



# Species richness and speciation in the genus *Lepilemur* in northwestern Madagascar

Leslie Wilmet<sup>1,2\*</sup> (leslie.wilmet@hotmail.com), Cédric Vermeulen<sup>2</sup>, Roseline C. Beudels-Jamar<sup>3</sup>,  
Christoph Schwitzer<sup>1</sup>

<sup>1</sup> Bristol Conservation and Science Foundation, c/o Bristol Zoo Gardens, Bristol, UK

<sup>2</sup> University of Liege - Gembloux Agro Bio Tech, Gembloux, Belgium

<sup>3</sup> Royal Belgium Institute of Natural Sciences, Belgium, Conservation Biology Unit

# I.1 The genus *Lepilemur*

## 1.1.1 Phylogeny

Kingdom	<i>Animalia</i>
Phylum	<i>Chordata</i>
Under phylum	<i>Vertebrata</i>
Class	<i>Mammalia</i>
Infra Classe	<i>Eutheria</i>
Order	<i>Primates</i>
Suborder	<i>Strepsirrhini</i>
Infraorder	Lemuriformes
<b>Family</b>	<b><i>Lepilemuridae</i></b>
Genus	<i>Lepilemur</i>

sportive lemurs

Before 2006  
⇒ 8 species

Today  
⇒ 26 species

## 1.1 The genus *Lepilemur*

### 1.1.2 General informations

- Medium-sized primates (body length ~ 20cm / tail length ~ 25 cm/ weight < 1 kg)
- Nocturnal and folivorous
- Exclusively arboreal
- Vertical clinger and leaper
- Tree holes and tangles of branches used as shelter during the day



*L. tymerlachsonorum*

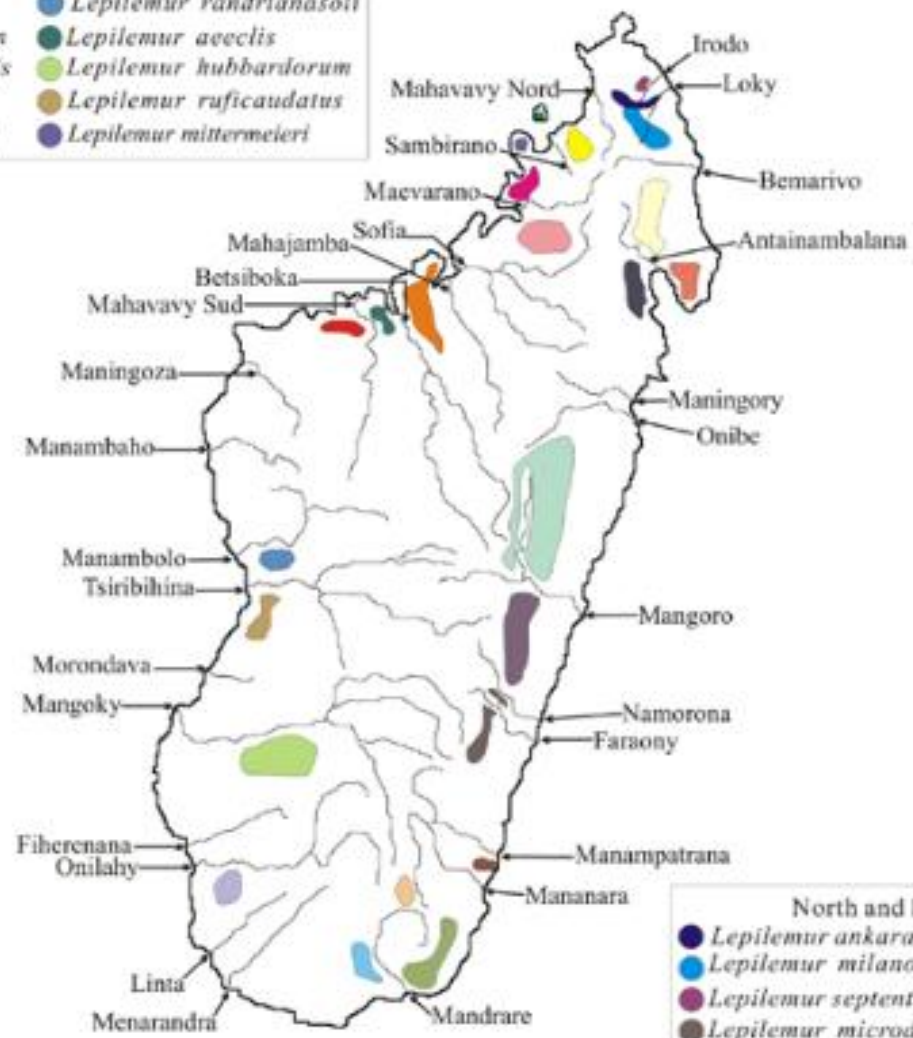
## I.1 The genus *Lepilemur*

### 1.1.3 Distribution and habitat

- Usually found in low-and mid-altitude evergreen and deciduous forests
- Very small distribution
- Lack of information on the exact range boundaries of some of the species



- West Coast *Lepilemur* Species**
- *Lepilemur tymerlachsoni*
  - *Lepilemur dorsalis*
  - *Lepilemur ahmansonorum*
  - *Lepilemur sahamalazensis*
  - *Lepilemur edwardsi*
  - *Lepilemur grevcockorum*
  - *Lepilemur petteri*
  - *Lepilemur randrianasoli*
  - *Lepilemur aecclis*
  - *Lepilemur hubbardorum*
  - *Lepilemur ruficaudatus*
  - *Lepilemur mittermeieri*



- North and East Coast *Lepilemur* Species**
- *Lepilemur ankaranensis*
  - *Lepilemur milanoii*
  - *Lepilemur septentrionalis*
  - *Lepilemur microdon*
  - *Lepilemur leucopus*
  - *Lepilemur seali*
  - *Lepilemur species nova #2*
  - *Lepilemur jamesorum*
  - *Lepilemur betsileo*
  - *Lepilemur mustelinus*
  - *Lepilemur fleuretae*
  - *Lepilemur scottorum*
  - *Lepilemur wrightae*

Revised distribution map of the sportive lemurs (genus *Lepilemur*) of Madagascar.

Source: Lei et al. 2008

# I.1 The genus *Lepilemur*

## 1.1.3 Main threats

- **Natural predators**

- Madagascar harrier hawk (*Polyboroides radiatus*)
- fossa (*Cryptoprocta ferox*)
- snakes (*Acrantophis madagascariensis*, *Acrantophis dumerili* and *Sanzinia madagascariensis*)



*Cryptoprocta ferox*

# I.1 The genus *Lepilemur*

## 1.1.3 Main threats

- **Natural predators**
    - Madagascar harrier hawk (*Polyboroides radiatus*)
    - fossa (*Cryptoprocta ferox*)
    - snakes (*Acrantophis madagascariensis*, *Acrantophis dumerili* and *Sanzinia madagascariensis*)
  - **Human-caused disturbance**
    - Hunting
    - Deforestation and habitat fragmentation
- => Uplisting of many of the 26 *Lepilemur* species into one of the threatened categories of the IUCN Red List



