

THE LIZARD FAUNA OF HUMID FORESTS ON THE PROPOSED WADJANA BASIN PRESERVE



Cygnet Surveys & Consultancy
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Specialist Consultancy

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Prepared by: Cygnets Surveys & Consultancy
2 Acron Road, St Ives 2075 NSW AUSTRALIA
Email: gerryswan@axtsystems.com

For: Vale Nouvelle-Calédonie

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Frontcover: *Rhacodactylus sarasinorum* – photo Ross A. Sadler

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1. INTRODUCTION

This study was undertaken to determine the species diversity of lizards in humid forest habitat of the proposed Wadjana Preserve.

Previous studies in the region of the Goro Plateau (Sadlier & Shea 2004; Sadlier 2006; Sadlier & Swan, 2009b) have identified humid forest as the habitat with the greatest diversity of lizard species. In the region a group of 19 species of lizard have now been recorded from the humid forest that covers the Special Reserves Forêt Nord, Pic du Grand Kaori and Pic du Pin and proposed Kwè Nord Range Preserve. A lower, but still significantly diverse lizard fauna is also found in the tall canopied maquis habitat (paraforestier and preforestier) of the region (Sadlier & Swan, 2009a; Sadlier & Swan, 2010; Sadlier & Swan, 2011).

Preservation of humid forest habitat in the Grand Sud has been identified as a major priority for conservation of the rich endemic for lizard fauna of the region (Sadlier 2006). The forests of the Goro Plateau and adjacent ranges are highly fragmented and are present as a number of isolated patches of varying size across the landscape - this makes them particularly susceptible to a range of threats, particularly with increased levels of activity in the region since the commencement of mining activities. Not only do these forests have a high species richness, they are also the preferred habitat for the giant geckos *Rhacodactylus leachianus* and *Rhacodactylus sarasinorum*, the later a regional endemic and found only in humid forest habitat.

Vale Nouvelle-Caledonie has proposed the preservation and management of humid forest in the Wadjana River drainage and Kwe Nord range to complement the network of existing humid forest habitat reserves represented by the Provincial Reserves in the Grand Sud. As part of the management of this area base-line inventories for lizard fauna in humid forests of the Wadjana River were undertaken to determine species richness and relative abundance, and to detect the presence of regionally significant species.

