



## 1 Objectives

- Compiling biodiversity data
- Deriving biodiversity maps
- Vulnerability to climate change

## 2 Sources and data-set compilation

- Various sources
- Data cleaning

## 3 Biodiversity data-set

- Summary
- Representativity
- Originality

## 4 Perspectives

- Species distribution models
- Generalized dissimilarity models

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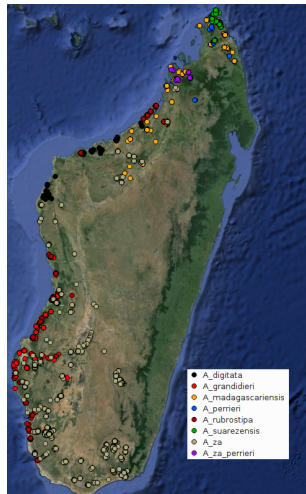
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# Objectives

## 1. Compiling biodiversity data

- Occurrence data (with spatial coordinates)
- For a maximal number of species
- In a maximal number of taxonomic groups

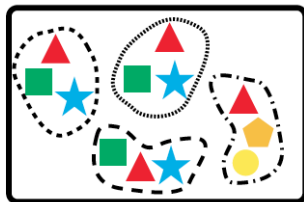


# Objectives

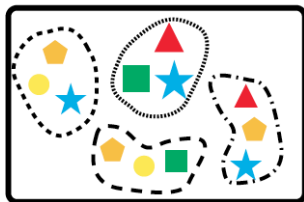
## 2. Deriving biodiversity maps

- $\alpha$  diversity: **species** diversity (richness, Shannon, Simpson)
- $\beta$  diversity: differentiation among **habitats**

low spatial turnover



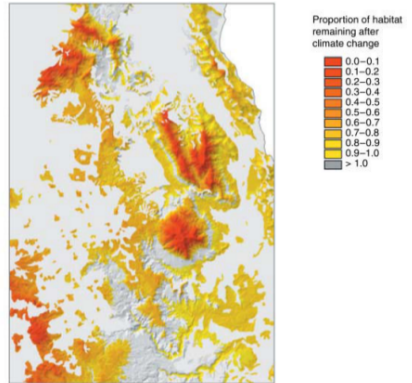
high spatial turnover



# Objectives

## 3. Vulnerability to climate change

- At the species level
- At the community level
  - Biodiversity refugia
  - Loss of habitats



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# Sources

- Data portals: Rebioma, BirdLife, AntWeb
- Data from published scientific articles
- Private data: Kew, Universities, Cirad, ONE, MEF





# Data cleaning

## Checking taxonomy

- **taxize** R package
- Plant data: TNRS (Taxonomic Name Resolution Service)
- Animal data: GNR (Global Names Resolver)

## Removing data

- 24% of the data
- Incomplete observations (coordinates)
- Unresolved taxonomic name



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# Biodiversity data

	Group	Species	Genus	Obs.	Main source
Plants	Trees	557	329	85236	IEFN
	Palms	201	17	5456	Kew (M. Rakotoarinivo, W. Baker)
	Ferns	651	76	10544	MNHN (F. Rakotondrainibe)
	Legumes	846	151	22693	Kew (J. Moat), MNHN (J.-N. Labat)
	Grasses	338	144	9933	Kew (M. Voronstova)
Vertebrates	Mammals (–lemurs)	318	50	2390	Rebioma
	Lemurs	64	15	3136	ONE
	Birds	214	147	40955	eBird, BirdLife
	Reptiles	448	70	5080	M. Vences, R. Pearson
	Amphibians	336	28	2550	M. Vences
Invertebrates	Snails	618	68	2560	T. Pearce
	Ants	513	103	68845	AntWeb
	Butterflies	407	112	13287	D. Lees
	Diptera	72	21	1595	Rebioma
	Coleoptera	30	16	164	Rebioma
<b>TOTAL=</b>		<b>5613</b>	<b>1347</b>	<b>274424</b>	

# Representativity regarding known biodiversity

	Group	BSM	Goodman 2005
Plants	Trees/Palms	758	2625
	Ferns	651	586
	Legumes	846	573
	Grasses	338	34
Vertebrates	Mammals	382	131
	Birds	214	209
	Reptiles	448	345
	Amphibians	336	199
Invertebrates	Snails	618	671
	Ants	513	583
	Butterflies	407	300
	Diptera	72	1796
	Coleoptera	30	351
Others	others	0	6790
<b>TOTAL=</b>		<b>5613</b>	<b>15373</b>

Oryx Vol 39 No 1 January 2005

## Short Communication

### Updated estimates of biotic diversity and endemism for Madagascar

Steven M. Goodman and Jonathan P. Benstead

# Comparison with other studies

## LETTER

### A method for quantifying biodiversity loss and its application to a 50-year record of deforestation across Madagascar

Thomas F. Allnutt<sup>1,2</sup>, Simon Ferrier<sup>3,4</sup>, Glenn Manion<sup>3</sup>, George V. N. Powell<sup>1</sup>, Taylor H. Ricketts<sup>1</sup>, Brian L. Fisher<sup>5</sup>, Grady J. Harper<sup>6</sup>, Michael E. Irwin<sup>7</sup>, Claire Kremen<sup>2</sup>, Jean-Noël Labat<sup>8</sup>, David C. Lees<sup>9</sup>, Timothy A. Pearce<sup>10</sup>, & France Rakotondrainibe<sup>8</sup>