## I.2 The research

Evolutionary processes

Explain

High species richness

One of the diversification mechanisms for Madagascar = Riverine barrier

Large River Model



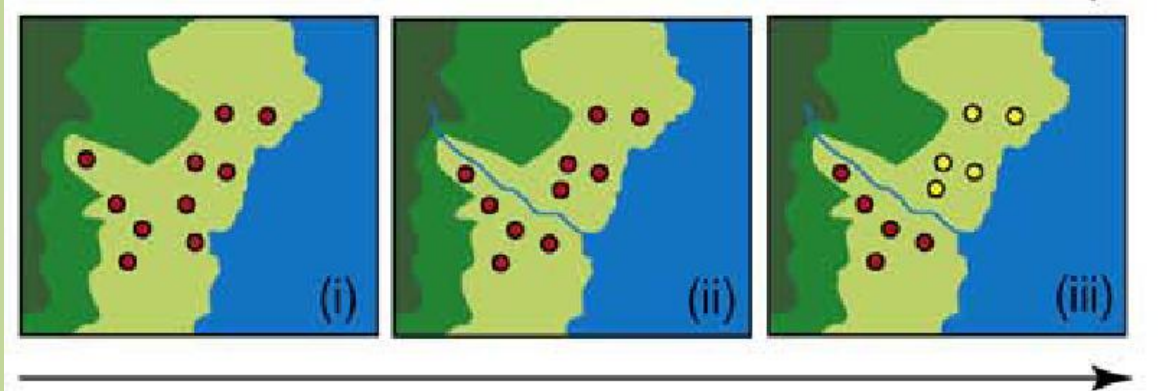
# I.2 The research

## 1.2.1. The Craul model “Large River Model” (2007)

= gene barrier => cryptic speciation



Large rivers



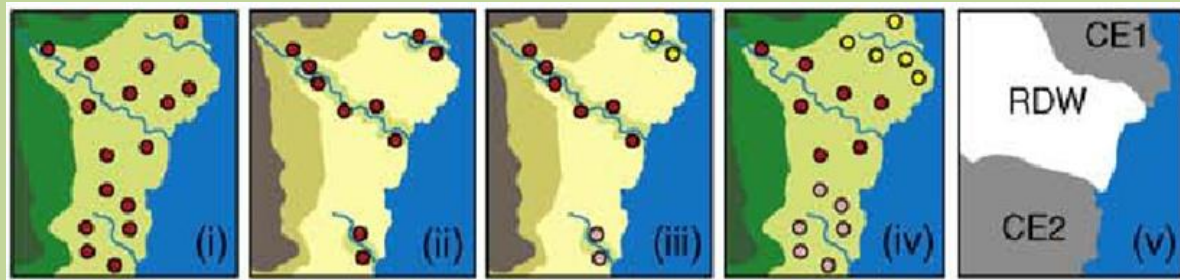
Source: Vences et al. 2009

## I.2 The research

### 1.2.1. The Craul model “Large River Model” (2007)

= gene barrier => cryptic speciation

Large rivers



= retreat zone during increasing aridity  
=> further recolonization by small populations isolated and potentially genetically differentiated

