegetation types present in the area are the Western Slopes Grassy Woodlands, Floodplain Transition Woodlands, and Western Peneplain Woodlands; Riverine Plain Grasslands and Western Slopes Grasslands, as well as shrublands such as Riverine Chenopod Shrublands (NSW LLS 2025a).

The Western LLS region is the largest in NSW and covers 314,500 km² (40% of NSW) and is larger than Victoria and Tasmania combined (NSW LLS 2025b). It is bounded by the Murray River to the south and the Murrumbidgee River to the east and includes the towns of Tibooburra, Bourke, Broken Hill, Cobar and Balranald. The area is semi-arid and arid rangelands unsuitable for intensive agriculture because of low and highly variable rainfall and soil type. Vegetation types include Mallee and Murray Pine Woodlands, Riparian Floodplains and Wetlands, Chenopod Shrublands, Bimble Box Woodlands, Mulga Woodlands, Brigalow Gidgee and Coolibah Blackbox (NSW LLS 2025b).

In both the Central West and Western LLS regions, Invasive Native Scrub (INS) is stated as an “issue” due to impacts on farm production (Gavel et al. 2014). Environmental impacts are couched in terms of prioritizing management of native pastures and open woodlands for agriculture without regard to topsoil loss (during the 19th and 20th centuries), changing the native vegetation communities that now survive in these altered landscapes. The principal invasive native scrub species as determined by LLS (Gavel et al. 2014) comprise 12 species of tree and shrub. Note that all 12 species are native to the region, including many species that are valuable food trees for listed insect, bird and mammal species (Table 1). As noted by Doerr et al (2009) with specific reference to bird occurrence patterns in the Cobar penneplain, there is a strong positive relationship between density of woody vegetation and bird diversity, with open and closed scrubland supporting greater numbers of bird species than open woodland and agricultural areas, including those species of particular conservation concern (Declining woodland birds, see also Watson 2011).

(ii) What impact, if any would harvesting 500,000 dry tonnes per annum of INS have on threatened species;

Invasive species, ecosystem modifications and agricultural activity are the threats identified in listing criteria of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as affecting the largest numbers of Australian threatened species (Kearney et al. 2018; Ward et al. 2019). Within New South Wales, habitat removal is considered a key threatening process, meaning it is a significant factor contributing to the decline of native plants and animals across the state (Karle et al. 2014). Using the estimate of 25 tonnes per hectare (actual biomass of INS varies widely in this ecosystem, but this is the average value specified by the proponent), harvesting 500,000 dry tonnes of biomass per annum equates to clearing approximately 20,000 hectares of native habitat per annum. Removal of large areas of INS will have detrimental impacts on threatened species, making them more vulnerable to climate change impacts, as recently noted by Mackey et al. (2025). Habitat loss (reduced area of woody vegetation supports lower population sizes of associated species), habitat fragmentation (breaking up the continuous native vegetation into smaller and smaller segments reduces resilience and connectivity) and the increase of edges (allowing for weed and feral animal incursions) are three separate but interacting consequences of harvesting INS. Habitat loss and fragmentation are two of the biggest drivers of species extinctions, therefore, the harvesting of INS could impact some species catastrophically to the point of extinction or could cause populations to decline, increasing their risk of extinction (Doerr et al. 2009). Habitat loss, fragmentation and increased edge effects will also compound additional threats, facilitating dispersal of feral animals and weed species (Hannah et al. 2007). Further, by reducing connectivity between populations, effects of drought, heat waves and other climatic events will be exacerbated (Watson et al. 2017), populations unable to escape deteriorating conditions in isolated portions of habitat.

(iii) What impact, if any, would harvesting 90,000 dry tonnes per annum of INS have on threatened species.

Regardless of the amount of INS removal, habitat loss and associated disturbance as specified in (ii) remains a key threatening process and fragmentation and reduced connectivity are both detrimental to species persistence at local and landscape scales (Hannah et al. 2007; Watson et al. 2017). Although less INS cleared (noting 90,000 dry tonnes of biomass per annum equates to annual clearing of approximately 3,600 ha) would entail proportionally less habitat lost, the relationship between area cleared and species impacted is complex, noting many of the listed plant species in the region are known from very small distributional ranges. For example the hopbush *Dodonaea sinuolata subsp. acrodentata* is known from a single locality near Hilston, and the daisy *Callotis moorei* is known from one property near Louth and three isolated populations near Menindee. These small ranges, variable soil types and patchy management histories interact, such that two sites on the same pastoral property may contain quite distinct ecological communities with differing sets of threatened species.

(b) Provide any further observations or opinions concerning the impact of the implementation of the Project on the environment.