2. STUDY SITES AND METHODS

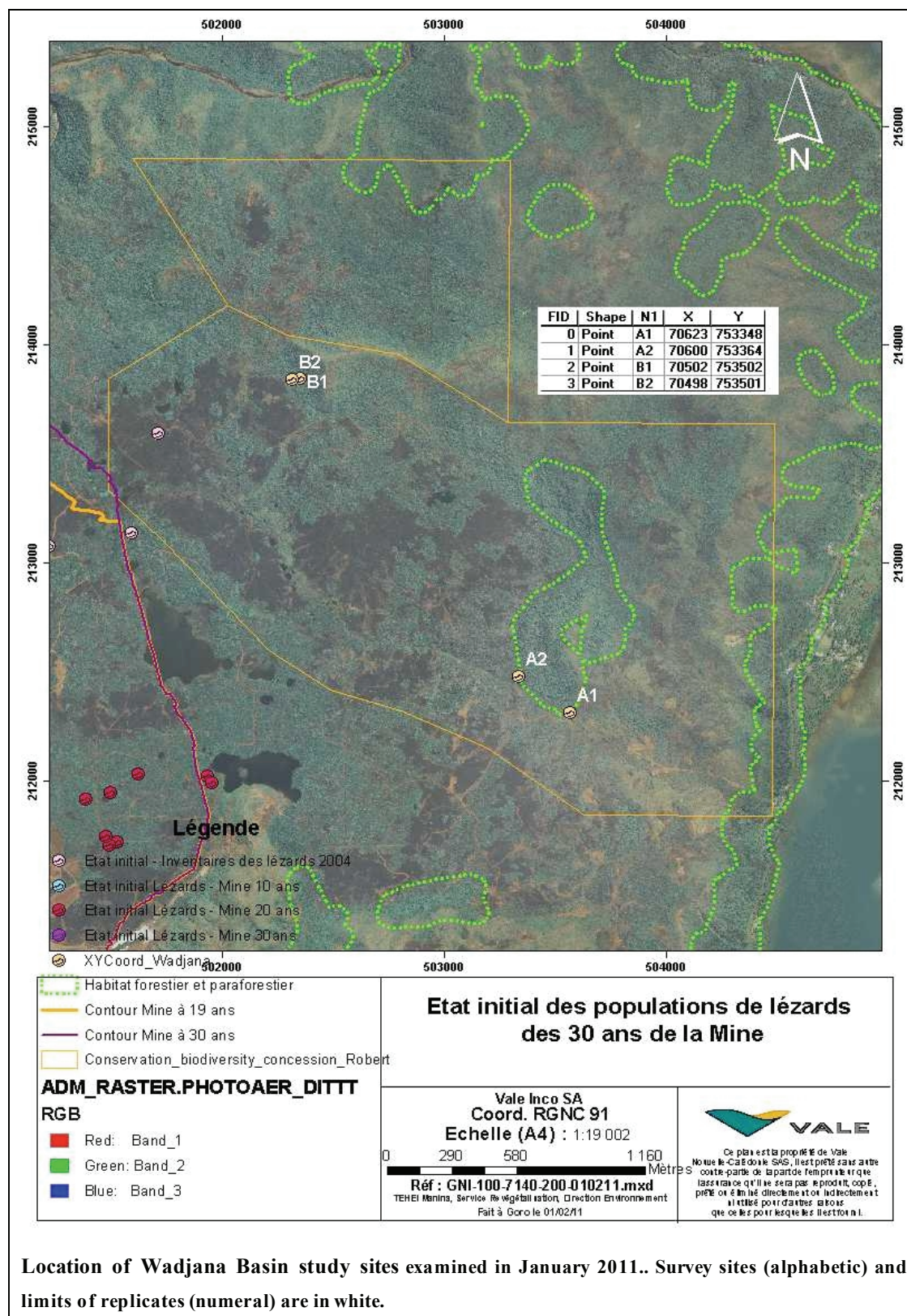
The study was conducted in the wet season in of January 2011. The conditions during the survey varied with periods of intermittent wet weather throughout, particularly in the early and latter part of the survey period. Two separate sites were investigated, each representing a discrete patch of humid forest in the area proposed for preservation.

2.1 Study sites.

Two sites, each representing an area of tall humid forest were sampled, one in the upper and one in the lower reaches of the Wadjana River. Each site had three transect lines, each transect line containing 20 transect stations (5-8 metres apart) respectively. The vegetation structure at each site was internally relatively homogenous. Both sites had a tall (site B) to very tall (site A) canopy with a relatively open understory of saplings, palms, and pandanus:

- Site A (0706231E 7533480N): three transects commencing near the edge of the forest closest to the creek line and passing through tall humid forest on a broad area with a gentle slope at the base of the range, then ascending a steep incline with areas of outcropping peridotite. The forest at the base of the slope had a moderately dense leaf litter layer, fallen logs and a sparse scattering of exposed rock on the surface, but changed markedly to being predominately outcropping rock with few fallen logs and scattered leaf litter piles on the steep slope. The majority of stations (~80%) were placed in forest at the base of range and the remainder on the steep slope with outcropping peridotite.
- Site B (0704987E 7535501N): three transects each commencing near the edge of the forest close to the creek line and passing for a short distance (~20m) through moderately tall humid forest at the base of the range, then ascending a steep incline with areas of outcropping peridotite. The tall forest at the base of the slope had a moderately dense leaf litter layer with some fallen logs and a sparse scattering of exposed rock on the surface; it then changed markedly to being predominately outcropping rock with few fallen

logs and scattered leaf litter piles on the steep slope. The majority of stations (~70%) were placed in on the steep slope with outcropping peridotite.





Forest patch on lower reaches of the Wadjana River - site A.



Site A forest interior – base of slope.



Forest patch on upper reaches of the Wadjana River - site B.



Site B forest interior – note steep slope and extensive outcropping peridotite.

2.2 Field methods.

Scincid lizards are the most diverse group in New Caledonia in terms of number of species and the niches occupied, and include:

- secretive species that shelter and forage below the surface of ground cover.
- diurnal surface-active species that tend to forage and bask on the surface of ground cover.
- diurnal surface-active species that are arboreal in habits and tend to forage and bask on the trunks and foliage of trees, and are occasionally active on the ground.