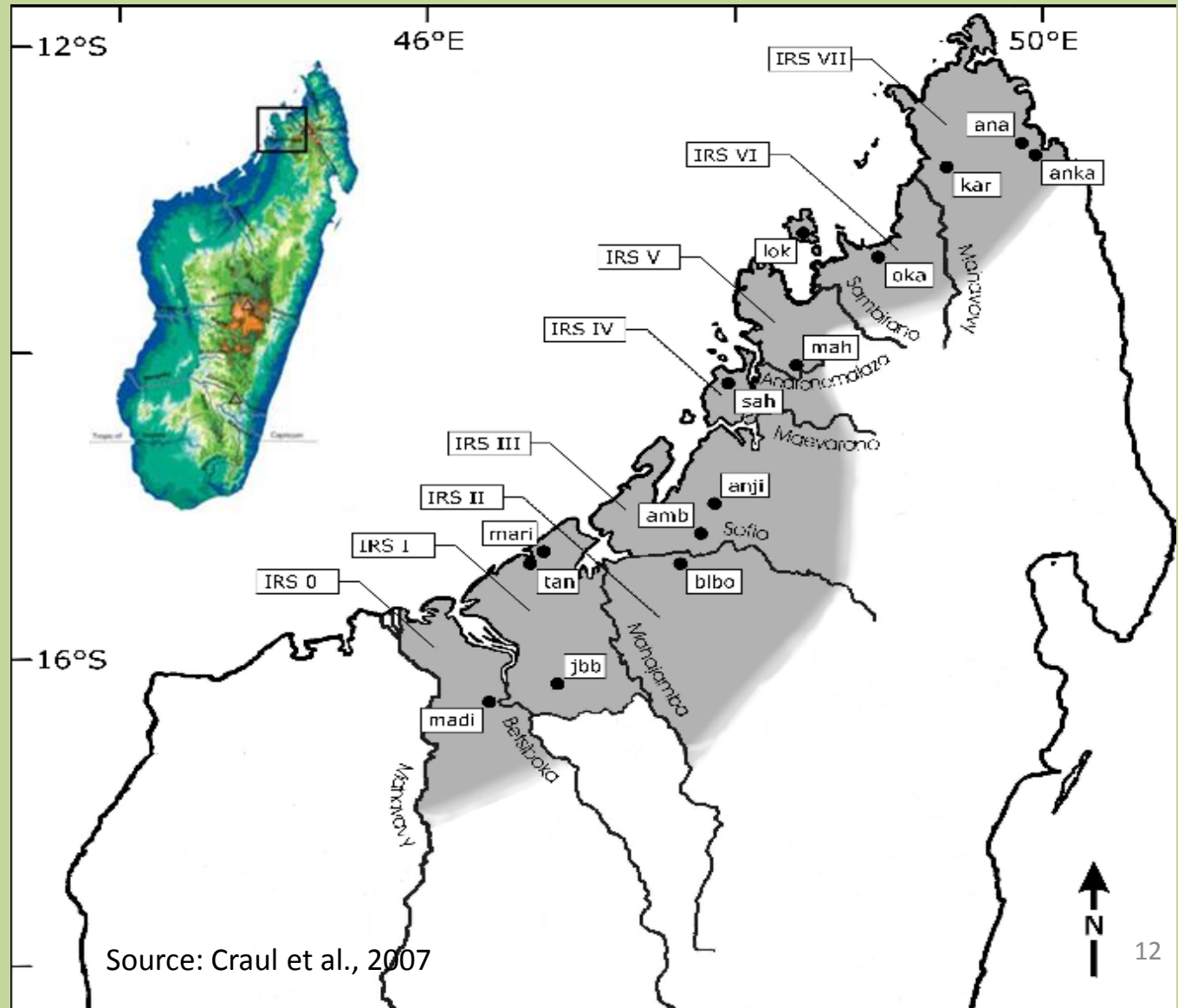
## I.2 The research

### 1.2.1. The Craul model “Large River Model” (2007)

7 Inter-River-System in  
northwestern Madagascar

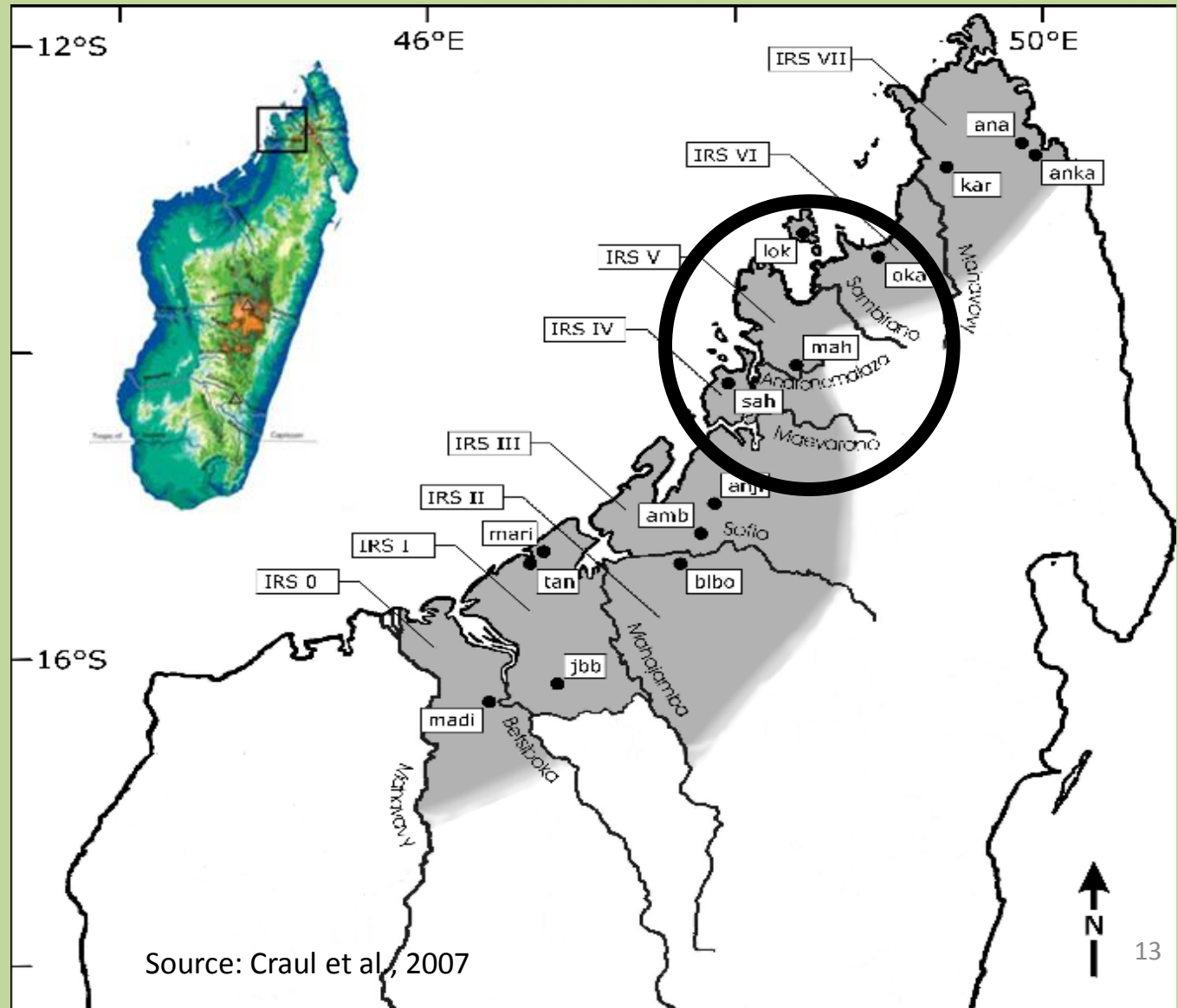
# I.2 The research

## 1.2.1. The Craul model “Large River Model” (2007)



# I.2 The research

## 1.2.2. Area of the study



Source: Craul et al., 2007

# I.2 The research

## 1.2.3. Studied species



*L. mittermeieri*  
Photo R.A. Mittermeier



*L. sahamalazensis*  
Photo Mélanie Seiler

*L. dorsalis*  
Photo Huguet Pierre

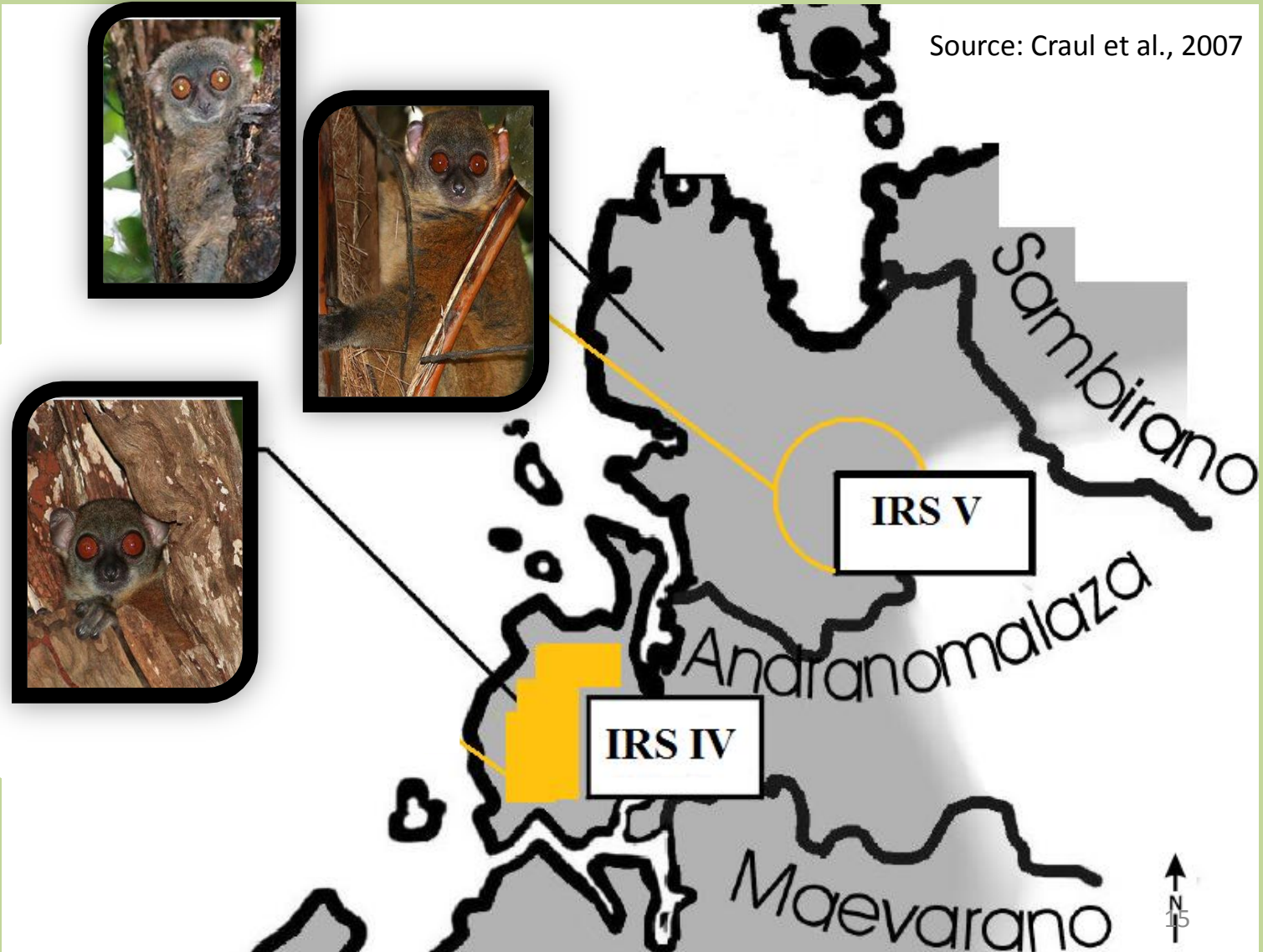


**Northwestern Madagascar**



# I.2 The research

## 1.2.2. Area of the study



## I.2 The research

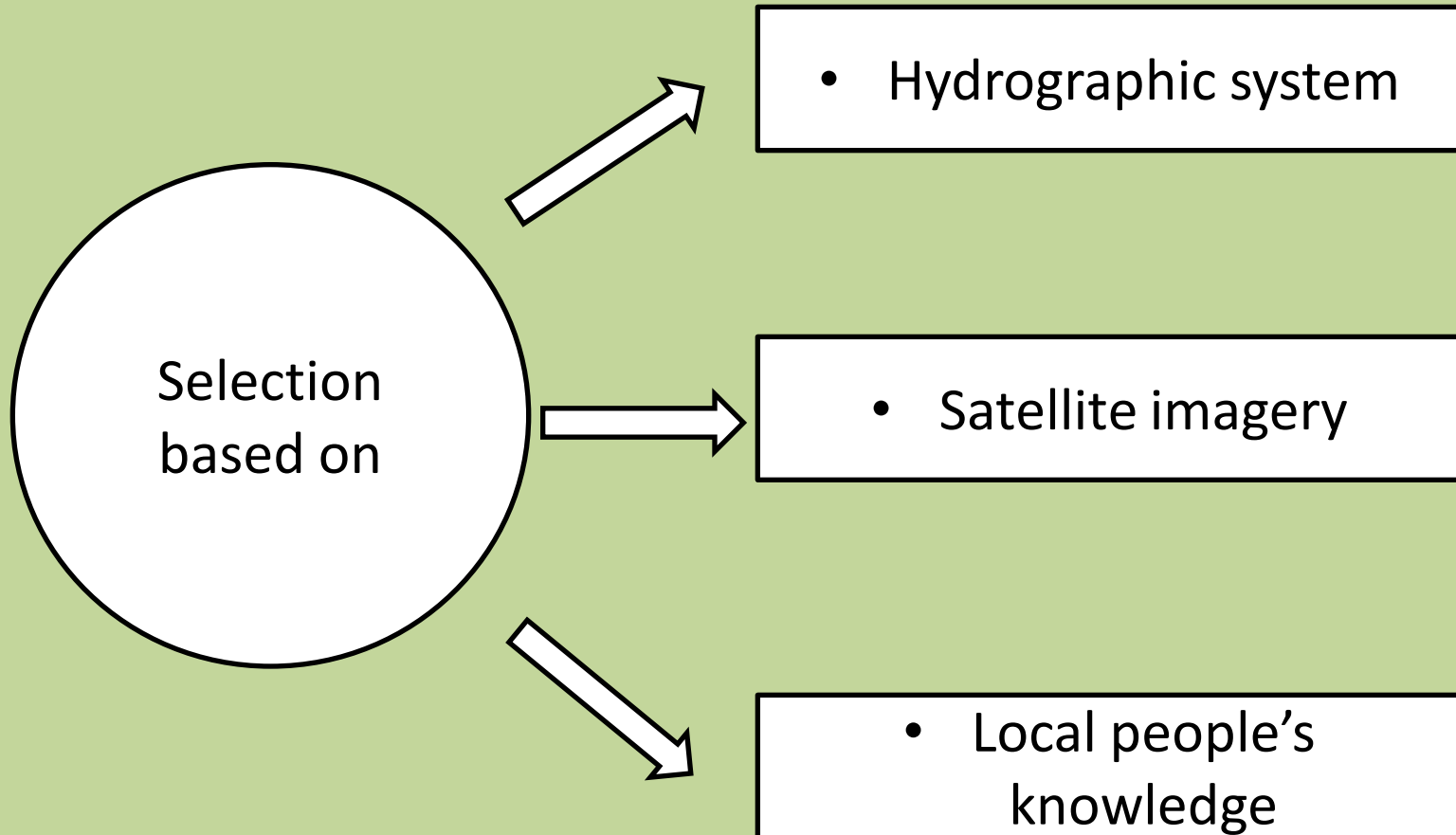
