

An assessment of the lizard fauna of forests on the Vale Nouvelle-Calédonie KO4 project area.

Cygnnet Surveys & Consultancy

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1. INTRODUCTION

Cygnnet Surveys and Consultancy (CSC) were contracted by Vale Nouvelle-Calédonie to provide an expert assessment of the lizard fauna likely to occur in forests located within the area of proposed development of the KO4 project, and identify the potential occurrence of sensitive species or habitat of conservation significance for lizards in these forests.

A number of studies have been commissioned by VN-C to investigate the lizard fauna of the Goro Plateau. The nature of these studies has been to establish monitoring sites for lizards (Sadlier & Swan, 2008), to inventory the lizard fauna in the areas of mine development (Sadlier & Swan, 2009a, 2010a; Sadlier *et al.*, 2011a) including the proposed development of the KO4 tailings storage facility (Sadlier *et al.*, 2014d, 2014e, 2015a, 2015b, 2015c), and to inventory the lizard fauna of areas proposed for preservation (Sadlier & Swan, 2009b and Sadlier *et al.*, 2011d). In addition a number of baseline inventory studies have been commissioned to assess the lizard fauna of concessions held by VN-C across the Grand Sud (Sadlier & Swan, 2010b & 2010c; Sadlier *et al.*, 2011b, 2011c, 2012, 2013a, 2013b, 2013c, 2014a, 2014b, 2014c).

These studies in combination have identified a rich and diverse lizard fauna of ~25 species on the Goro Plateau and adjacent areas of the Grand Sud. Included are a number of **significant species** which have been identified as of particular conservation concern by virtue having one or more aspects of their biology (habitat preferences, diet, home range, etc.) specialized, and which in combination with their extent of occurrence influences the ability of these species to persist into the future.

Humid forest is the richest with 20 species having been recorded from extensive survey work in forest habitat on the Goro Plateau. Included are three species of giant gecko formerly in the genus *Rhacodactylus*, one of which is endemic to the Grand Sud.

Forest scrub and tall maquis scrub (preforest and paraforest respectively) can also have a rich lizard fauna, with up to 14 species recorded from these habitat types, whereas open maquis arbustif or herbaceous maquis scrub typically have a lower diversity of species and low abundance of individuals. As a result of these studies humid forest, preforest and paraforest have been identified as **significant habitats** for lizards in the region.

This study focuses on six separate areas of forest within the area of what is defined as the project KO4 which is the fourth sub-basin found in the uppermost western drainages of the Kwé River.