Previous studies to assess the diversity and abundance of lizard species in forest and maquis habitats have shown that strategically placed glue traps are the most time effective method for detecting the presence of the majority of day active skinks, and are also particularly effective in detecting the presence of secretive species when placed at the entrance to likely sheltering sites. For these reasons this was the method used to detect diurnal and secretive lizard species in all habitats across the 7 sites surveyed. Glue traps were strategically placed at each of 20 stations (5-8 metres apart) located along each transect line for each replicate. Traps were placed under or next to sheltering sites (crevices and cracks created where outcropping cuirasse boulders contact the ground, under and next to logs), in areas of litter or amongst surface debris, and under vegetation. For each trap placed at each station along a transect line the basic microhabitat attributes of the station with regard to potential sheltering sites were recorded.

Geckos are usually the less diverse of the two lizard groups present. Geckos are active at night and forage in low shrubs, small trees, or the forest canopy, and shelter by day in vegetation or under cover on the ground. Nocturnal searches were usually undertaken in the first two hours after sunset. The method used to search for geckos detecting the reflection from the eye when a beam of light is directed towards the lizard or, by scanning vegetation with a powerful light at closer range to observe geckos on twigs or branches. Binoculars modified to carry a torch and emit a light beam from below the eyepieces of the binocular were used to detect eye reflection. This method readily detects both the larger and smaller geckos, but to be effective

requires a minimum search distance of 10-15m., and a co-worker is required to collect the gecko for positive identification while the first observer keeps the animal in sight from a distance. Records are also kept of lizards encountered opportunistically on transects during the course of checking glue traps.

Search effort and conditions: At each site replicate one glue trap per station was laid at each of the 20 stations along the transect line. A total of 120 trap stations were operational throughout the survey period for a period of ~4 full days and nights after being established, although a period of rain reduced the effective trapping effort to 3 days (360 trap days/night in total). Temperatures around midday during the survey period ranged from 23.1-25.1°C ($\bar{x}$ 24.4°) and humidity was consistently high at 87.3-100% ($\bar{x}$ 96.3%)

Timed nocturnal searches consisted of walking along transects through forest marked by a string line. During the January survey period a total of 4 person hours of searching in one session as undertaken at site A (23.5°C, humidity 90.6% and cloud cover 50%) and 3 person hours in one session at site B (25.4°C, humidity 96.6% and cloud cover 100%). Rain throughout the remainder of the survey period did not allow for further timed night searches.

Voucher specimens were taken of each species for future taxonomic and population studies.

3. RESULTS

A total of 14 species of lizard were recorded during the survey period (for both sites combined) representing 8 species of skinks and 6 geckos. The skinks *Marmorosphax tricolor* and *Sigaloseps deplanchei* were commonly encountered at both sites, and together constituted 85% of records for this lizard group during the survey. The geckos *Bavayia septuiclavis* and *Bavayia sauvagei* were recorded at both sites. Among the remaining species encountered were a number of southern region endemics, including two species of particular conservation significance, the skink *Graciliscincus shonae* and gecko *Rhacodactylus sarasinorum*.

3.1 Distribution and abundance: *Marmorosphax tricolor* was the most abundant species of skink, constituting 59.8% of records for this group and *Sigaloseps deplanchei* 25.3% of records. Both are secretive species only rarely seen active by day – all records of these species are from captures on glue traps.

Proportionally (given equal trap effort at each site where effort equates to the number of transect stations at each site, and equal duration of trap effort at all stations) more individuals of *M. tricolor* were recorded from site B (61% of all records for this species) than from site A (39%). This is possibly due to a greater proportion of trapping stations passing through outcropping peridotite at site B (~70%), than at site A (~40%), and as such sampling a higher proportion of the preferred sheltering sites for this species at site B. Conversely, more *S. deplanchei* were recorded from site A (77% of all records for this species) than from site B (23%), possibly reflecting the greater extent of forest floor leaf litter layer, the preferred microhabitat for this species, sampled at site A (see preforest survey reports - Sadlier and Swan, 2009a; 2010; 2011).