### 1.2.4. Objectives of the research

1. To determine the exact distributions of *L. sahamalazensis*, currently unknown
2. To clarify the distributions of *L.dorsalis* and *L. mittermeieri* and to assess their allopatry or parapatry



## II.1 Study sites

### II.1.1. Selection and localization of study sites



## II.2 Forest characterization

Systematic for characterization



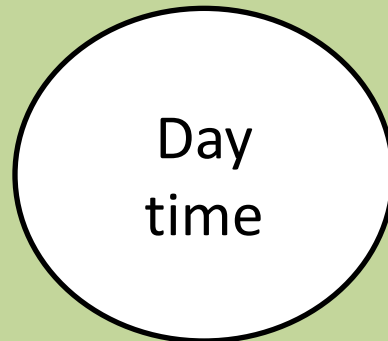
General qualification of  
forest quality

Categories

0 = very bad  
1 = bad  
2 = medium  
3 = good

## II.3 Lemur survey

### II.3.1. Presence/absence



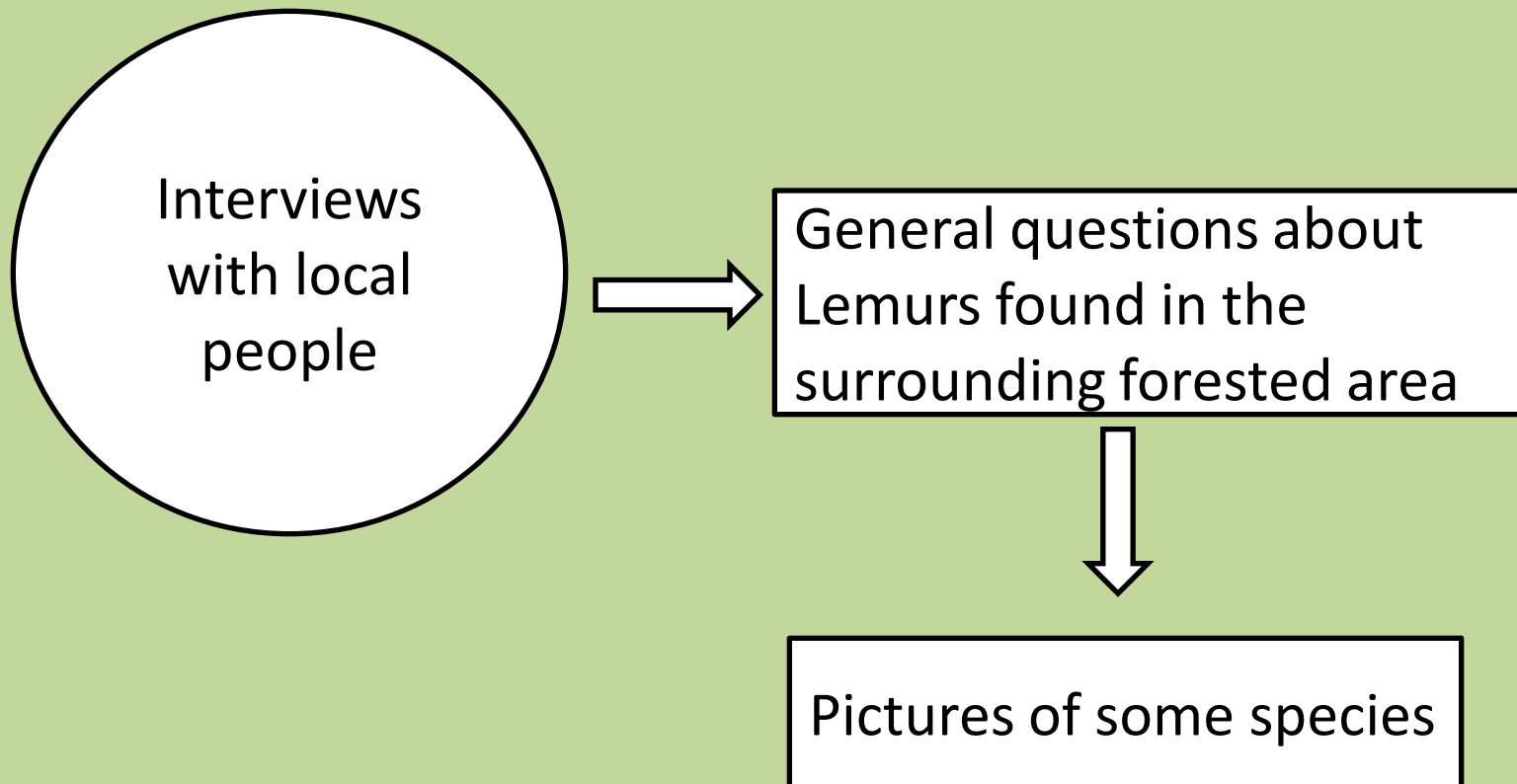
Reconnaissance walks run  
by three persons (Main  
researcher + two guides)



Nocturnal walks (minimum  
of 2 hours)

