

Carlo Rondinini

Global Mammal Assessment programme Dipartimento di Biologia e Biotecnologie Università degli Studi di Roma La Sapienza



The role of agroecosystems in biodiversity conservation

1. Increas7oaing human pressure (conversion to agroecosygf vb l hjh dd cf cstems included) causes global biodiversity decli 6hdxffdddddùf +ffffdpkddfj ldddD° 77XXXXXXXXX sssssssssssssssssssssssss., plj vvvvvvvvvvevc yvv+ Ne pppppppppppppppppppppppppppppppppp THEREFORE l ui oin Xfddf y y

Agroecosystems & biodiversity

1. Increasing human pressure (conversion to agroecosystems included) causes global biodiversity decline

- 2. Species concentrate in the remnant natural areas
- 3. This is where most conservation efforts are directed

BUT

- 4. Conserving biodiversity in intact natural areas is not enough
- 5. Future scenarios predict further loss of natural habitat

THEREFORE

6. Biodiversity must be conserved also in converted areas

1. The increasing human pressure on the natural environment, including the conversion into agroecosystems, is causing the ongoing global biodiversity decline

The IUCN Red List

NIVERSITY VIRGINIA

Þ 🕸 🔻 🍪 🏠 💻	http://www.iucnredlist.org/initiatives/mammals	😭 🔻 🕻 🐨 global mammal assessment 🔍 🗕 🗗 🗙
	The IUCN Red List of Threatened Species [™] 2009.2	Login Feedback FAQ Terms of use
	Enter Mammal search term(s)	Seuments AELP SAVE SPECIES Nowi
Home » Initiative	<u>⊧s</u> » Mammals	
	Mammals	
Mammals	Included in the IUCN Red List is the comprehensive assessment of the conservation status of the world's 5 488 species mammal species. Here you will find global summary statistics for the	
on the IUCN Red Lis	assessment, as well as individual species accounts including IUCN Red List threat category, range map, ecology information, and other data for every mammal species.	
Assessment Process	The current dataset on mammals is the product of one of several global initiatives led by ILICN	
Analysis of Data	and partners to rapidly expand the geographic and taxonomic coverage of the IUCN Red List.	
Description of Data	Use the search tool at the top of the page to search for mammals in the IUCN Red List	
Acknowledgements	database by name, taxonomy, country, region, habitat type, threat type, or IUCN Red List status.	
	TEXAS A&M AgriLIFE CONSERVATION INTERNATIONAL TEACHING • Research • Extension • Service UNIVERSITY	

LIVING CONSERVATION

Home | Contact | FAQ | Feedback | Site Map | Donate Now Privacy & Security | Terms of Use © International Union for Conservation of Nature and Natural Resources.



IUCN (2010) The IUCN Red List of Threatened Species. www.iucnredlist.org

SAPIENZA Università di Roma

Globally threatened species



Global past trend of threat



Global trend trend of threat



Past, present and predicted global extinctions



Species extinction

CBD (2010)

Global threats to mammals



Schipper, ..., Rondinini et al. (2008) The status of the world's land and marine mammals: diversity, threat and knowledge. *Science* 322:225

How we are dealing with threats globally



2. Species concentrate in the remnant natural areas that are still intact or have not been extensively converted

Sample: 5030 (ca. 95%) terrestrial mammals

Order	Number of species		
Afrosoricida	54		
Carnivora	280		
Cetartiodactyla	240		
Chiroptera	1139		
Cingulata	21		
Dasyuromorphia	73		
Dermoptera	2		
Didelphimorphia	94		
Diprotodontia	139		
Eulipotyphla	442		
Hyracoidea	5		
Lagomorpha	92		
Macroscelidea	16		
Microbiotheria	1		

Order	Number of species		
Monotremata	5		
Notoryctemorphia	2		
Paucituberculata	6		
Peramelemorphia	19		
Perissodactyla	16		
Pholidota	8		
Pilosa	10		
Primates	411		
Proboscidea	2		
Rodentia	2215		
Scandentia	19		
Sirenia	3		
Tubulidentata	1		

Species-habitat relationships



An example from IUCN Red List website for *Lyncodon patagonicus*

Habitat and Ecology [top]

Habitat and Ecology:	Lyncodon patagonicus is found in herbaceous and shrub steppes and xerophytic woodlands (Osgood, 1943; Prevosti and Pardiñas, 2001). Its habits are little known; available data indicate that <i>L. patagonicus</i> is nocturnal-crepuscular and that it preys on fossorial rodents and birds (Cabrera and Yepes, 1940; Koslowsky, 1904; Redford and Eisenberg, 1992). May be assopciated with tuc-tuc (<i>Ctenomys spp.</i>) communities (Tell <i>et al.</i> 2001).
Systems:	Terrestrial
List of Habitats:	 3 Shrubland 3.4 Shrubland - Temperate 4 Grassland 4.4 Grassland - Temperate