A single individual of the skink *Graciliscincus shonae* was recorded from site B. The species is regarded as predominately fossorial, having only ever been detected by searching beneath suitable sheltering sites, from captures in glue traps set in rock piles or under logs, or from pitfall traps, and has never been seen active on the surface of the forest floor. The single individual recorded during this survey was captured on a glue trap set at the base of a tree. This in combination with individuals

recorded from pitfall traps during monitoring of humid forests elsewhere in the region indicates this species is active on the surface of the forest floor, most probably at night and/or in the early and late hours of the day.

Two species of skink, *Caledoniscincus cf. atropunctatus* and *Tropidoscincus variabilis*, were recorded active by day in the forest and from glue traps set at the transect stations, but only rarely. Both species are known to be widely distributed across the region and were relatively abundant in humid forest habitat surveys undertaken in the warmer months towards the end of the dry season (November/December). The low number of lizards observed active by day during this survey is considered to be a consequence of reduced activity in these species given the overcast weather conditions, rather than reflecting low abundance.

Three species of small diplodactylid gecko were recorded during the survey. *Bavayia septuiclavis* and *Bavayia cf. sauvagei*, were recorded during night surveys of both sites, neither species was abundant. *Bavayia septuiclavis* has a broad distribution in the region and has also been recorded from open and canopied maquis habitats. By contrast *Bavayia cf. sauvagei* has a much more scattered distribution in the region and has mainly been recorded from canopied maquis and some (but not all) humid forest patches. A single individual of *Eurydactylodes symmetricus* was recorded from site A on the lower reaches of the Wadjana drainage. The species was known from very few records historically but has now been recorded from a number of canopied and open maquis sites in the region, and from humid forest on the Kwe Nord range.

The giant gecko *Rhacodactylus sarasinorum* was recorded from both sites (two individuals at site A, one at site B) and the species is now known from a number of humid forest patches in the region with a reasonably tall canopy of mature trees - the encounter rate is similar to that for most other humid forest sites in the region.

		Site A	Site B	Total
SKINKS	<i>Caledoniscincus cf. atropunctatus</i>	5 (2)	4 (1)	9 (3)
	<i>Caledoniscincus austrocaledonicus</i>	1	1	2
	<i>Graciliscincus shonae</i>	-	2	2
	<i>Lioscincus nigrofasciolatus</i>	2	-	2
	<i>Marmorosphax tricolor</i>	42	62	104
	<i>Nannoscincus mariei</i>	-	1	1
	<i>Sigaloseps deplanchei</i>	34	10	44
	<i>Tropidoscincus variabilis</i>	4 (1)	2	6 (1)
Total skinks		91	83	174
GECKOS	<i>Bavayia cf. sauvagei</i>	10 (4)	4	14 (4)
	<i>Bavayia septuiclavis</i>	3	6 (2)	9 (2)
	<i>Eurydactylodes symmetricus</i>	(1)	-	- (1)
	<i>Nactus pelagicus</i>	1 (6)	-	1 (6)
	<i>Rhacodactylus auriculatus</i>	1	-	1
	<i>Rhacodactylus sarasinorum</i>	2	1	3
Total geckos		28	13	41

Table 1: Distribution of lizard species by site – records for skinks represent captures from ground glue traps and observations (brackets), and records for geckos represent night observations and captures from ground glue traps (brackets).

The Gekkonid gecko *Nactus pelagicus* was recorded from seven individuals at site A, mostly from traps set at stations near outcropping peridotite. This species has not previously been recorded from sites on the Goro Plateau, but has been recorded from several nearby coastal localities (Prony, Cap N'Doua, Goro). It's presence at site A is likely to be a consequence of this the proximity of this forest to adjacent coastal habitats.

3.2 Assessment of survey methods: Placement of glue traps in the vicinity of sheltering sites had several clear impacts on rate of detection (calculated as the no. of records as a proportion of effort for each microhabitat, where effort equates to the number of transect stations for a particular microhabitat type as a % of total number of stations assuming equal duration of trap effort at all stations).