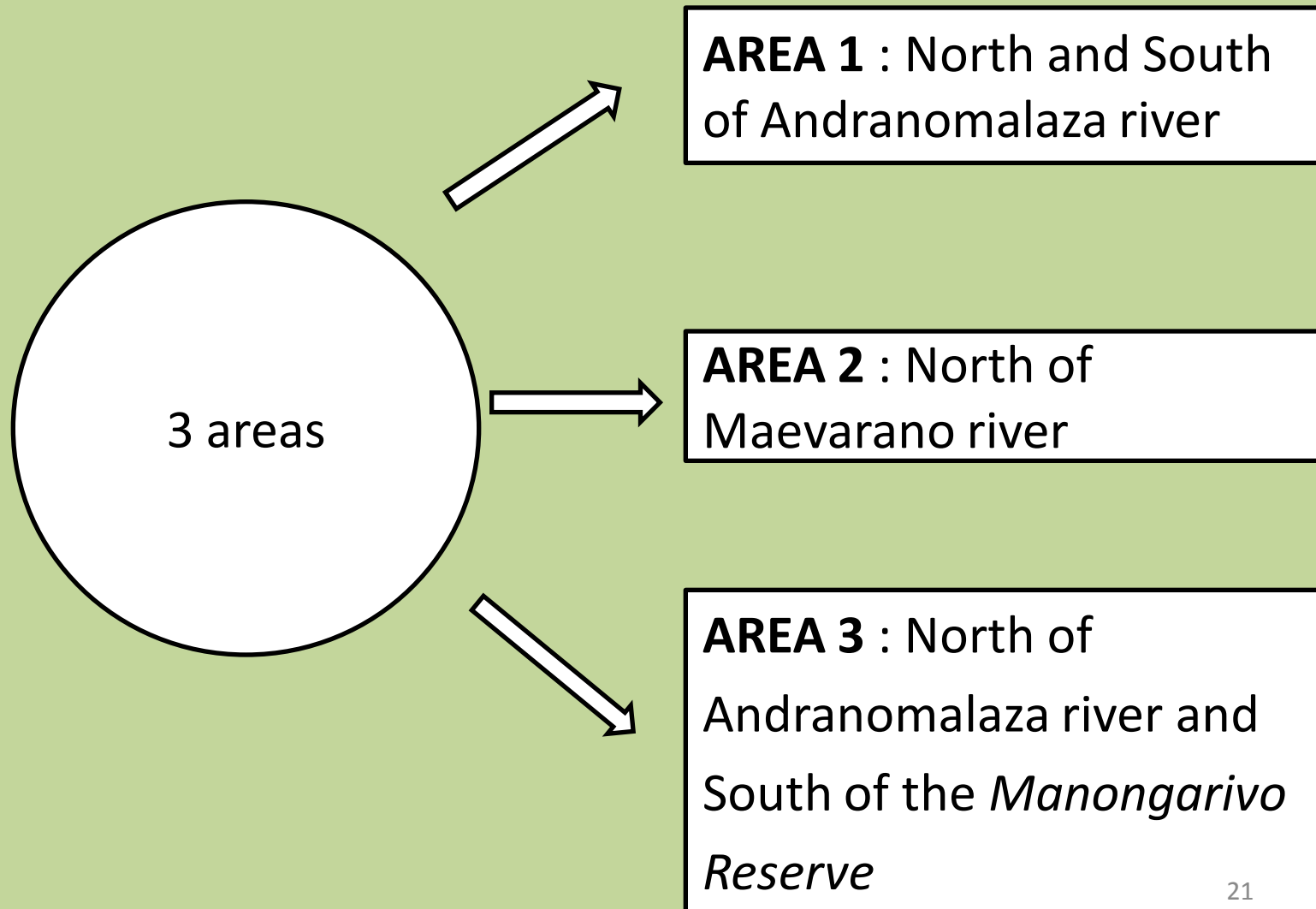
## II.3 Lemur survey

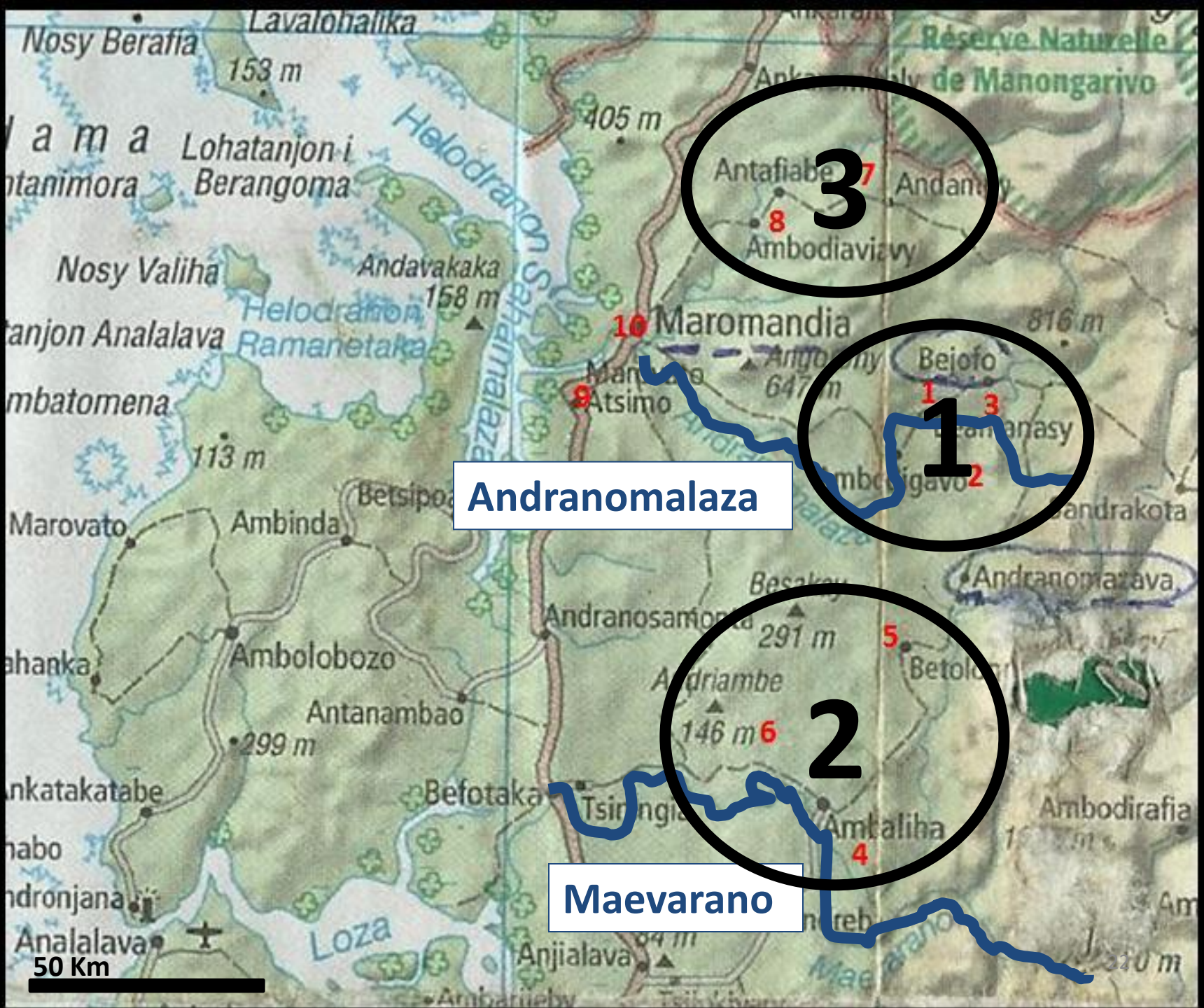
### II.3.1. Presence/absence



## II.1 Study sites

### II.1.1. Selection and localization of study sites





## III.1 Study sites characteristics

	SITE NO.	SITE	COORDINATES	ALTITUDE [M]	MONTH	FOREST CHARACTERIZATION (0=VERY BAD 1=BAD 2=MEDIUM 3= GOOD) (F=FAR AWAY)	HUNTING
AREA 1 (13 DAYS)	1	Bedjofo	S. 14°14'04.5" E. 48°18'59.5"	242	April	0	Yes
	2	Anefitrabe	S. 14°17'27.0" E. 48°21'42.4"	206	April	1	No
	3	Antsahabe	S. 14°12'00.2" E. 48°21'45.2"	219	April	2	Yes
AREA 2 (14 DAYS)	4	Sasindro	S. 14°32'39.4" E. 48°17'33.6"	154	April-May	1/2	No
	5	Betolongo	S. 14°24'40.4" E. 48°14'40.4"	44	May	1	Yes
	6	Andrafiabe	S. 14°29'54.6" E. 48°12'18.7"	31	May	2 F	Yes
AREA 3 (10 DAYS)	7	Bitsitsiky	S. 14°07'27.9" E. 48°13'49.8"	94	May	2 F	Yes
	8	Ambodivanio	S. 14°05'51.9" E. 48°10'57.7"	72	May	1	Yes

