Environmental Impact Assessment for the Proposed Gas-field in the Pilliga Forests

An assessment of the submitted documentation

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I am an ecologist who has undertaken significant ecological studies in the Pilliga forests since 1997, particularly on birds and mammals. I completed my Master of Science thesis based on my 6 years field work in the Pilliga and worked for Forests NSW, NSW DPI, and as a consultant to Forestry Corporation and the Office of Environment and Heritage. As such I am in a good position to assess the value of the Pilliga forests for their significance as a refuge for our wildlife and as an example of the woodland vegetation that was once widespread across the western slopes and plains of NSW.

The Pilliga forests constitute the largest temperate semi-arid woodland remaining in Australia. The forest's half a million hectare size is important for maintaining wildlife populations because it allows large enough populations of many threatened species to maintain the genetic diversity required for long term survival. Thus, while part of the forest is still used for commercial selective extraction of timber resources, that area should not be discounted for its biodiversity values as it acts together with the area conserved in National Park, Nature Reserve and State Conservation Areas by making for more integrated forest boundaries and with additional foraging and breeding resources utilised by many species, not the least of which are iconic species such as the Koala and Barking Owl.

I am concerned that the risks posed by the gas-field development will reduce the conservation value of the Pilliga. The plan includes substantial clearing for roads and pipe-lines and around gas wells. There is a considerable risk to the groundwater of the area which is also connected to the great artesian basin, a lifeline for many rural communities across northern NSW. The risks of saltwater pollution have already been demonstrated. If the death of forest is repeated at the proposed well sites, the forest will be devastated and at increased risk to invasion by exotic weeds or of turning into salt pans. The wildlife of Pilliga is forest fauna. Any risk to the forest is a risk to them. Pilliga is all we have left in terms of a large viable semi-arid forest ecosystem. It should not be put at risk by mining that will increase greenhouse gas production and thus climate volatility/heating, cause direct local threats and may devalue the conservation image and thus the will of management to keep the Pilliga intact.

The Terrestrial Ecology Assessment (Chapter 15)

As a scientist, I was particularly disappointed to discover numerous inadequacies in the terrestrial ecology assessment produced for this project (Chapter 15).

Of particular concern to me is that the report has utilised a wide range of grey literature reports or general literature on fauna or fauna management but has completely ignored some of the important ecological studies undertaken right in the Pilliga and published in scientific peer reviewed journals

or similar publications. These studies contain important information about how plants and wildlife survive in the Pilliga context and on the importance of the remnant forests of Pilliga to their conservation. Table 1 lists the largest and most notable studies undertake since 1990. However, there is an even longer history of ecological research in the forests and Chapter 15 incorporates almost none of it. This alone invalidates this study as an adequate assessment tool. Yet this information was freely available to the chapter authors. One has to ask why was it ignored? Was it perhaps because the reports generally highlight how important the Pilliga forests are for conservation on the western slopes and plains of NSW?

Table 1. Scientific papers and reports presenting the results of recent larger ecological studies in the Pilliga forests: selected summaries only. Full references are in the bibliography along with references for additional studies.

Reference	Location of study	Aim of study	Method of study	Key findings
Barrott 1999	All Pilliga forests	To investigate habitat use and distribution of Koalas while directly comparing five different census techniques; To ground-truth a preliminary habitat atlas map (AKF) for Koalas in the region.	Walked transects, faecal pellet counts, listening for unelicited calls, call play-back and spotlighting on 96 transects, each 400 m long, spread throughout the Pilliga.	Faecal pellet counts and aural survey techniques most effective. Koalas recorded on 61 of 116 transect counts (52.6%). Koalas recorded on 33 of 46 transects located in Central Pilliga (72%), at 27 of 40 transects located in West Pilliga (68%) and at one of 30 transects in East Pilliga (3%). Preliminary population estimate of 18,000 Koalas.
Binns and Beckers 2001	All Pilliga forests	To describe the broad patterns of terrestrial vascular flora in the Pilliga as part of the first systematic botanical survey in the area.	All vascular plant species were recorded, along with cover-abundance scores, in 482 plots, each 0.1 ha in size. Plots were located randomly, stratified by mapped forest type.	Totals of 753 native and 100 exotic plant species recorded. Average was 43.1 (range 11-75) native species and 2 (range 0-29) exotic species per plot. 34% plots contained no exotic species. Nine principal floristic associations, or broad forest types, were identified and these floristic groups had a strong geographical pattern in their distribution. The two main species of *Callitris* occur in all or most floristic groups, but they are strongly negatively associated with each other.