No. stations	Rock crevice 30 [25%]	Next to rock 34 [28.3%]	Under veg. 6 [5%]	In open 9 [7.5%]	Under log 14 [11.7%]	Next to tree 27 [22.5%]	Total 120 100%
<i>M. tricolor</i>	29 (1.2)	32 (1.1)	8(1.6)	4 (0.5)	14(1.2)	17 (0.75)	104
<i>S. deplanchei</i>	9(0.4)	4 (0.15)	4 (0.8)	6 (0.8)	6 (0.5)	15 (0.66)	44
<i>C. cf. atropunctatus</i>	2 (0.08)	3 (0.1)	-	-	3 (0.25)	1 (0.04)	9
<i>C. austrocaledonicus</i>	-	1 (0.03)	-	-	1 (0.08)	-	2
<i>T. variabilis</i>	-	2 (0.07)	-	-	-	3 (0.13)	5
<i>L. nigrofasciolatum</i>	-	-	-	-	-	-	-
<i>G. shonae</i>	-	1 (0.03)	-	-	-	-	1
<i>N. mariei</i>	1 (0.04)	-	-	-	-	-	1
Total	41	43	12	10	24	36	166

Table 5: Number of individuals of each species recorded from glue-trap stations on transect lines through all replicates – numbers in brackets are the proportion of individuals recorded per unit of area as expressed by the number of records as a proportion of effort for each micro-habitat.

$$\text{Proportion of individuals per unit area of microhabitat surveyed} = \frac{\text{number of individuals recorded from a microhabitat type}}{\text{proportion of survey effort for each microhabitat}}$$

Where survey effort for a particular microhabitat equates to the number of transect stations for that microhabitat as a percentage (%) of the total number of stations across all microhabitat types ie. the proportion of survey effort for the microhabitat 'rock crevice' was 11.7% of the total survey effort across all microhabitat types. As such, the proportion of individuals recorded per unit area for *Marmorosphax tricolor* from 'rock crevice' microhabitat (1.2) is derived from the number of individuals recorded (29) /proportion of survey effort for this particular habitat type (25%).

For the secretive skink species *Marmorosphax tricolor* and *Sigaloseps deplanchei* there were clear trends in microhabitat preference:

- proportionally more *Marmorosphax tricolor* were recorded from glue traps placed next to a rock or at the entrance of a rock crevice ($\bar{x}$ 1.15 records/station combined) or under a log (1.2 records per unit microhabitat) than from glue traps placed in leaf litter away from obvious sheltering sites ($\bar{x}$ 0.95 records per unit microhabitat for traps set under vegetation, in the open or at the base of a tree combined), confirming previous trends of a preference for sheltering and moving around these features of the forest floor .
- proportionally more than double the number of *Sigaloseps deplanchei* were recorded from glue traps placed in leaf litter away from obvious sheltering sites ($\bar{x}$ 0.75 records per unit microhabitat for traps set under vegetation, in the open or at the base of a tree combined) as were recorded from traps placed next to or under sheltering sites ($\bar{x}$ 0.35 for next to a rock, at the entrance of a rock crevice, under a log combined).

There were not sufficient captures made of the other species of skinks to get meaningful assessments of microhabitat preference.

The gecko *Nactus pelagicus* was recorded mainly from glue traps placed on the forest floor at site A. The species is extremely wary and difficult to approach at night, but the number of records obtained from site A indicates it is likely to be moderately abundant in this patch of forest.

There were marked differences in night search success for the geckos *Bavayia septuiclavis* and *Bavayia sauvagei* between the two sites. At site A 0.5 individuals/person hour were recorded for *B. septuiclavis* and 2.5 individuals/person hour for *B. sauvagei*, while at site B 2.3 individuals/person hour were recorded for *B. septuiclavis* and 1.3 individuals/person hour for *B. sauvagei*. The higher overall recorded densities at site B for both species combined could be attributed to the dense understory shrubs and small saplings at this site providing more foraging sites for these species. It is also possible that site A has previously been infested by the Little Red Fire Ant (*Wasmannia auropunctata*), resulting in overall lowered population densities. The recording rate of 2.3 individuals/person hour for *B.*

septuiclavis at site B is similar to that obtained for this species during surveys of humid forest on the Kwe Nord range (Sadler & Swan, 2009b).

4. ASSESSMENT

4.1 Species diversity: Fourteen species of lizard were recorded from the forests of the Wadjana drainage. This is similar, but lower, than that recorded for surveys of humid forest habitat on the special reserves Forêt Nord, Pic du Grand Kaori and Pic du Pin (17 species in total – Sadler and Shea 2006). However, the special reserves have received significantly greater search time, particularly in the past 3 years while monitoring for the abundance of lizards has been undertaken by Vale-Nouvelle Calédonie. Surveys of humid forest on the Kwe Nord range (Sadler and Swan, 2009b) recorded nine species, seven of which were recorded from the Wadjana forests.