## III.2 Forest characterization

	SITE NO.	SITE	COORDINATES	ALTITUDE [M]	MONTH	FOREST CHARACTERIZATION (0=VERY BAD 1=BAD 2= MEDIUM 3= GOOD) (F=FAR AWAY)	HUNTING
AREA 1 (13 DAYS)	1	Bedjofo	S. 14°14'04.5" E. 48°18'59.5"	242	April	0	Yes
	2	Anefitrabe	S. 14°17'27.0" E. 48°21'42.4"	206	April	1	No
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AREA 2 (14 DAYS)	4	Sasindro	S. 14°32'39.4" E. 48°17'33.6"	154	April-May	1/2	No
	5	Betolongo	S. 14°24'40.4" E. 48°14'40.4"	44	May	1	Yes
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	8	Ambodivanio	S. 14°05'51.9" E. 48°10'57.7"	72	May	0	Yes



## III.2 Forest characterization

Site n°4=Sasindro : category 1/2 = medium/good



## III.1 Lemur survey

### III.1.1.Presence/absence of lemur species in the 8 study sites

#### Scientific name

<i>Eulemur macaco</i>	<i>Eulemur flavifrons</i>	<i>Mirza zaza</i>	<i>Hapalemur occidentalis</i>	?	<i>Lepilemur</i>	<i>Phaner parienti</i>
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#### Malagasy name

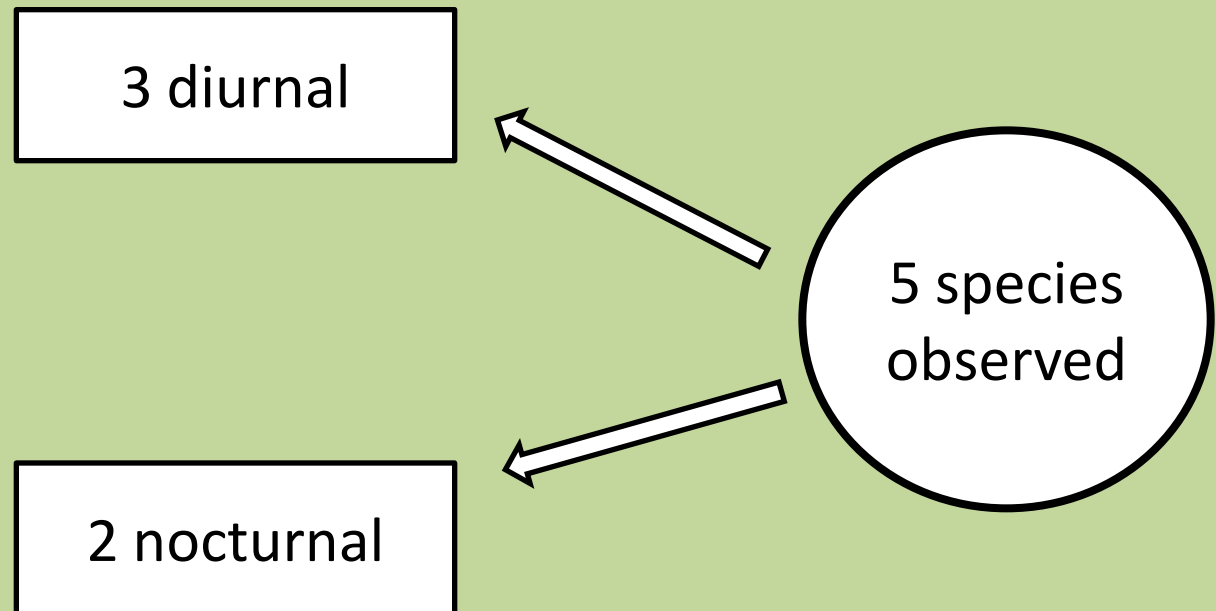
Akomba	Akomba	Valivehy	Akomba valiha	Tsintsihy	Fitsidika	?
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Area	Site no.							
1	1	(+)	-	(+)	+		(+)	
	2	-	(+)	+	(+)		(+)	
	3	(+)	-	(+)	+		(+)	
2	4	-	(+)	+	+	(+)	(+)	
	5	-	+	(+)	(+)	(+)	(+)	
	6	-	+	(+)	(+)	(+)	(+)	
3	7	(+)	-	(+)	+	(+)	+	+
	8	+	-	+	(+)	(+)	(+)	+

## III.1 Lemur survey

### III.1.1.Presence/absence of lemur species in the 8 study sites

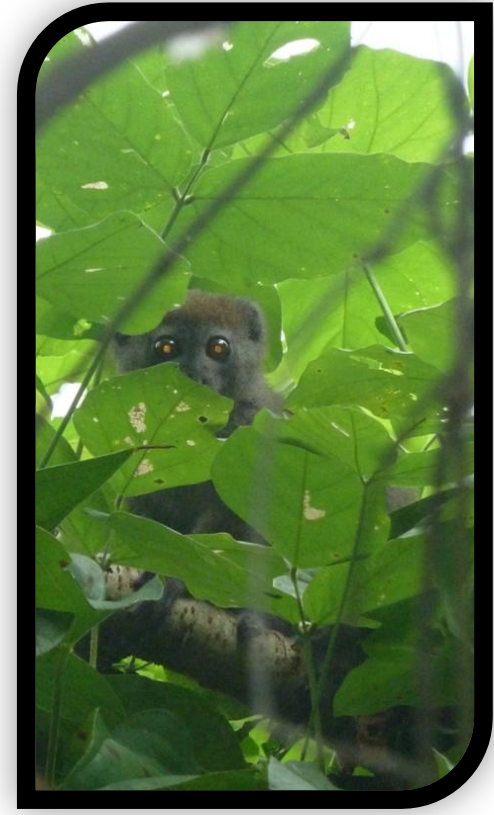
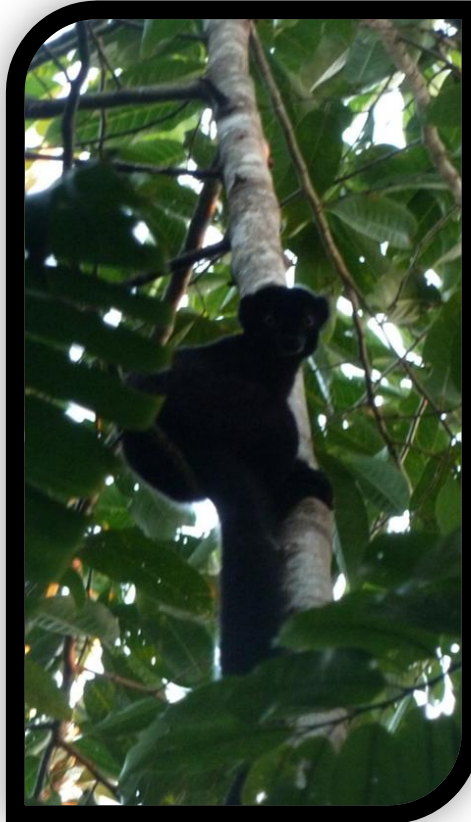
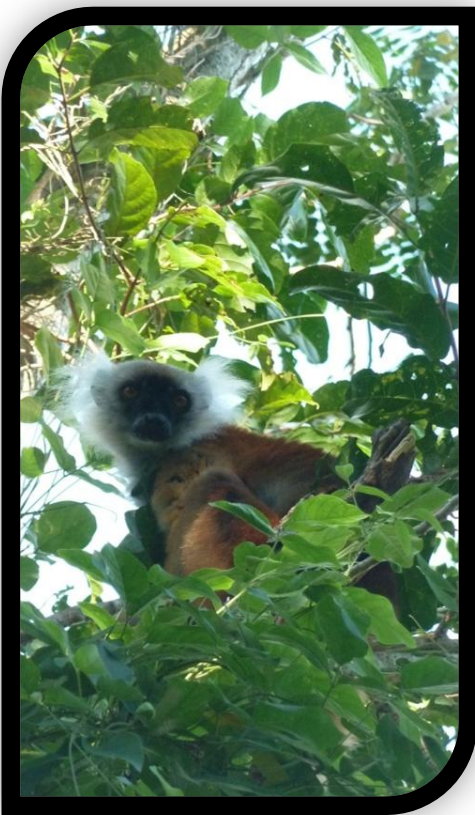
Scientific name						
<i>Eulemur macaco</i>	<i>Eulemur flavifrons</i>	<i>Mirza zaza</i>	<i>Hapalemur occidentalis</i>	?	<i>Lepilemur</i>	<i>Phanerparienti</i>