Given the contentious nature of the classification of INS and the assessment methodology applied to its management (Doerr et al 2009), oversight of the removal of semi-arid woodland and associated habitats within New South Wales varies greatly, with no established process to evaluate biodiversity impacts. The risk of impacts to the environment through large-scale habitat loss for biomass are high (Mackey et al. 2025) and extensive baseline monitoring would be required to ensure that listed species and ecological communities are not being negatively impacted. In closing, I refer to Eldridge & Soliveres (2015) summary of the broader issue of woody encroachment in Australian rangelands, finding no evidence justifying the continued clearing of INS, further noting:

- (1) Shrub effects on ecosystems are complex and no standardised management (e.g. removal) should be applied to every case;
- (2) Overgrazing suppresses the generally positive effect of shrubs on native species and the ecosystem services they provide;
- (3) Woody encroachment does not hinder any ecological functions or ecosystem services, rather it enhances many of them, noting that negative connotations of woody encroachment are based on studies from western regions of the United States of America, not empirical data from Australian ecosystems;
- (4) There has been little rigorous assessment of the long-term effectiveness of woody vegetation removal and no evidence that this improves land condition in most cases.

Professor David M Watson

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18 August 2025

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References

- Allsopp, P. G. (1977). Insects associated with *Eremophila gilesii* F. Muell. in southern Queensland. *Queensland Journal of Agricultural and Animal Sciences*, 34(2), 157–161.
- Barea, L. P., & Watson, D. M. (2007). Temporal variation in food resources determines onset of breeding in an Australian mistletoe specialist. *Emu*, 107(3), 203–209.
- Belder, D. J., Paton, D. C. & Pierson, J. C. (2022). Potential effects of arid shrubland degradation on habitat suitability for a declining arid zone bird, the Chestnut-rumped Thornbill (*Acanthiza uropygialis*). *Austral Ecology*, 47(3), pp.603–618.
- BGCI (Botanic Gardens Conservation International) & IUCN SSC Global Tree Specialist Group. 2019. *Dodonaea viscosa*. *The IUCN Red List of Threatened Species* 2019: e.T66292425A146224257. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T66292425A146224257.en>
- Braby, M. F., & Edwards, T. D. (2006). The butterfly fauna of the Griffith district, a fragmented semi-arid landscape in inland southern New South Wales. *Pacific Conservation Biology*, 12(2), 140–154.
- BGCI (Botanic Gardens Conservation International) & IUCN SSC Global Tree Specialist Group (2021). *Eremophila mitchellii*. *The IUCN Red List of Threatened Species* 2021: e.T192234025A192234036. <https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T192234025A192234036.en>
- Doerr, V. A., Doerr, E. D., McIntyre, S., Stol, J., Davies, M., Drew, A., Warren, G., Moore, D. and Howling, G., 2009. Managing invasive native scrublands for improved biodiversity outcomes in agricultural landscapes. Report to the Central West Catchment Management Authority, Dubbo, NSW.
- Dunn, K. L., Kitching, R. L., & Dexter, E.M. (1994). The national conservation status of Australian butterflies. A report to Australian National Parks and Wildlife Service, Canberra ACT.
- Eldridge, D. J., & Soliveres, S. (2015). Are shrubs really a sign of declining ecosystem function? Disentangling the myths and truths of woody encroachment in Australia. *Australian Journal of Botany*, 62(7), 594–608.
- Fensham, R., Laffineur, B. & Collingwood, T. (2019). *Eucalyptus populnea*. *The IUCN Red List of Threatened Species* 2019: e.T133373973A133373975. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T133373973A133373975.en>
- Gavel, T., Treweek, R., & Saunders, D. (eds.) (2014). Managing invasive native scrub to rehabilitate native pastures and open woodlands. Central West LLS, Dubbo, NSW and Western LLS, Cobar, NSW. 125 pp. https://www.lls.nsw.gov.au/_data/assets/pdf_file/0007/685222/managing-invasive-native-scrub.pdf
- Gowland, K. (2022). *Geijera parviflora*. *The IUCN Red List of Threatened Species* 2022: e.T200148932A200149909. <https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T200148932A200149909.en>
- Hannah, D., Woinarski, J. C. Z., Catterall, C. P., McCosker, J. C., Thurgate, N. Y., & Fensham, R. J. (2007). Impacts of clearing, fragmentation and disturbance on the bird fauna of Eucalypt savanna woodlands in central Queensland, Australia. *Austral Ecology*, 32(3), 261–276.
- Hobbs, J. N. (1967). Honeyeaters and emu bush, *Eremophila*. *Emu-Austral Ornithology*, 66(4), 386–388.
- Kearney, S. G., Adams, V. M., Fuller, R. A., Possingham, H. P., & Watson, J. E. (2020). Estimating the benefit of well-managed protected areas for threatened species conservation. *Oryx*, 54(2), 276–284.
- Kerle, A., Goldney, D., & Fleming, M. (2014). Habitat loss and landscape degradation: the disastrous outlook for vertebrate fauna in central western NSW. *Australian Zoologist*, 37(1), 40–74.
- Mackey, B. G., Lindenmayer, D. B., Keith, H. and de Bie, J. 2025. Burning forest biomass is not an effective climate mitigation response and conflicts with biodiversity adaptation. *Climate Resilience and Sustainability*, 4(2).
- Malcolm, P. (2012a). *Acacia aneura*. *The IUCN Red List of Threatened Species* 2012: e.T19892219A19996730. <https://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T19892219A19996730.en>