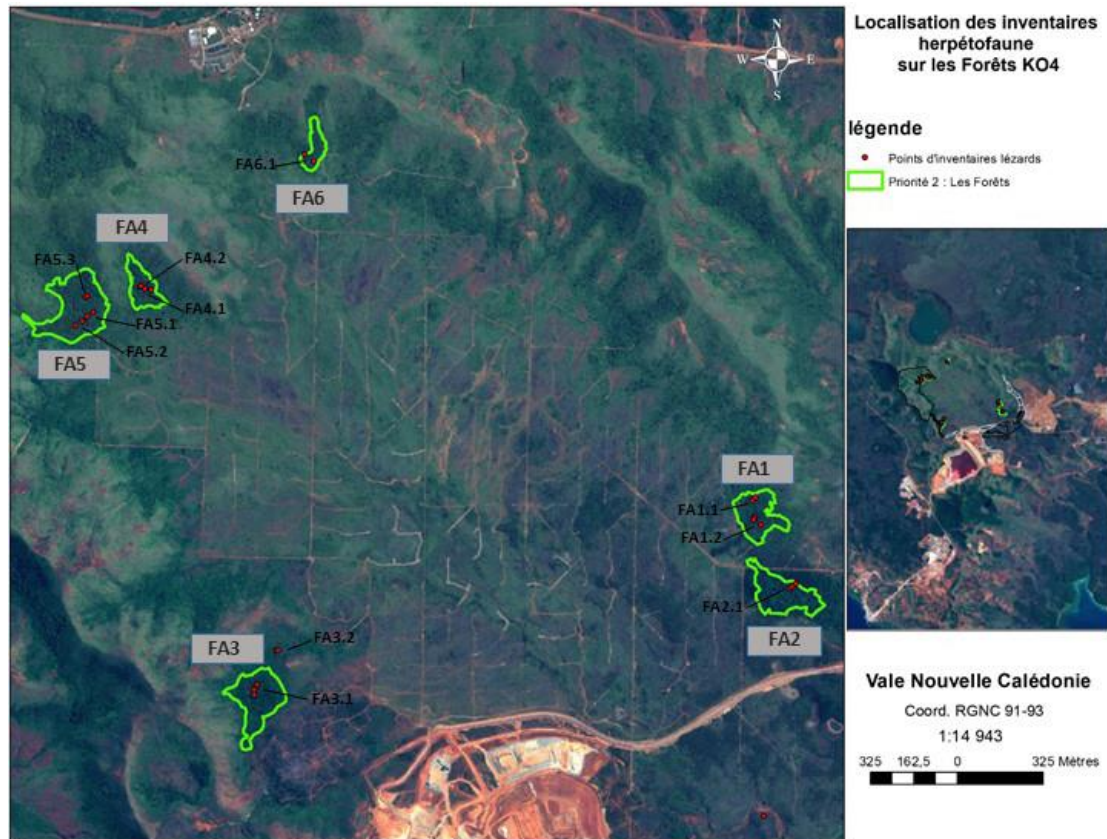
2. STUDY SITES

A total of 11 sites were established across the six areas of forest identified within the KO4 project area (see Table 1 below). These sites are labelled according to the particular area of forest (FA1, FA2 etc), then by number assigned to the site within each area of forest (FA1.1 for site 1 in forest area FA1).

Site	Co-ordinates		Vegetation (type_n1)	(type_n2)
FA1.1	Transect A	-22.28867S x 166.93254E	Forest	N
	Transect B	-22.28858S x 166.93263E	Forest	N
	Transect C	-22.28926S x 166.93266E	Forest	N
FA1.2	Transect A	-22.28934S x 166.93260E	Forest	O
	Transect B	-22.28949S x 166.93286E	Forest	O
	Transect C	-22.29939S x 166.93303E	Forest	O
FA2.1	Transect A	-22.29165S x 166.93394E	Forest	O
	Transect B	-22.29160S x 166.93402E	Forest	O
	Transect C	-22.29150S x 166.93414E	Forest	O
FA3.1	Transect A	-22.29536S x 166.91443E	Forest	O
	Transect B	-22.29518S x 166.91443E	Forest	O
	Transect C	-22.29504S x 166.91455E	Forest	O
FA3.2	Transect A	-22.29384S x 166.91524E	Forest scrub (<i>Tristaniopsis</i>)	-
	Transect B	-22.29387S x 166.91524E	Forest scrub (<i>Tristaniopsis</i>)	-
	Transect C	-22.29385S x 166.91531E	Forest scrub (<i>Tristaniopsis</i>)	-
FA4.1	Transect A	-22.28164S x 166.91035E	Forest	O
	Transect B	-22.28166S x 166.91058E	Forest	O
FA4.2	Transect A	-22.28156S x 166.91016E	Forest	O
	Transect B	-22.28153S x 166.91020E	Forest	O
FA5.1	Transect A	-22.28245S x 166.90849E	Forest	O
	Transect B	-22.28257S x 166.90828E	Forest	O
FA5.2	Transect A	-22.28287S x 166.90782E	Forest	O
	Transect B	-22.28276S x 166.90807E	Forest	O
FA5.3	Transect A	-22.28194S x 166.90819E	Forest	O
	Transect B	-22.28190S x 166.90828E	Forest	O
FA6.1	Transect A	-22.27706S x 166.91617E	Forest	O
	Transect B	-22.27728S x 166.91649E	Forest	O

TABLE 1 – forest sites surveyed in the KO4 project area - note: 'Habitat' corresponds to the broad vegetation types (type_n1), and the code for the finer level of vegetation type (type_n2) as determined in field during the course of the surveys.

Forest areas FA1, FA2 and FA3 were surveyed in the period 13th – 15th March 2015, and areas FA4, FA5 and FA6 in the period 28th – 30th May 2015. Most of the forest areas were humid forest at the base of the ranges around the perimeter of the KO4 project area, except for forest area FA1 which is classified *Arillastrum* forest, and site 2 on forest area FA3 (FA 3.2) was initially identified as *Notofagus* forest but later revised and determined to be *Tristaniopsis guillanii* scrub. Forest areas FA4 and FA5 had small areas of outcropping peridotite within the forest, and forest area FA6 extensive outcropping peridotite.