## III.1 Lemur survey

### III.1.1.Presence/absence of lemur species in the 8 study sites

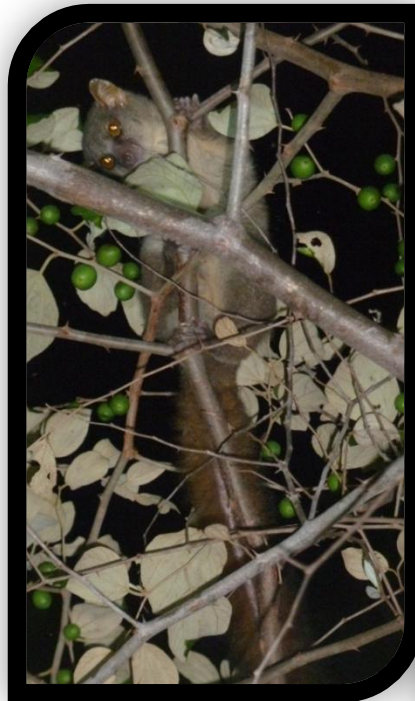
Scientific name						
<i>Eulemur macaco</i>	<i>Eulemur flavifrons</i>	<i>Mirza zaza</i>	<i>Hapalemur occidentalis</i>	?	<i>Lepilemur</i>	<i>Phaner parienti</i>



## III.1 Lemur survey

### III.1.1.Presence/absence of lemur species in the 8 study sites

Scientific name						
<i>Eulemur macaco</i>	<i>Eulemur flavifrons</i>	<i>Mirza zaza</i>	<i>Hapalemur occidentalis</i>	?	<i>Lepilemur</i>	<i>Phanerparienti</i>



## III.1 Lemur survey

### III.1.1.Presence/absence of lemur species in the 8 study sites

#### Scientific name

*Eulemur  
macaco*

*Eulemur  
flavifrons*

*Mirza  
zaza*

*Hapalemur  
occidentalis*

?

*Lepilemur*

*Phaner  
parienti*

#### Malagasy name

Akomba

Akomba

Valivehy

Akomba  
valiha

Tsintsihy

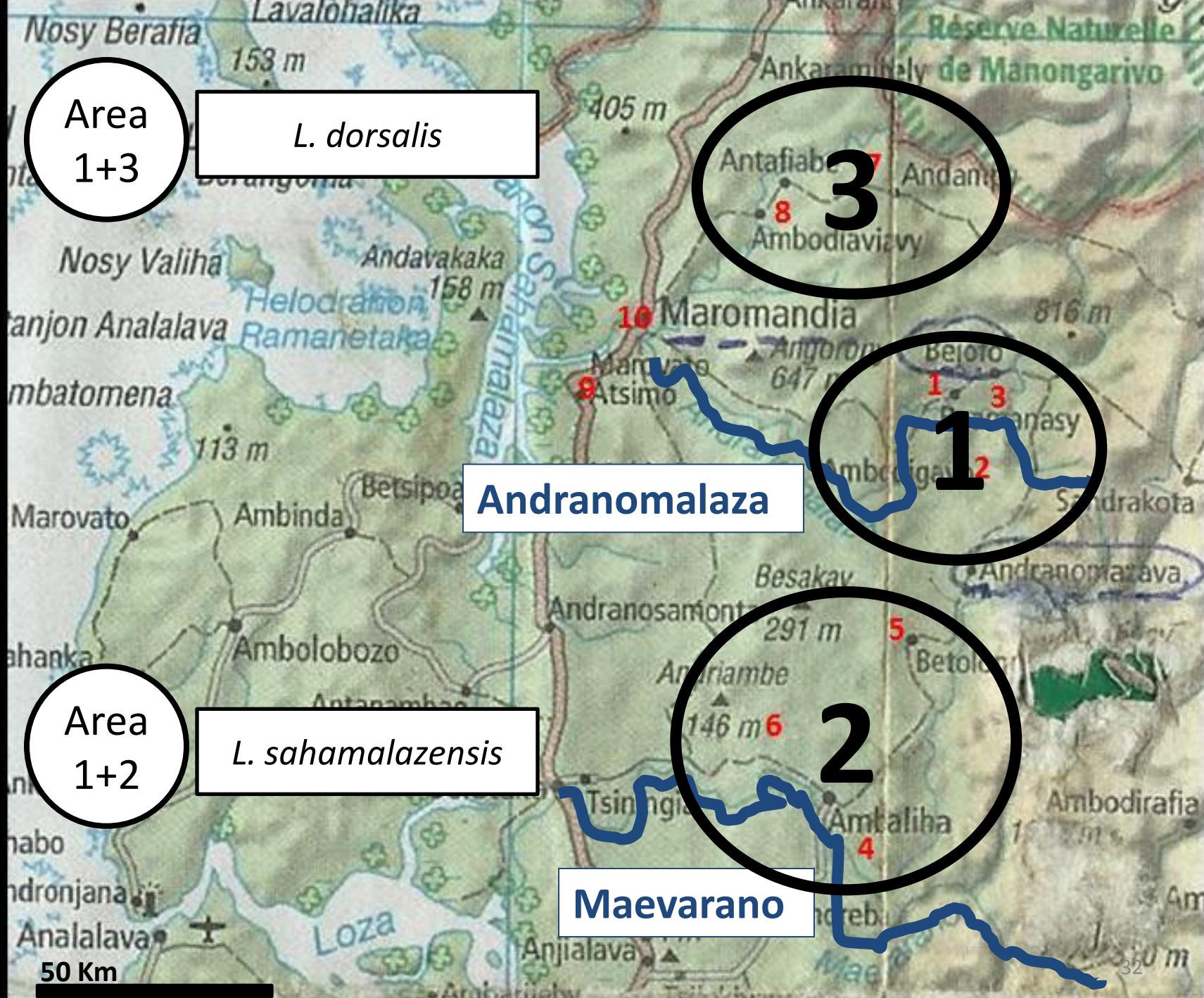
Fitsidika

?

Area	Site no.							
1	1	(+)	-	(+)	+		(+)	
	2	-	(+)	+	(+)		(+)	
	3	(+)	-	(+)	+		(+)	
2	4	-	(+)	+	+	(+)	(+)	
	5	-	+	(+)	(+)	(+)	(+)	
	6	-	+	(+)	(+)	(+)	(+)	
3	7	(+)	-	(+)	+	(+)	+	+
	8	+	-	+	(+)	(+)	(+)	+

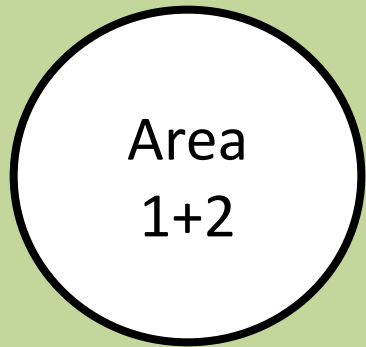


# IV.1 Lemur survey





# IV.1 Lemur survey



**WHY?**



## IV.1 Lemur survey

		Scientific name	
		?	<i>Lepilemur</i>
		Malagasy name	
		Tsintsihy	Fitsidika
Area	Site no.		
1	1		(+)
	2		(+)
	3		(+)
2	4	(+)	(+)
	5	(+)	(+)
	6	(+)	(+)
3	7	(+)	+
	8	(+)	(+)

1. Local name



WHY?