- Malcolm, P. (2012b). *Acacia aneura*. *The IUCN Red List of Threatened Species* 2012: e.T19892219A19996730. <https://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T19892219A19996730.en>
- Martin, W. K., Eyars-Chaddock, M., Wilson, B. R., & Lemon, J. (2004). The value of habitat reconstruction to birds at Gunnedah, New South Wales. *Emu-Austral Ornithology*, 104(2), 177-189.
- McDougall, A., Porter, G., Mostert, M., Cupitt, R., Cupitt, S., Joseph, L., ... & Burbidge, A. (2009). Another piece in an Australian ornithological puzzle—a second Night Parrot is found dead in Queensland. *Emu-Austral Ornithology*, 109(3), 198–203.
- McQuillan, P. B., Forrest, J. A., Keane, D., & Grund, R. (2019). *Caterpillars, Moths and Their Plants: Of Southern Australia*. Butterfly Conservation SA Incorporated.
- Milner, K. V., Leigh, A., Gladstone, W., & Watson, D. M. (2020). Subdividing the spectrum: quantifying host specialization in mistletoes. *Botany*, 98(9), 533–543.
- Ndi, C. P., Semple, S. J., Griesser, H. J., & Barton, M. D. (2007). Antimicrobial activity of some Australian plant species from the genus *Eremophila*. *Journal of Basic Microbiology*, 47(2), 158–164.
- NSW LLS (New South Wales Local Land Service) (2025a) Central West Local Land Service region. NSW Government <https://www.lls.nsw.gov.au/regions/central-west>
- NSW LLS (2025b). Western Local Land Service region. NSW Government <https://www.lls.nsw.gov.au/regions/western>
- Page, M., Witt, G. B., Noel, M., Slaughter, G., & Beeton, R. J. S. (2008). Economic and environmental analysis of fodder harvesting practices associated with mulga (*Acacia aneura*) and fire management practices in the mulga lands of south western Queensland. University of Queensland.
- PF Olsen & EPA (2016). Private Native Forestry Field Guide for Cypress and Western Hardwood Forests. State of NSW and Environment Protection Authority. https://www.lls.nsw.gov.au/_data/assets/pdf_file/0009/807489/Private-Native-Forestry-Field-Guide-for-Cypress-and-Western-Hardwood-Forests.pdf
- Thompson, W. A., & Eldridge, D. J. (2005). White cypress pine (*Callitris glaucophylla*): a review of its roles in landscape and ecological processes in eastern Australia. *Australian Journal of Botany*, 53(6), 555-570.
- Turner, M. S. (2001). Conserving Adelaide's Biodiversity: Resources. Urban Forest Biodiversity Program, Adelaide, South Australia.
- Ward, M. S., Simmonds, J. S., Reside, A. E., Watson, J. E., Rhodes, J. R., Possingham, H. P., ... & Taylor, M. (2019). Lots of loss with little scrutiny: the attrition of habitat critical for threatened species in Australia. *Conservation Science and Practice*, 1(11), e117.
- Warnock, A. D., Westbrooke, M. E., Florentine, S. K., & Hurst, C. P. (2007). Does *Geijera parviflora* Lindl. (Rutaceae) facilitate understorey species in semi-arid Australia?. *The Rangeland Journal*, 29(2), 207–216.
- Watson, D. M. (2011). A productivity-based explanation for woodland bird declines: poorer soils yield less food. *Emu: Austral Ornithology* 111:10–18
- Watson, D. M., Doerr, V. A. J., Banks, S. C., Driscoll, D. A., van der Ree, R., Doerr, E. D. & Sunnucks P. (2017). Monitoring ecological consequences of efforts to restore landscape-scale connectivity. *Biological Conservation* 206: 201–209.

Annexures

1. Curriculum vitae of Professor David M Watson
2. Brief from the Environmental Defenders Office, on behalf of the Nature Conservation Council