Reference	Location of study	Aim of study	Method of study	Key findings
Date *et al*. 2002	All Pilliga forests	To determine if there are identifiable assemblages of birds with consistent patterns of distribution among vegetation types; and, whether there are consistent patterns of disturbance among bird assemblages and bird habitats; and, whether particular bird assemblages have declined or are under threat of disturbance from logging, fire and grazing	568 transects, each 200 m long and 60 m wide, were surveyed once during a 20 minute survey period within three hours of dawn. The transects were usually located in pairs or triplets, approximately 100 m apart. All birds seen or heard were recorded.	170 bird species were recorded, of which 140 are woodland species. Bird species assemblages of Broad-leaved Ironbark woodlands were similar to those of box-ironbark woodlands. Blakely's Red Gum woodlands were characterized by 36 bird species that were virtually absent from box-ironbark and Broadleaved Ironbark woodlands, including 10 threatened and declining species. The diverse fauna and flora in the Pilliga require adaptive management of grazing, logging, fire regimes and firewood collection to be conserved. Careful long-term monitoring and review of management protocols through experimental research which examines different disturbance regimes at different geographic scales is required to ensure the long-term survival of all bird species in the Pilliga forests.
Date and Paull 2000	All Pilliga forests	General wildlife survey throughout the Pilliga in 1993-1994.	Range of observational and trapping techniques at each of 90 transects, each 200 m long, spread throughout the Pilliga.	Reports observations for all species of wildlife encountered. Evidence of Koala presence (mainly from observations of faecal pellets) was recorded at 40 of 90 transects (44.4%). Koalas were recorded at 10 of 18 transects in Central Pilliga (56%), at 19 of 42 transects in East Pilliga (45%), at 7 of 18 transects in West Pilliga (39%) and at 4 of 12 transects in the Southern Pilliga (33%).
Humphreys *et al*. 2001	Central Pilliga	To investigate the factors limiting the extent of White Cypress Pine	Soil chemical, structural and hydrological measurements were analysed from plots that sampled a range of forest types in which White Cypress Pine occurred along a continuum of relative abundance.	White Cypress Pine occurs on a wide range of landforms, both erosional and depositional, and on a variety of texture contrast soils and deep sands spanning a wide range of chemical properties. WCP avoids moist or wet sites, such as Broom and Belah, which are also sites where the extreme values of various soil chemical properties occur (e.g. soil pH, soluble salts%, carbonate%).

Reference	Location of study	Aim of study	Method of study	Key findings
Kavanagh and Barrott 2001	All Pilliga forests	To summarise data from two regional surveys and one research project; To provide an estimate of Koala population size and review threatening factors.	Review of the findings of surveys by Barrott (1999) and Date and Paull (2000), and the research later published by Kavanagh *et al*. (2007). These findings were placed into an historical context based on interviews with long-term residents (van Kempen 1997).	Koala population estimated at about 15,000 animals in 1998-1999. Evidence that Koalas have increased dramatically in abundance over the previous 50 years. Koalas widespread (in 1999) across the landscape but more common in west and central Pilliga than in the east. East Pilliga has been burnt frequently by wildfires. Threats include drought and heat stress, wildfire, tiger pear and possibly introduced predators. Koala home ranges included a minimum of 20 eucalypt stems per ha larger than 20 cm diameter. Selective logging for White Cypress Pine had minimal adverse effects on the Koala.
Kavanagh and Stanton 2009	West and Central Pilliga	To determine the habitat requirements, sensitivity to logging, population size and conservation management of the Barking Owl in the Pilliga forests.	Nine Barking Owls were radio-tracked for one year and a total of 35 birds from 20 territories were trapped and colour-banded. Assessments were made of home-range area, foraging habitat, nesting habitat, diet, breeding success, and other ecological attributes.	Barking Owl home ranges averaged about 2,000 ha. The owls displayed no strong preference for, or against, any of the commonly occurring forest vegetation types for foraging. They also showed no aversion to foraging in areas logged selectively for White Cypress Pine within the previous 16 years. However, nest-hollows were always located in large old eucalypts, usually Red Gums and Narrow-leaved Ironbarks, but frequently also in large dead ringbarked trees. Nest trees were usually located within forest stands that were less disturbed than surrounding areas. A wide variety of trees and tall shrubs were used for roosting, including Narrow-leaved Ironbark, White Cypress Pine, Belah, Rough-barked Apple, Wilga and Bull Oak. Barking Owl diets consisted of a wide range of native prey items, mostly birds, insects and some mammals. Breeding success was variable and limited by drought and predation in some years. Population density was estimated at approximately 20 territories (40 adults) within 50,000 ha, which was extrapolated to approximately 100 territories (200 adults) for the Pilliga forests (only half of which is occupied by this species).