A further three species of forest dependant lizards are considered likely to occur in the Wadjana humid forests. The skink *Simiscincus aurantiacus* has been recorded from humid forest and canopied maquis habitats in the region and the giant gecko *Rhacodactylus leachianus* from humid forest of the special reserves Forêt Nord, Pic du Grand Kaori and Pic du Pin. Also, the large skink *Phoboscincus garnieri*, is likely to be widespread in the region and to occur in a range of habitats including humid forest. These three species are also expected to occur in the Wadjana humid forests, giving a potential species richness of 17 species in the reserve.

Several other species of largely forest dependent lizard have also been recorded from the region of the Goro Plateau. The geckos *Bavayia geiteina* and *Bavayia robusta* have been recorded from the upper slopes of Forêt Nord, but not from forest at the base of the range. *B. geiteina* appears to prefer areas of outcropping peridotite and can be locally abundant, while *B. robusta* is arboreal in habits and has only been recorded infrequently from humid forest on the Goro Plateau. Both species have a scattered distribution in the Grand Sud and appear to be absent from a number of sites with suitable habitat. The skink *Caledoniscincus festivus* has been recorded from Pic du Pin but not from the humid forests to the south of the Grand Lac and Lac Huit, despite extensive search effort in suitable habitat. As such, it is difficult to

make any prediction on the likely occurrence of these species in the Wadjana humid forests.

4.2 Significant species: Significant species are those of particular conservation significance by virtue having one or more aspects of their biology (habitat preferences, diet, home range, etc.) specialised, which in combination with a limited extent of occurrence can affect the ability of the species to persist into the future. The giant gecko, *Rhacodactylus sarasinorum* is endemic to southern New Caledonia, with the majority of records for the species coming from forested habitats on or adjacent to the Goro Plateau. The species is large in size, likely to have a complex life history and considered to be at risk from a range of threats (Bauer & Sadlier, 2000; Sadlier & Bauer, 2003; Sadlier, 2006). A recent assessment of the conservation status of all New Caledonian lizards using IUCN conservation criteria (in preparation) assessed this species as ‘Vulnerable’. The populations of *R. sarasinorum* on the Goro Plateau are of particular conservation significance given coastal populations of the species are likely to be in decline induced by a range of threats associated with human occupation, including loss of forest habitat from clearing for agriculture, fire and introduction of invasive ants into coastal forests.



Rhacodactylus sarasinorum – a species of giant gecko endemic to southern Grande Terre and recorded from both Wadjana humid forest sites surveyed.

4.3 Restricted species

Regional endemics: A number of New Caledonian lizards have been identified as ‘southern endemics’ (Sadler, 2006), and the humid forests of the Goro Plateau contain a particularly large number of species in this category. Of the species recorded from Wadjana humid forests nearly all the skinks (*Caledoniscincus cf. atropunctatus*, *Sigaloseps deplanchei*, *Graciliscincus shonae*, *Tropidoscincus variabilis*) and nearly all the geckos (*Bavayia cf. sauvagei*, *Bavayia septuiclavis*, *Eurydactylodes symmetricus* and *Rhacodactylus sarasinorum*) are restricted to the southern ultramafic region. As such, their distribution and the actions required to assure their conservation is in a more limited geographical context.

4.4 Conservation significance of humid forest of the Wadjana Basin.

In southern New Caledonia, the greatest diversity of lizards is found in humid forest, with approximately 22 species expected to occur in this habitat (Sadler, 2006; Sadler and Swan, 2009b), of which 20 species have now been recorded from forest habitat in the region of the Goro Plateau (Sadler and Swan, 2010). Of these over half the species are largely restricted to this habitat type¹.

1) recent survey work (Sadler and Shea, 2004; Whitaker and Sadler unpublished; Sadler and Swan 2009b, 2010, 2011) in a range of maquis habitats in the Grande Sud has shown that some moisture dependent species usually associated with primary forest will inhabit maquis habitats, where the microhabitat is sufficiently moist to meet the species requirements.