Forest Sites surveyed on the KO4 development area in 13-15 March and 28-30 May 2015.

- Green line represents the boundaries of forest areas (Bluecham Vale NC projection).
- Individual sites marked with red circles.



Forest areas FA1 and FA2.



Forest area FA3.1.



Forest area FA3.1 – interior of forest.



Forest scrub area FA3.2 – *Tristaniopsis guillanii* scrub forest on dome of hill slope.



Forest area FA3.2 – note outcropping cuirasse surface.



Forest area FA5.



Forest area FA4.



Forest interior typical of forest areas FA4 and FA5 with scattered outcropping peridotite.



Forest area FA6.



Forest area FA6 dominated by large peridotite boulders.

3. METHODS

Survey sites at each forest area were selected according to the following criteria:

- to encompass the full range of habitat within each forest so as to assess the species diversity of each forest area as completely as possible.
- to target specific microhabitats in which lizard species of particular conservation concern might occur.
- to obtain an estimate of the number of individuals of each species likely to be affected by any proposed development activities.

Previous studies to assess the diversity and abundance of lizard species in forest habitats in the Grand Sud have shown that strategically placed glue traps are highly effective in detecting the presence of the majority of day active skink species, and particularly effective in detecting the presence of secretive skinks in forests, notably those that utilize rock refugia. It is also the only effective method for detecting the presence of skink species in areas with a dense understory and groundcover such as in maquis habitats. For these reasons this methodology has been the primary method used to detect diurnal and secretive skinks in all habitats across surveyed over the past 8 years (since 2008) by CSC.



Typical placement of glue traps under vegetation in forest habitat.

The number of sites surveyed reflected the size of the individual forest areas. Three areas of forest had three transects, each transect representing a site replicate, and at three forest sites two transects. At each transect one glue-trap was laid at each of 10 stations (each station 5-8 m. apart) along a transect line. Glue traps were strategically 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. Records are also kept of lizards encountered opportunistically on transects during the course of checking glue traps.

Geckos are usually the less diverse of the two lizard groups present. Geckos are active at night foraging in low shrubs, small trees, or the forest canopy. By day they shelter in retreat sites in standing vegetation or under cover on the ground. Timed nocturnal searches are

usually undertaken in the first two hours after sunset. Frequent rain in the late afternoon and early evening hours during both survey periods did not allow for timed nocturnal searches to be undertaken. However, night searches had been undertaken under better conditions during earlier studies at site 1 in forest area FA1 (FA1.1), at site 1 in forest area FA3 (FA3.1) and along the road that forms (in part) the northern boundary of forest area FA2 (Sadlier *et al.*, 2011b). Night searches of forest areas close to the forests in the KO4 project area have previously been undertaken during surveys of Forêt Nord and Pic du Grand Kaori (Sadlier & Shea, 2004; Sadlier & Swan, 2008) and adjacent areas (Sadlier *et al.*, 2011c), of the nearby Kwe Range (Sadlier & Swan, 2009b) and areas associated with the mine development (Sadlier & Swan, 2009a, 2010a, 2011a), in areas near to the KO4 project area (Sadlier & Swan, 2010b), as well as forest areas targeted for preservation in Wadjana basin (Sadlier & Swan, 2011d). CSC have also undertaken a number of surveys of forest areas throughout the Grand Sud as part of surveys of mining concessions held by VNC which have included night surveys and assessment of nocturnal lizards (geckos). The information from other field surveys undertaken by CSC within and in close proximity to the KO4 forests, and in the region in general, allow an informed assessment to be made of the likely occurrence in the KO4 forests of those nocturnal or diurnal species that were not detected due to unfavourable weather conditions.

The assessments made of lizard species diversity of the individual forest areas on the KO4 project area are based on both records obtained during all surveys of these forests, and the expected occurrence of species considered likely to occur in these forests but not detected. This notion of expected occurrence is based on visual assessment of the forests and their microhabitat and results of previous extensive field and research experience in forests in the Grand Sud by CSC. As such, the results presented in Table 2 also includes species expected to occur (identified by a hollow circle ○), that could possibly occur (identified by '?'), or expected not to occur (X) in the forest areas of the KO4 project area, but which were not recorded during the surveys of these forests undertaken by CSC. Note for sites FA1.1 and FA3.1 the upper figures of individuals recorded are the results from surveys of these forests areas undertaken in July/August 2014 (Sadlier *et al.*, 2014d) and those below the individuals recorded in March 2015.