#### Comparison

- Allnutt et al. 2008: **2843**
- Kremen et al. 2008: **2315**  
(Ants, Butterflies, Frogs, Geckos, Lemurs and Plants)
- BioSceneMada: **5613**



*Science* **320**, 222 (2008);  
DOI: 10.1126/science.1155193

#### Aligning Conservation Priorities Across Taxa in Madagascar with High-Resolution Planning Tools

C. Kremen,<sup>1,2,†</sup> A. Cameron,<sup>1,2,†</sup> A. Moilanen,<sup>3</sup> S. J. Phillips,<sup>4</sup> C. D. Thomas,<sup>5</sup> H. Beentje,<sup>6</sup> J. Dransfield,<sup>4</sup> B. L. Fisher,<sup>7</sup> F. Glaw,<sup>8</sup> T. C. Good,<sup>9</sup> G. J. Harper,<sup>10</sup> R. J. Hijmans,<sup>11</sup> D. C. Lees,<sup>12</sup> E. Louis Jr.,<sup>13</sup> R. A. Nussbaum,<sup>14</sup> C. J. Raxworthy,<sup>15</sup> A. Razafimanahana,<sup>2</sup> G. E. Schatz,<sup>16</sup> M. Vences,<sup>17</sup> D. R. Vieites,<sup>18</sup> P. C. Wright,<sup>19</sup> M. L. Zizra<sup>9</sup>

Globally, priority areas for biodiversity are relatively well known, yet few detailed plans exist to direct conservation action within them, despite urgent need. Madagascar, like other globally recognized biodiversity hot spots, has complex spatial patterns of endemism that differ among taxonomic groups, creating challenges for the selection of within-country priorities. We show, in an analysis of wide taxonomic and geographic breadth and high spatial resolution, that multitaxonomic rather than single-taxon approaches are critical for identifying areas likely to promote the persistence of most species. Our conservation prioritization, facilitated by newly available techniques, identifies optimal expansion sites for the Madagascar government's current goal of tripling the land area under protection. Our findings further suggest that high-resolution multitaxonomic approaches to prioritization may be necessary to ensure protection for biodiversity in other global hot spots.

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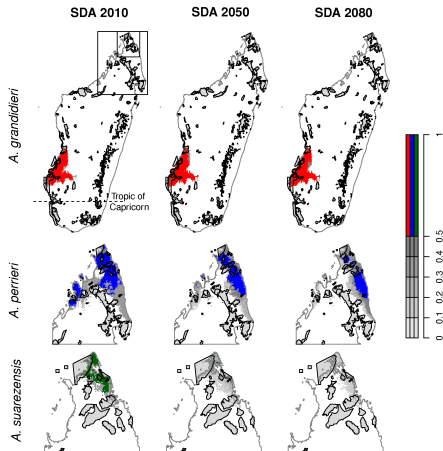
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# Species distribution models

- At the species level
- Species range =  $f(\text{present climate} + \text{other factors})$
- Prediction of future species distribution
- Ensemble forecasting approach

- 5613 SDMs !!
- Superposing species distributions
- $\alpha$  and  $\beta$  diversity



# Species distribution models

Biological Conservation 166 (2013) 11–22



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## Vulnerability of baobab species to climate change and effectiveness of the protected area network in Madagascar: Towards new conservation priorities



Ghislain Vieilledent<sup>a,b,\*</sup>, Cyrille Cornu<sup>b,c</sup>, Aida Cuní Sanchez<sup>d</sup>, Jean-Michel Leong Pock-Tsy<sup>b</sup>, Pascal Danthu<sup>a,b</sup>

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<sup>d</sup> University of York, York Institute of Tropical Ecosystem Dynamics, Environment Department, Heslington, YO10 5DD York, United Kingdom



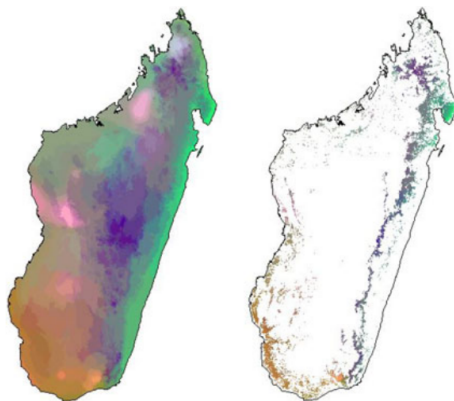
# Species distribution models

- R script written for Baobab species
- Run the R script for the 5613 species
- Compute biodiversity indices



# Generalized dissimilarity models

- At the community level
- Dissimilarity between pairs of locations
- One model for the 5613 species
- $\beta$  diversity



Biological dissimilarity across Madagascar prior to habitat loss (left), in 2000 (right)

# Generalized dissimilarity models

## LETTER

### **A method for quantifying biodiversity loss and its application to a 50-year record of deforestation across Madagascar**

Thomas F. Allnutt<sup>1,2</sup>, Simon Ferrier<sup>3,4</sup>, Glenn Manion<sup>3</sup>, George V. N. Powell<sup>1</sup>, Taylor H. Ricketts<sup>1</sup>, Brian L. Fisher<sup>5</sup>, Grady J. Harper<sup>6</sup>, Michael E. Irwin<sup>7</sup>, Claire Kremen<sup>2</sup>, Jean-Noël Labat<sup>8</sup>, David C. Lees<sup>9</sup>, Timothy A. Pearce<sup>10</sup>, & France Rakotondrainibe<sup>8</sup>

Allnut et al. 2008 Conservation Letters

# Generalized dissimilarity models

- New R package **gdm**
- Write the R script and run the model



... Thank you for attention ...