Reference	Location of study	Aim of study	Method of study	Key findings
Kavanagh *et al.* 2007	Central Pilliga	To determine whether selective logging for White Cypress Pine affected Koala survival and fecundity, home-range size and fidelity, movements and tree preferences.	Radio-tracked 30 Koalas for one year in a planned logging experiment that incorporated a before-after-control-impact design, with replication.	Koalas continued to occupy all or part of their previous home-ranges after selective logging, and home-range sizes remained similar between logged and unlogged areas. Home-ranges for both sexes overlapped and were ~12 ha for males and 9 ha for females. Koala survival and the proportions of breeding females were similar in logged and unlogged areas. The principal food trees of the koala were red gums, mainly *Eucalyptus blakelyi* and *E. chloroclada*, and the pilliga box (*E. pilligaensis*), none of which were logged in this study. Selective logging for white cypress pine does not appear to adversely affect koala populations. Thorn-stick injury from the introduced plant *Opuntia aurantiaca* and extended periods of extremely hot, dry weather were identified as important threatening factors.
Milledge 2004	All Pilliga forests	To determine the distribution and relative abundance of the Barking Owl and other nocturnal fauna	Rapid call-playback and spotlighting surveys were undertaken once at 510 sites during autumn-winter 2001. Sites were 1.5-2.0 km apart and spaced along roads and vehicular tracks.	Barking Owls were recorded at 92 sites (18%) with records concentrated in the north and west of the Pilliga forests. The pattern of records closely followed the distribution of the non-commercial Pilliga Box, Poplar Box and White Box forests and woodlands, and areas which had not been burnt by wildfire for many years. Barking Owl records were correlated with the distribution of other nocturnal birds and mammals.
Norris *et al*. 1991	Central Pilliga	To review the evidence for changed forest structure and floristics following European settlement.	Inspection of historical maps showing extent of particular vegetation types, a review of the climatic record, and a review of the historical and ecological evidence behind a number of assertions made by Rolls (1981).	Evidence of a remarkably stable vegetation pattern over the past century in the “core area” of the Central Pilliga. Regeneration of White Cypress Pine was not confined to two major events, as described by Rolls (1981), but spread across many events resulting in a range of tree age-classes. Dense shrub cover was common in places and certainly not unknown at the time of first settlement when open woodlands and grassy plains were believed to be the norm.

Reference	Location of study	Aim of study	Method of study	Key findings
Parnaby *et al.* 2010	South-Central and East Pilliga	To report an opportunistic, post-fire (prescribed burn) assessment of collapse rates of hollow-bearing trees near fire boundary roads.	Initial assessments of the number of hollow-bearing trees were made from a moving vehicle 1-6 weeks after a prescribed burn. A follow-up assessment was undertaken 8 months later within 29 burnt plots, of 50 x 40 m, in three areas of the Pilliga forests. The numbers of collapsed trees in these plots were counted and correlated with other plot based measurements.	381 hollow-bearing stems were measured, 329 of which were burnt and 57 of these burnt stems had collapsed. The low intensity prescribed burns resulted in mean tree collapse rates ranging from 14%-26%, depending on the burn area (14% of 179 stems for plots dominated by red gum, 25.8 % of 62 stems for the ironbark dominated mixed species plots, 18.5% of 54 stems for the red gum dominated plots along Dandry Creek, and 17.6% of 34 stems for plots dominated by Scribbly Gum and mixed species). Low intensity prescribed burns are progressively depleting the hollow-bearing tree resource that is already formally recognized as threatened.
Paull 2001	West Pilliga forests	To estimate the pre-European forest stand structure of Narrow-leaved Ironbark dominated forests	Twenty 1 ha plots were selected. In each plot, every stump, or live and dead ironbark tree and white cypress pine greater than 64 cm (or 60 cm for WCP) diameter (measured at 60 cm above the ground) was counted.	The numbers of large old trees for both Narrow-leaved Ironbark and White Cypress Pine have declined over the past 90 years. Specific results difficult to interpret because no comparable historic data available.
Paull and Date 1999	State Forests of the Nandewar and Brigalow South bioregions	General survey of mammal species	Three 200 m transects located in each of 40 study areas were surveyed twice during 1993-1995. Survey methods included spotlighting, Elliott A traps, hair tubes, predator scats, cage traps and call-playbacks for certain species.	Twenty-one species of non-flying native mammals were recorded. This was about 50% of the known historical diversity of mammal species from this region (43 recorded species), with 11 considered extinct and 12 species known from the region but not recorded during the survey. Of the species detected during the survey, 10 were considered as common or widespread, while 12 species were rare or under-recorded. Grass-dependent species and species between 50 g and 6 kg have suffered most from extinction.
Sodequist 2009	All the Pilliga forests and immediately surrounding areas	To determine the most important areas and how isolated the Pilliga Barking Owl population is	Nocturnal survey, Cluster analysis of records and radio tracking	The Pilliga contains the largest and possibly only sustainable Barking Owl population in Southern Australia and at present it appears to be isolated from other nearby populations due to incompatible land uses.