4. RESULTS

Lizard species of the KO4 project area: A total of 11 lizard species have been recorded from the KO4 forest areas, and a further four are assessed as being expected to occur in some or all of these forests.

TABLE 2	Forest Areas & Sites											Total records for each species
Species	FA1 1.1 1.2		FA2 2.1	FA3 3.1 3.2		FA4 4.1 4.2		FA5 5.1 5.2 5.3			FA6 6.1	
<i>Caledoniscincus austrocaledonicus</i>	○	○	○	○	1	○	○	○	○	○	○	1
<i>Caledoniscincus festivus</i>	?	?	?	?	X	?	?	?	?	?	X	0
<i>Caledoniscincus notialis</i>	1 0	○	3	0 4	2	○	○	○	○	○	○	10
<i>Graciliscincus shonae</i>	○	○	○	○	X	○	○	○	○	○	○	0
<i>Lioscincus nigrofasciolatus</i>	○	1	○	○	○	○	○	○	○	○	○	1
<i>Marmorosphax tricolor</i>	17 21	23	11	12 10	3	10	11	10	14	14	○	156
<i>Nannoscincus mariei</i>	○	○	○	○	X	○	○	○	○	○	○	0
<i>Phoboscincus garnieri</i>	○	○	○	○	○	○	○	○	○	○	○	0
<i>Sigaloseps deplanchei</i>	5 4	7	3	1 2	X	3	1	1	2	3	○	32
<i>Simiscincus aurantiacus</i>	1	○	○	○	X	○	○	○	○	○	○	1
<i>Tropidoscincus variabilis</i>	1	○	○	○	○	○	○	○	○	○	○	1
<i>Bavayia goroensis</i>	?	?	?	?	X	?	?	?	?	?	X	0
<i>Bavayia sauvagii</i>	1	○	○	?	X	?	?	?	?	?	?	1
<i>Bavayia septuiclavis</i>	0 1	○	○	2 0	○	○	○	1	○	○	○	4
<i>Eurydactylodes symmetricus</i>	○	○	○	○	X	○	○	○	○	○	X	0
<i>Rhacodactylus auriculatus</i>	1	○	○	○	○	○	○	○	○	○	○	1
<i>Rhacodactylus leachianus</i>	○	?	?	?	X	?	?	?	?	○	X	0
<i>Rhacodactylus sarasinorum</i>	0 1	○	○	○	X	○	○	○	○	○	X	1
Total each site	54	31	17	31	6	13	12	12	16	17	0	208

A further three species, the skink *Caledoniscincus festivus* and geckos *Bavayia goroensis* and *Rhacodactylus leachianus*, are assessed as possibly occurring in the project KO4 forest areas though they were not observed. Of these *Bavayia goroensis* is listed as threatened on the IUCN Red list. This species has been recorded from other areas of humid forest in close proximity on the Kwé Range, but has not been encountered with any consistency indicating it is difficult to detect. The giant gecko *Rhacodactylus leachianus* appears to have a scattered distribution in the area. It has been recorded from larger areas of humid forest such as at the base of Forêt Nord and Pic du Grand Kaori, but not smaller areas of forest, possibly reflecting a loss of structural diversity with regard to trunk size and forest canopy in small forest patches. It should be noted that the giant gecko *Rhacodactylus auriculatus* has only rarely been recorded within the interior of humid forest habitat, rather it is usually in association with humid forest at its edge or where man-made tracks enter the forest, and it is at the edge of the humid forest areas that this species would be expected to occur.

Of the eleven species of lizard recorded the project KO4 forest areas five are recorded from previous studies. The skink *Simiscincus aurantiacus* and gecko *Rhacodactylus sarasinorum* were recorded from forest area FA1 during a survey in July/August 2014 (Sadlier et al., 2014d), and three species, the skink *Tropidoscincus variabilis* and geckos *Bavayia sauvageii* and *Rhacodactylus auriculatus* were recorded as part of the inventory of species on the AS7 concession undertaken in 2011 (Sadlier et al., 2011b) which included a forest site (AS7-A) adjacent to site in forest area FA1.