The Wadjana humid forests are important to the conservation of lizards in the region in that:

- they represent relatively large and relatively undisturbed areas of humid forest, a habitat that has been reduced to isolated patches in the Grand Sud, and as such, represents a finite resource for the conservation of largely forest dependent lizard species in a regional context.
- they have a level of lizard diversity close to that present in humid forests habitat of the Provincial Special Reserves in the region, including two species of conservation significance, and as such will complement the conservation of largely forest dependent lizard species in the region.

- the forest in the upper reaches of the drainage are free of the introduced invasive Little Red Fire Ant that has infested much of the coastal forest in southern New Caledonia and which appears to have a significant negative impact on lizards (Jourdan et al., 2001).

These attributes identify preservation of the proposed Wadjana humid forests as a significant contribution to the conservation of the lizard fauna of southern New Caledonia at a regional level.

4.5 Threats to the Wadjana humid forests.

These forests are present as isolated patches small in size, and as such are vulnerable to a range of threats that would have a negative effect on the endemic lizard fauna that include:

- the impact of firing of adjacent maquis habitat resulting in loss or degradation of the forest edge leading a reduction in area of occurrence, and ultimately those features of a large forest that allow it to support higher population densities in some species than smaller patches, particularly the giant geckos which by virtue of their size could have large home ranges and as a consequence low population densities. Firing of the forest edge will not only reduce the overall area of humid forest but will expose the forest edge and likely lead to loss of humidity some distance into the forest interior. The impacts on the lizard fauna are likely to be a reduction in the number of suitable sheltering sites at ground level for moisture dependent species, particularly those for which fallen logs (*Marmorosphax tricolor*, and *Simiscincus aurantiacus*) or dense leaf litter (*Sigaloseps deplanchei*) are important microhabitat. Such a loss of humidity is also likely to alter the structure of the invertebrate community, and as a consequence prey availability, given that some species of lizards have fairly specialised diets.
- infestation by the introduced Little Red Fire Ant (*Wasmannia auropunctata*) would result in reduced population abundance and also loss of species diversity (Jourdan et al., 2001), given the potential of this species to infest forest habitat at high densities. The Little Red Fire Ant has been reported (and was present during the study) from the Wadjana forest site A on the

lower drainage, but not from site B on the upper reaches of the drainage system.

- high levels of infestation by rats leading to predation on both ground dwelling and arboreal species of lizards that are active at night. In particular, the eggs and young of the giant gecko *Rhacodactylus sarasinorum*, are likely to be highly vulnerable.
- some activities associated with development within the area of the mine along its eastern perimeter (Route de la Wadjana) could have indirect impacts on the reserve, such as light pollution from night lighting and dust from roads.

5. RECOMMENDATIONS.

To ensure the long term persistence of the lizard fauna of the Wadjana humid forests active management with regard to proximity of development, access, fire control and invasive and feral species are likely to require:

- measures be taken to prevent the spread of fire to the forest edge.
- monitoring for the early detection and control of invasive species, specifically the Little Red Fire Ant, within humid forest.
- implementation and ongoing control of rats.
- management of maquis habitat within the proposed conservation zone as a buffer against fire impacting on the forest edge.
- management of nearby mining activities such that they do not indirectly impact on the forests.

Further, recent studies have highlighted the significant contribution of canopied maquis habitats to maintaining lizard diversity and abundance in the region in extending the distribution of otherwise primarily humid forest dependent species. In this context the inclusion of areas of maquis preforest in areas adjoining the Wadjana drainage would further enhance the contribution of the area to the conservation of forest dependent lizard species on the Goro Plateau and in the Grande Sud.

6. SUMMARY

Survey work in the forest patches of the Wadjana drainage to date have recorded a moderately rich lizard fauna of 14 species, with an additional three or more species likely to be recorded with further survey work, giving a potential species diversity equivalent to that recorded for designated Provincial reserves in the region. As such, the proposed reserve area on the Wadjana drainage would make a valuable contribution to conservation of the lizard fauna of the region. However, the reserve area is subject to a number of threats, most generic to humid forests in the region, but which would benefit from active management strategies. The conservation significance of the proposed reserve would benefit from the inclusion of adjacent areas of canopied maquis that lie outside the long-term plan of mine development.

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