Reference	Location of study	Aim of study	Method of study	Key findings
Stanton 2011	Central and West Pilliga forests	To determine the diet and important food resources of the Barking Owl; To investigate whether the restricted distribution of Barking Owls is related to prey availability.	Barking Owl diets were analysed from a sample of 1546 regurgitated pellets, 315 faecal samples, and by direct observations of foraging birds within 19 territories in the Pilliga. Prey availability was assessed using bird census counts, spotlight surveys, small mammal trapping, bat surveys and insect netting.	Barking Owls preyed on most species of diurnal and nocturnal birds, as well as Sugar Gliders, bats and insects. Prey size ranged from 0.3 g insects to ~800 g cockatoos and mammals. Most prey were native species. Barking Owl distribution was positively associated with prey availability (total prey biomass), especially with biomass of diurnal birds and nocturnally active prey. The Pilliga forests appear to provide marginal habitat for Barking Owls, with the best (most productive) habitat already cleared for agriculture or on the forest edge. However, it is still the most important population in Southern Australia and vital for the species conservation
Tokushima *et al*. 2008	Pilliga Nature Reserve	To obtain basic ecological information to assist conservation management; To describe population fluctuations and local distribution in relation to wildfire.	Pilliga Mouse was trapped at two paired sites (four locations) using finely-tuned Elliott A traps. Trapping was conducted in 11 sessions from September 1997 to October 2001, involving 6376 trap-nights and yielding 791 captures (of 343 individuals) of *Pseudomys pilligaensis*	Pilliga Mouse population densities were low before the 1997 wildfire but irrupted to a very high peak (up to 83 mice per ha) about 29 months after the wildfire, thereafter falling sharply and remaining low (0-5 mice per ha) until trapping ended about four years after the fire. The breeding season spanned October-April, with some females breeding repeatedly within a season. Prolonged good rains soon after the wildfire may have facilitated the irruption. This species normally occurs at low density and sparse distribution in disjunct patches of refuge habitat but can become briefly ubiquitous when environmental conditions are favourable.
Tokushima and Jarman 2008	Pilliga Nature Reserve	To obtain basic ecological information to assist conservation management; To report on the demographic processes underlying the phenomenon of irruption in the Pilliga Mouse.	Methods as described above.	Average weight of captured *P. pilligaensis* was 11.3±1.5 g (range 6.0 g to 16.5 g, *n* = 363). In total, 171 mice (89 males, 82 females) were captured at least twice during the same trapping session. Median of all recorded movements was 40.0 m, the longest distance between successive captures was 181.1 m. *P. pilligaensis* was non-territorial in the peak phase (as shown by the overlapping of numerous home ranges). Young females dispersed more and with more successfully than males, explaining the capacity of this species to rapidly colonise habitat that becomes suitable after disturbances such as wildfire.

Reference	Location of study	Aim of study	Method of study	Key findings
van Kempen 1997	All Pilliga forests	To review the ecological, economic and sociological history of the Pilliga forests	Interviews with long-tern residents of small towns near the Pilliga.	Major increase in numbers of the Koala observed by local residents over the past century, co-inciding with a number of factors, including cessation of hunting and ringbarking of eucalypts. Reports on frequency of sightings for other wildlife species, including arrival of feral predators. Notes on changes in forest structure and composition.
Whipp *et al*. 2012	Central Pilliga	To determine the extent to which forest stand structure and composition has changed over 60 years (1940s-2005)..	Vegetation plots established in the 1940s were re-located and re-measured. Counts of tree species by tree diameter size classes were compared between the two sample periods.	Major changes in forest structure observed over the past 60 years. A three- to four-fold increase in the density and basal area of trees from the three genera (*Eucalyptus, Callitris* and *Allocasuarina*) was observed. The magnitude of the changes that have occurred over time far exceed the differences between mapped forest types.