Range of *Lyncodon patagonicus*

Species-habitat relationships

🖼 Land Cover		
Land Cover		
Land Cover		
L'a recellar paragonicae		
Code Description	Area (so km)	Score
10 Cultivated and Managed areas	90304	~
20 Mosaic cropland (50-70%) / vegetation (grassland/shrubland/forest) (20-50%)	14090	~
22 Mosaic cropland (50-70%) / forest (20-50%)	3	~
30 Mosaic vegetation (grassland/shrubland/forest) (50-70%) / cropland (20-50%)	44738	~
40 Closed to open (>15%) broadleaved evergreen or semi-deciduous forest (> 5m)	30155	~
41 Closed (>40%) broadleaved evergreen and/or semi-deciduous forest	44	~
42 Open (15-40%) broadleaved semi-deciduous and/or evergreen forest with emergents	1568	~
50 Closed (>40%) broadleaved deciduous forest (>5m)	15163	~
60 Open (15-40%) broadleaved deciduous forest/woodland (>5m)	634	~
100 Closed to open (>15%) mixed broadleaved and needleaved forest	275	~
110 Mosaic forest or shrubland (50-70%) and grassland (20-50%)	121462	high 🔽
120 Mosaic grassland (50-70%) and forest or shrubland (20-50%)	112629	high 🔽
130 Closed to open (>15%) (broadleaved or needle-leaved, evergreen or deciduous) shrublar	357651	ngh 💌
135 Closed (>40%) broadleaved deciduous shrubland (<5m)	51008	high
136 Open (15-40%) broadleaved deciduous shrubland (<5m)	26	medium
140 Closed to open (>15%) herbaceous vgt (grassland, savannas or Lichens/Mosses)	469	low
141 Closed (>40%) grassland	5	····
143 Open (15-40%) grassland	9	high 🔽
150 Sparse (<15%) vegetation	160169	high 🔽
151 Sparse (<15%) grassland	38	high 🔽
160 Closed to open (>15%) broadleaved forest regularly flooded (semi-permanently or tempor-	109	~
180 Closed to open (>15%) grassland or woody vgt on regularly flooded or waterlogged soil, f	776	~
		- Lel
		bave and Close

Environmental variables



Globcover (ESA, 2008) 300m resolution

Environmental variables



SRTM elevation (NASA and USGS, 2007) at 90m resolution

Globcover and SRTM water

Habitat suitability models (HSM)



Habitat data

Combined environmental variables:

Land cover Elevation Hydrology

Habitat suitability model of Lyncodor patagoni**dus** gentina Legend Suitable Unsuitable

Results of HSM evaluation



Model prevalence

Global mammal richness (geographic ranges)



Global mammal richness (HSM)



Relative difference (ranges - HSM)



Global trend trend of threat



Human population density



WCMC (2004)

Mammal distribution by broad habitat type



3. Remnant natural areas are also those where most conservation efforts (including the creation of protected areas) are directed

Protection level of main biomes



Jenkins & Joppa (2009) Biol Conserv 142:2166

Protection level of main biomes



Hoekstra et al. (2005) Ecol Lett 8:23

4. Unfortunately it is demonstrated that protecting only intact natural areas is not enough to conserve biodiversity

Species represented in remaining habitat

Species Numbers and Habitat Area



McNeely et al. (2001)

Italian protected areas



Elevation of Italian protected areas



High elevation == low economic value

What else should be protected in Italy to conserve vertebrates



Boitani et al. (2003)

5. The scenarios of socio-economic development (including the most optimistic) predict an increase rather than a decrease of anthropogenic pressure in the next 40 years, with further habitat loss for species

Global models of socio-economic development

- Scenarios
 - Millennium Ecosystem Assessment (MEA 2005)
- Amount of land converted
 - IMAGE (Alkemade et al. 2009)
- Spatial allocation
 - Globio (Alkemade et al. 2009)

The four scenarios



*Global population in 2050

Projected increase in conversion of natural habitat



Crop area Livestock area







Projected global habitat loss for mammals to 2050 as compared to 2000



Projected global habitat loss for mammals to 2050 as compared to 2000

Global Orchestration

TechnoGarden





Change in suitable habitat (1000* Kmsq*Species)