## IV.1 Lemur survey

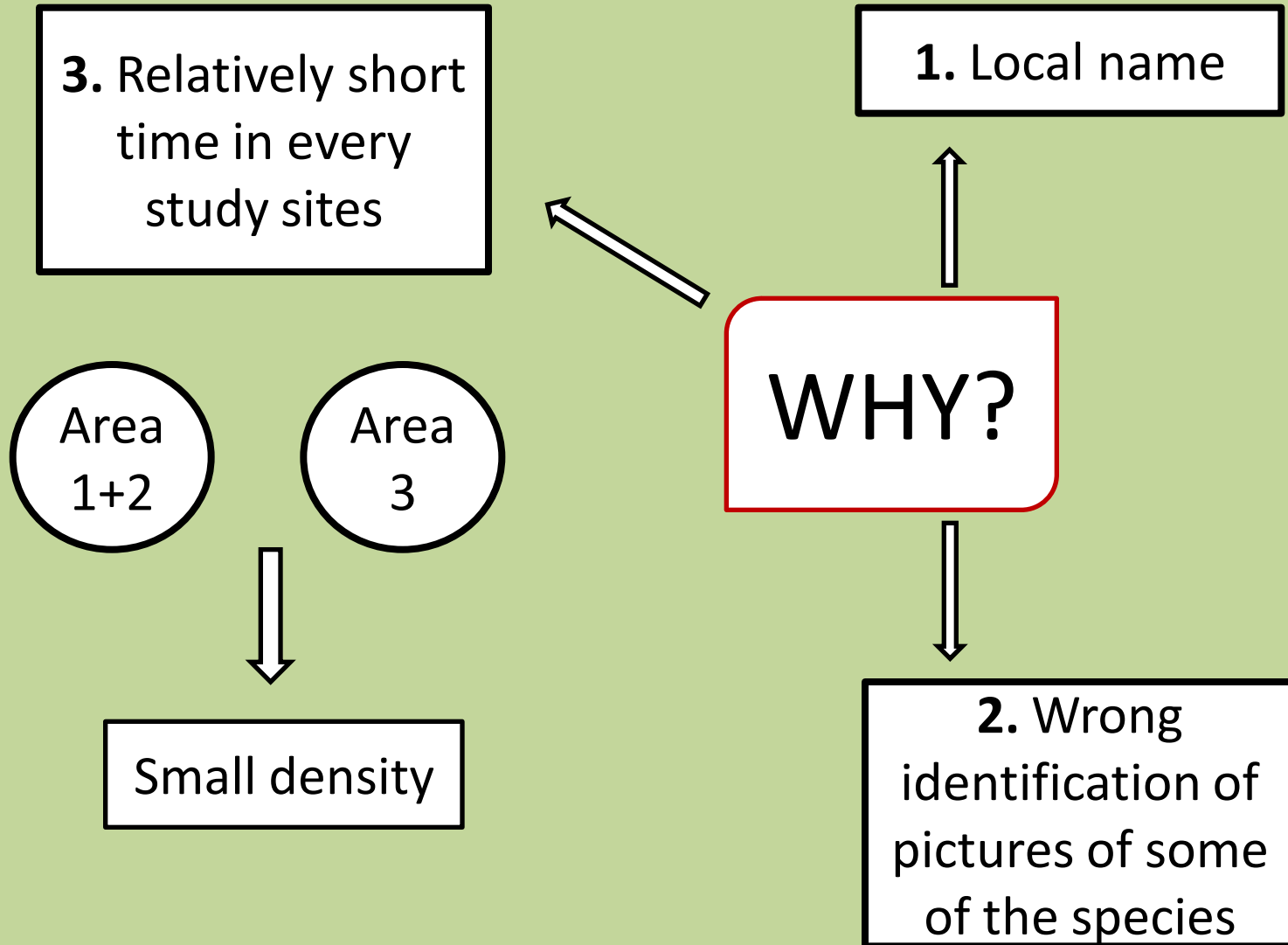
		Scientific name		
		?	<i>Lepilemur</i>	<i>Phanerparienti</i>
		Malagasy name		
		Tsintsihy	Fitsidika	?
Area	Site no.			
1	1		(+)	
	2		(+)	
	3		(+)	
2	4	(+)	(+)	
	5	(+)	(+)	
	6	(+)	(+)	
3	7	(+)	+	+
	8	(+)	(+)	+

1. Local name



WHY?

## IV.1 Lemur survey



## IV.2 Forest characterization

High  
anthropogenic  
pressure



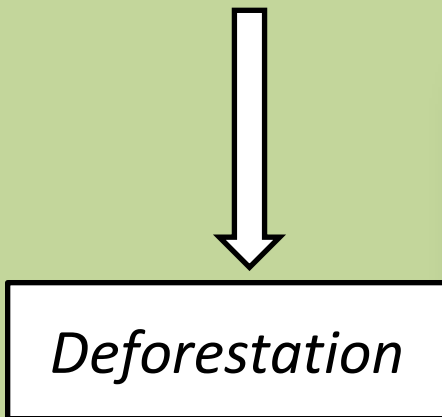
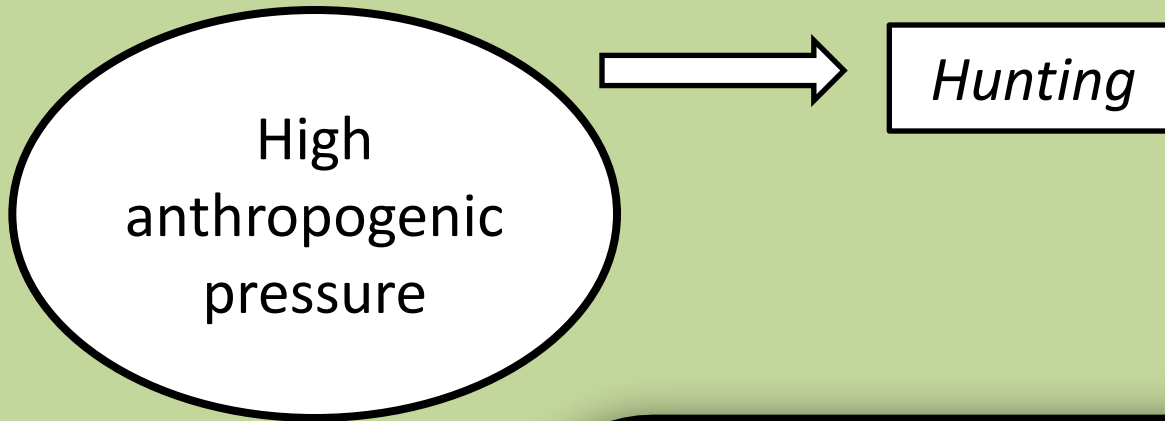
Hunting

	Site no.	Hunting
Area 1 (13 days)	1	Yes
	2	No
	3	Yes
Area 2 (14 days)	4	No
	5	Yes
	6	Yes
Area 3 (10 days)	7	Yes
	8	Yes



Trap for *Eulemur macaco*

## IV.2 Forest characterization



## IV.2 Forest characterization



## *V. L. sahamalazensis*

If there is still *L. sahamalazensis* in the hinterland of the peninsula



Densities in the forested area visited are not viable



**Sahamalaza Peninsula is the only place where *L. sahamalazensis* occurs in viable population**



## *V. L. sahamalazensis*

**Sahamalaza Peninsula is the only place where  
*L. sahamalazensis* occurs**

*L. sahamalazensis* = Critically  
Endangered (IUCN Red List)



The species needs urgent  
protection.



(Sahamalaza - Iles Radama National Park)

# Acknowledgment



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**Fonds Léopold III**

pour l'Exploration et la Conservation de la Nature asbl

<http://www.naturalsciences.be/LIII/FR/about>



Thank you for your attention



# References

- **Vences M., Wollenberg K.C., Vieites D.R., Lees D.C., 2009.** Madagascar as a model region of species diversification. *Trends in Ecology & Evolution* 24,8: 456-465.
- **Lei R., Engberg S. E., Andriantompohavana R., McGuire S. M., et al., 2008.** Nocturnal Lemur diversity at Masoala National Park. *Special Publication, Museum of Texas Tech University* 53:1-41.
- **Craul M., Zimmermann E., Rasoloharijaona S., et al., 2007.** Unexpected species diversity of Malagasy primates (*Lepilemur* spp.) in the same biogeographical zone: a morphological and molecular approach with the description of two new species. *BMC Evolutionary Biology* 7:83.



Thank you for your attention