The FA1 forest area is the best studied on the KO4 project area. Survey work for lizards has been undertaken in this area of forest on three separate occasions, in March 2011, July/August 2014 and March 2015. From the survey work undertaken on, or in the immediate vicinity of, the FA1 forest area a total of 10 species of lizard have been recorded. This represents 55% of the lizard fauna that could be expected to occur, or possibly occur, in forest habitat on the KO4 project area. Included are two species listed as threatened on the IUCN Red list, the skink *Simiscincus aurantiacus* (Vulnerable B1ab(i,ii,iii,iv)) and the giant gecko *Rhacodactylus sarasinorum* (Vulnerable B1ab(i,ii,iii)+2ab(i,ii,iii)), the giant gecko being a species restricted to the Grand Sud. A further five species of lizard are assessed as being expected to occur in forest habitat within the FA1 forest area (see Table 2). One of these, the giant gecko *Rhacodactylus leachianus*, is a species widespread on Grand Terre and not listed as threatened on IUCN criteria (least concern), whereas the species of skink, skinks *Graciliscincus shonae* (Vulnerable B1ab(i,ii,iii)+2ab(i,ii,iii)) and *Nannoscincus mariei* (Vulnerable B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)) and the gecko *Eurydactylodes symmetricus* (Endangered B1ab(ii,iii,iv,v)) are listed as threatened. The gecko *Bavayia*

goroensis (Endangered B1ab(iii)), also on the IUCN Red list, is assessed as possibly occurring in the FA1 forest area.

The FA2 forest area lies adjacent to the FA1 forest area. Three species of lizard were recorded from the survey of this forest undertaken in March 2015. The assessment of the FA2 forest area indicates it would be expected to have a similar diversity of lizard species to that recorded or expected to occur in the FA1 forest. The presence of the giant gecko *Rhacodactylus leachianus* in the FA2 forest is questionable. The forest canopy is tall but the tree diameter and structural complexity of the canopy was assessed as not being optimal for this species. The gecko *Bavayia goroensis* is assessed as possibly occurring in the FA2 forest area though not observed.

The FA3 forest area is near the proposed project KO4 Bureau. Site FA3.1 was located within the area of humid forest and site FA3.2 in *Nothofagus* forest on the crest of a low range. The area of forest in which site 1 was located was surveyed in July/August 2014 (Sadlier et al., 2014d) as part of a broad assessment of habitats with the KO4 project area, and again in March 2015 as part of the specific survey of forests on the project area. From these studies a total of four species of lizard were recorded. The assessment of the FA3 forest indicates the area of humid forest would be expected to have a similar diversity of lizard species to that recorded or expected to occur in other forests in the region. The presence of the giant gecko *Rhacodactylus leachianus* in the FA3 forest is questionable, the tree diameter and structural complexity of the canopy was assessed as not being optimal for this species. The gecko *Bavayia goroensis* the IUCN Red list is assessed as possibly occurring in the FA3 humid forest area though not observed. The area of *Tristaniopsis* scrub forest on the range (site FA3.2) had a low canopy with little structural diversity typical of tall maquis scrub (paraforest). Three species of lizard were recorded from the survey of this site undertaken in March 2015, and the overall lizard diversity is expected to be low with only a few generalist species likely to be present.

The other forest areas on the KO4 project area have not been as extensively studied. The forest areas FA4, FA5 and FA6 were surveyed in April 2015 during a period when weather conditions were unfavorable for recording day active species of lizard (daytime temperature in forest ~20°C). Forest areas FA4 and FA5 were located at the base of the range and in close proximity to each other, FA5 was the larger of these. Two species of 'forest' inhabiting skinks *Marmorosphax tricolor* and *Sigaloseps deplanchei* were recorded from both forest areas, and the gecko *Bavayia septuiclavis* from FA5. The assessment of the FA4 and FA5 forests indicates these areas of humid forest would be expected to have a similar diversity of lizard species to that recorded, or expected to occur, in other forests in the region. The presence of the giant gecko *Rhacodactylus leachianus* in the FA4 forest is however questionable. The forest canopy of the FA4 forest is tall but the tree diameter and structural

complexity of the canopy was assessed as not being optimal for this species. The gecko *Bavayia goroensis* was assessed as possibly occurring in both the FA4 and FA5 forest areas though not observed.