-13.7 - -1.5 - 1.5 - -0.2 -0.2 - 0.2 - 0.2 - 0.8 0.8 - 1.2 1.2 - 12.8

Order from Strength

Adapting Mosaic



6. The planning and management tools that allow the coexistence between production and conservation now exist

Forest use in East Kalimantan, Borneo



Wilson, ..., Rondinini et al. (2010) Conserving biodiversity in production landscapes. *Ecol Appl* 20:1721

Contribution of different forest uses to mammal conservation in East Kalimantan

	Percentage of target contribution			
Land use	Plantain squirrel (low sensitivity)	Lesser mouse-deer (medium sensitivity)	Bornean gibbon (high sensitivity)	
Cleared	0	0	0	
Converted	0.1	0	0	
Production, <30% forest cover	0.1 (0.25)	0	0	
Improved production, $<30\%$ forest cover	0.1 (0.25)	0	0	
Production, between 30 and 90% forest cover	0.1 (0.5)	0	0	
Improved production, between 30 and 90% forest cover	0.25(0.5)	0	0	
Production, >90% forest cover	0.25 (1)	0.25 (1)	0.25(1)	
Improved production, $>90\%$ forest cover	0.5 (1)	0.5 (1)	0.5 (1)	
Protected, <30% forest cover	0.1 (0.25)	0	0	
Improved protection, <30% forest cover	0.25 (0.25)	0	0	
Protected, between 30 and 90% forest cover	0.25 (0.5)	0.25 (0.5)	0	
Improved protection, between 30 and 90% forest cover	0.5 (0.5)	0.5 (0.5)	0	
Protected, >90% forest cover	0.5 (1)	0.5 (1)	0.5 (1)	
Improved protection, >90% forest cover	1 (1)	1 (1)	1 (1)	

Notes: The values in parentheses indicate the maximum possible zone contribution given the allowable zone transitions, which was used to calculate the contributing area of occupancy for each species. The plantain squirrel (*Callosciurus notatus*) has low sensitivity to forest degradation; the lesser mouse-deer, also known as the lesser Indo-Malayan chevrotain (*Tragulus kanchil*), has medium sensitivity; and the Bornean gibbon (*Hylobates muelleri*) has high sensitivity.

Cost of different conservation strategies in East Kalimantan

Cost component	Estal p	blishment of new rotected areas	Improved management of production forest	Improved management of protected areas
Start up costs Management costs Opportunity costs		50 163 2634	60	163
Total	3	2847	60	163

Cost minimisation analysis

- Mammal distribution from HSM
- Species-specific persistence target
- Cost minimisation through software MarZone (UQ)
 - Simulated annealing

Recommended management changes in East Kalimantan to optimise mammal conservation

Land use zones	Current area of each land use (ha)	Recommended area under the full zoning analysis (ha)
Cleared	5714366	5 714 366
Converted	2105111	2 105 111
Production, with less than 30% forest cover remaining	4469618	4 429 808
Improved production, with less than 30% forest cover remaining	0	0
Production, with between 30 and 90% forest cover remaining	918610	33 620
Improved production, with between 30 and 90% forest cover remaining	0	872 641
Production, with greater than 90% forest cover	2278120	137
Improved production, with greater than 90% forest cover	0	2 186 951
Protected, with less than 30% forest cover remaining	835808	182 190
Improved protection, with less than 30% forest cover remaining	0	693 429
Protected, with between 30 and 90% forest cover remaining	710865	15 025
Improved protection, with between 30 and 90% forest cover remaining	0	708 188
Protected, with greater than 90% forest cover	2513334	0
Improved protection, with greater than 90% forest cover	0	2 604 365
Total area	19545832	19 545 832

Scenario comparison for East Kalimantan



Wilson, ..., Rondinini et al. (2010) Conserving biodiversity in production landscapes. Ecol Appl 20:1721

Conclusion

To slow down or reverse decline, biodiversity must be conserved also in (partly) converted areas, including agroecosystems, by applying planning and management techniques that allow the coexistence between production and conservation

This is doable

Special thanks to friends and collaborators at:

The Global Mammal Assessment lab at Sapienza: Luigi Boitani, Giovanni Amori, Daniele Baisero, Alessia Battistoni, Federica Chiozza, Moreno Di Marco, Piero Visconti

The IUCN SSC: Mike Hoffmann, Jan Schipper, Simon Stuart and the other approx. 5000 individuals involved in the mammal Red List

The University of Queensland and James Cook University: Kerrie Wilson, Hugh Possingham, Bob Pressey and many others