Biodiversity offset package (Chapter 15.5)

I object to using an offset package to deal with the damage and destruction of the forest on the following basis:

- The Pilliga forests have been considered as an important conservation area for decades, even with selective timber extraction. Destruction of conservation areas is not consistent with biodiversity offsetting principles (even under the current twisted legislative interpretation).
- Why should it be permitted to destroy the forest for mining when there are no other large intact areas of forest that could be considered as "like for like" offsets? Pilliga's size and spatial integrity make it unique.
- The fact that Santos has no plan of where it might source like for like offsets is a good indication that there are none available.
- some parts of the package are out of date with the changed legislation.
- The promise of "compensatory measures such as Koala research" looks very much like a bribe to keep some members of the scientific community quiet. How could a research project be compensatory for the potential harm being done to the forest, waterways and aquifers let alone Koalas without additional money allocated to implement the findings of the research? What if the research reveals that Koalas have declined as a result of the gas exploration carried out by Santos and their predecessors? Can we trust Santos to publish and act on those findings?

Aquatic ecology (Chapter 16)

Once again, there is a poor use of published aquatic studies in this region. The aquatic ecology report relies heavily on the use of existing data sets for its consideration of fish species. However, the databases they have consulted generally have very poor representation of small fish species and extremely patchy data for larger commercial species. One small fish species of conservation concern is the Purple-spotted Gudgeon (*Mogurnda adspersa*), which historically occurred in tributaries of the Namoi River (and still persists in areas around Narrabri). Reliance on databases for the presence of this cryptic, non-commercial species is unacceptable. Surveys for this species both up and down stream of the proposed impact zones should be conducted before it is ruled out of consideration of this assessment.

Groundwater and Geology Assessment (Chapter 11)

Somewhat like the ecology chapters, the groundwater and geology chapter appears to cite no original data sources in its description of the geological environment. Yet there has been specific geology, geomorphology and hydrology studies completed in the Pilliga and published in peer reviewed books and journals e.g. Hesse and Humphreys (2001), Humphreys *et al.* (2001). The geology and geomorphology of the Pilliga is unusual and the fact that the report authors have chosen to ignore the published works raises concerns for the competence of their information.

A more tangible concern is that the chapter authors state correctly that "*There is no known beneficial use of groundwater from the target coal seams in the Maules Creek Formation or from strata or coal seams of the Black Jack Group*". Yet this is exactly the water proposed to be removed from the coal seams and disposed of in the local waterways.

The authors seem to discount the fact that water continues to flow under the sand surface in Pilliga's sand choked creeks. The authors describe the creeks as intermittent or ephemeral, ignoring the reality that water is still present and flowing subsurface. I am concerned that the chapter authors (and thus Santos) are not working with real data regarding the hydrology of these streams. This could make their discharge plans for water with "no known benefit" unworkable.

There seems to be no plan for water discharge over periods of extended drought. Some of the creeks in the area had no significant above sand flows for over seven years during the millennium drought. Will Santos continue to attempt to stockpile unusable water if there is an extended drought? Or will they stop water extraction and thus gas production? The test gas extraction sites had a number of failures of the poisonous water retention plans either due to overfilling or poor pond construction. What assurances can the public have that Santos will act responsibly and stop producing toxic water when there is no safe method to discharge it.

And this assumes that it is ever safe to discharge the waste water. Surely they should be under the same constraints as every town in the Murray Darling basin that they have to discharge cleaner water than they are taking. But how would this apply when you are bringing water out of the ground that has "no known benefit". Santos should not have any freedom to release such dangerous

water. The Darling River system already has problems with high salinities. This will only make matters worse.

Other comments

The EIS is over 7000 pages yet it omits many potential data sources and seems to have been constructed with the "bullshit callipers" in mind. This is not a document that can be fully comprehended even by any regulator, but the message is clear. This is a project that is going to:

- industrialise an area currently managed as a wild place,
- reduce its conservation value,
- further pollute the Murray-Darling river system with saline, toxic water,
- produce increased amounts of greenhouse gasses both from CO2 emissions and escaped methane,
- risk wildlife habitat through increased fragmentation,
- and set a precedent that it is OK to risk our wild places and biodiversity heritage for the financial gain of a corporation.

The damage already done to the Pilliga during the trial and exploration phase shows what we have to look forward to on a grander scale if this project goes ahead.

Sincerely,

Matthew Stanton

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