Forest area FA6 was a small area of forest located in a gully on the slopes of the range. It was atypical to the other five areas surveyed in that the forest floor was dominated by extensive jumbled peridotite boulders with very little of the ground surface exposed. No lizards were recorded during the survey of this area of forest in April 2015. The unusual nature of this site is evident by the absence of records for the 'forest' inhabiting skinks *Marmorosphax tricolor* and *Sigaloseps deplanchei*. These two species are widespread throughout most areas of forest in the region, including maquis forest (paraforest and preforest) under certain conditions. The assessment of the FA6 forest indicates both these would be expected to occur in this area of humid forest, and that several other crepuscular skink species, *Simiscincus aurantiacus*, *Graciliscincus shonae* and *Nannoscincus mariei*, would also be expected to occur in the matrix of rock and soil on the forest floor. Several surface active species would also be expected to occur in this area of forest. However, the presence of geckos is less certain, and it is questionable whether the unusual structure of this forest provides the appropriate sheltering sites.

Significant species: Two threatened species have been recorded from the forests of the KO4 project area. The skink *Simiscincus aurantiacus* and the giant gecko *Rhacodactylus sarasinorum* were recorded from forest area FA1 during surveys of the KO4 project area in July/August 2014. Both species have been found in a number of forest sites across the Grand Sud. A recent study (Sadlier & Bauer, 2014) which examined the extent of genetic differentiation of a range of lizard species in the region found that a number of these species each comprised a single genetic unit consistent with a single widespread population with gene flow between populations historically, despite the now fragmented distribution of forest habitat in the Grand Sud. The implications for conservation management some of these species, including *Simiscincus aurantiacus* and *Rhacodactylus sarasinorum*, are that they constitute a single regional management unit on genetic criteria. Further, both *Simiscincus aurantiacus* and *Rhacodactylus sarasinorum* are each widely represented throughout the Reserve system in the Grand Sud, occurring in the Reserves Foret Nord, Pic du Grand Kaori, Pic du Pin and Riviere Bleue.

Our assessment of the forest areas of the KO4 project area indicates that a further three species of conservation significance are expected to occur in areas of forest within the KO4 project area, though not observed during the survey. The skinks *Graciliscincus shonae* and *Nannoscincus mariei* and the gecko *Eurydactylodes symmetricus* are expected to be present in all the forest areas surveyed, with the exception of site FA3.2, and FA6 for

Eurydactylodes symmetricus. The populations of both *Graciliscincus shonae* and *Eurydactylodes symmetricus* were also shown to each comprise a single genetic across the Grand Sud, and as such the populations of each species in the region comprises a single management unit on genetic criteria for conservation management purposes. Conversely the genetic data for *Nannoscincus mariei* showed clear population sub-structuring within the Grand Sud and that population in these genetic subgroups each represented a distinct management unit on genetic criteria for conservation management purposes. The gecko *Bavayia goroensis*, a regional endemic and species of conservation significance, has previously been recorded from the region in humid forest and tall maquis forest habitat of the Kwé ranges, and could possibly occur in most forest areas of the KO4 project (with the exception of FA3.2 and FA6) area.

Significant sites: The forests of the KO4 project area (with the exception of the *Tristaniopsis scrub* forest FA3.2) are all considered to contain a high diversity of lizard species, including a number of conservation significance. The sites FA1.1 and FA5.3 both have high canopied forest with a well-developed vegetation structure and are considered to contain the highest diversity of lizard species, including two species of giant gecko. Most of the other areas of forest are also expected to contain a high diversity of lizard species, but the structural complexity of the canopy is considered to not be optimal for the giant gecko *Rhacodactylus leachianus*, and its presence in these other forest areas is considered questionable. Forest area FA6 is considered to have the lowest diversity of species of all the humid forest areas surveyed, and forest area FA3.2, the *Tristaniopsis scrub* forest, is not considered to have any species of conservation significance.

5. SUMMARY

The humid forests, including the *Arillastrum* forest FA1.1, of the KO4 project area are assessed as containing a high diversity of lizard species (up to 16), which includes a number of species (4-6) listed on the IUCN Red list at a high level of conservation significance. Most of these species are also found in forest areas elsewhere in the Grand Sud, including those in Reserves, and most are part of a broader region-wide management unit on genetic criteria.

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